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SEKAPUR SIRIH

Assalamualaikum warahmatullahi wabarakatuh
dan Salam Sejahtera.

Alhamdulillah, syukur ke hadrat Allah S.W.T. kerana dengan limpah kurniaNYa Diges Akademik PSA bagi tahun 2022 telah berjaya dihasilkan. Syabas dan tahniah saya ucapkan kepada Jawatankuasa Penerbitan yang diselaraskan oleh Pusat Penyelidikan, Inovasi dan Pengkomersialan (CRI) Politeknik Premier Sultan Salahuddin Abdul Aziz Shah (PSA).

Penerbitan Diges Akademik PSA ini adalah suatu usaha murni bagi menyokong aspirasi negara dalam memperkayakan koleksi bahan ilmiah di institusi pengajian tinggi terutamanya dalam bidang Technical and Vocational Education and Training (TVET). Usaha ini juga membuktikan bahawa kita sentiasa responsif dan relevan dalam bidang penulisan, penyelidikan dan inovasi selaras dengan hasrat Pelan Pembangunan Pendidikan Tinggi Negara. Penulisan ini juga diharapkan akan menjadi wadah bagi perkongsian ilmu, pemikiran dan kepakaran di kalangan warga PSA, pihak industri dan komuniti setempat.

Adalah diharapkan agar penulisan dan penerbitan di institusi ini akan terus berkembang sehingga menjadi satu budaya dalam memartabatkan khazanah ilmu negara. Alhirnya, saya mendoakan agar Diges Akademik PSA ini akan dimanfaatkan oleh semua pihak demi kelestarian ilmu dalam sistem pendidikan negara.

Sekian, terima kasih.

Dr. Hj. Mohd Zahari bin Ismail
Pengarah
Politeknik Premier Sultan Salahuddin Abdul Aziz Shah

PRAKATA

Assalamualaikum warahmatullahi wabarakatuh
dan Salam Sejahtera.

Segala pujian dan kesyukuran ke hadrat Allah S.W.T kerana dengan izin dan limpahan rahmatNya maka Pusat Penyelidikan, Inovasi dan Pengkomersialan (CRI), Politeknik Premier Sultan Salahuddin Abdul Aziz Shah (PSA) telah berjaya menerbitkan Diges Akademik PSA bagi tahun 2022.

Setinggi tinggi penghargaan dan tahniah diucapkan kepada semua pihak yang terlibat terutamanya kepada Sidang Redaksi Diges 2022, penyelaras CRI Jabatan dan para pensyarah yang telah memberi komitmen dan usaha yang tidak berbelah bahagi dalam menjayakan penerbitan Diges Akademik PSA ini.

Penerbitan ini merupakan satu inisiatif oleh CRI bagi pengumpulan dan perkongsian idea serta penyelidikan yang berjaya dihasilkan dan digarap untuk tatapan dan manfaat umum. Sumbangan yang sangat berharga ini di harap dapat dijadikan sebagai satu rujukan bagi menyemai minat untuk berfikiran kritis, kreatif dan inovatif dalam menghasilkan penebitan berilmiah.

Justeru itu, diharapkan usaha penerbitan Diges Akademik PSA 2022 ini dapat memberi inspirasi kepada pensyarah dan pelajar untuk menghasilkan penulisan berkualiti dan berimpak tinggi. Semoga usaha murni ini akan berterusan sehingga menjadi satu budaya di kalangan pensyarah dan pelajar di PSA.

Sekian, terima kasih.

Dr. Ts. Hjh. Wan Rosemehah binti Wan Omar
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ISI KANDUNGAN

Heart Rate Monitoring System for Patients Through IoT

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Abstract—Due to its very high potential, the Internet Concept of Things (IoT) has been integrated in modern medicine system. Therefore, today's generation of health monitoring systems need to be designed to develop an effective health monitoring system. Where it can reduce the risk of heart disease, stroke, and death. Problems associated with heart rate are serious diseases that need to be monitored periodically. In addition, it takes time to make an appointment with the doctor on a regular basis. There may even be a family of patients who cannot help monitor the patient's condition constantly. And ordinary device methods can only be monitored by doctors at the hospital. Objective recommended for heart rate monitoring based on Internet-of-Things (IoT) techniques is to plan a heart rate monitoring system with the characteristics of data transmission to patients or physicians in an emergency. This data will be recorded at intervals of time accessible by facilitating family and patient physicians. Features to access data using android apps for doctors are provided in the system together by sending notification in case of an emergency so the action needs to be taken by the doctor. Android is easily available for doctors and android apps as well as easy-to-use data access.

Keywords —health monitoring; IoT; android application; notification

I. INTRODUCTION

The Internet of Things (IoT) is a new concept, providing the possibility of health monitoring using wearable devices. The IoT is defined as the network of physical objects which are supported by embedded technology for data communication and sensors to interact with both internal and external objects states and the environment.

Currently, there are many IoT solutions that enable different healthcare applications. These applications focuses on the use of sensors that can acquire medical data without interfering too much in daily life of the patients. They use wearable sensor or mobile sensors that can directly transmit data to Internet or through a gateway (smartphone or a computer). In the best-case scenario, these systems can activate different alarms that are transmitted to the doctor when medical parameters are not in the normal range[1].

The purpose of this project is to monitoring system and early detection of chronic diseases is important to avoid the risk related to this kind of diseases. This is the motivation behind developing a system that regularly monitors the health condition of patients and giving proper medical care to them at the right time. Knowing the body and the symptoms that the heart is getting worse will help people stay healthier and out of the hospital. Mobile phones are part of people's day to day life. This system will make use of user's mobile phone as a monitoring device that monitors the health condition of patients. This work suggests the design of a health monitoring system that provides various services to monitor the patients using wireless technology with prediction of possibility of heart disease. It mainly provides a solution for identifying heart diseases by monitoring heart rate.

A previous study about monitoring system for healthy patient has been proposed. The devices have been implemented to measure critical elements in healthcare monitoring by M. Haghi[2]. With the majority of these devices are in one lead such as electrocardiogram(ECG) and electroencephalogram (EEG) measurement and skin temperature. There have been recent efforts in wearable devices to provide multi-task vital signs measurement. And these solutions are hard to implement and are not efficient enough in power consumption.

Next, there is other paper focuses on the heart rate monitoring and alert which is able to monitor the heart beat rate condition of patient by B. Malilick[3]. That has been designed by using finger tip through arduino and processing software. The system determines the heart beat rate per minute and then sends short message

service (SMS) alert to the smartphone. It is a very efficient system and very easy to handle and thus provides great flexibility and serves as a great improvement over other conventional monitoring and alert systems.

In the last decade the health monitoring systems have drawn considerable attentions of the researchers. The prime goal was to develop a reliable patient monitoring system so that the health can monitor their patients, who are either hospitalized or executing their normal daily life activities. In this work it can present a mobile device based wireless health monitoring system[4]. Our proposed system is designed to measure and monitor important physiological data of a patient in order to accurately describe the status healthy. In addition the proposed system is able to send alarming message about the patient's critical health data by text messages. By using the information contained in the text message the health monitoring system can provide necessary medical advising.

II. METHODOLOGY

Figure 1 illustrates the architecture of wireless connectivity based heart rate monitoring system. It mainly consists of three different wireless technologies of Wi-Fi, Zigbee and Bluetooth.

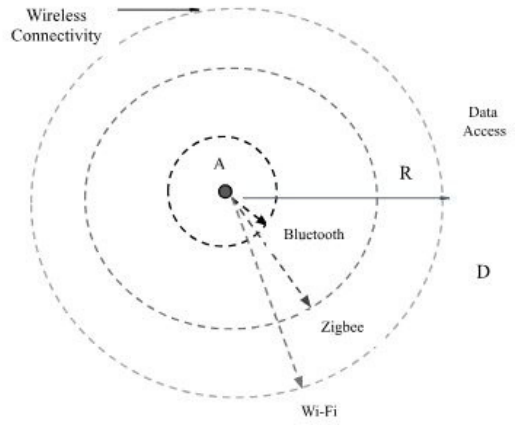

Figure 1: Architecture of wireless connectivity -based heart rate monitoring system

Where,
A = the access point –ECG and pulse sensor
R = the coverage distance from center of access point in other (m).
D = Data access to the patient

Based on the architecture of wireless technology above. The data transmission from the access point which is from the ECG and pulse sensor transmit via wireless technology of Wi-Fi is higher than Zigbee and Bluetooth module[4]. Because the values nodes of bluetooth per network is around seven only, that are lower nodes compares with three different wireless technology. The higher of the data rates (Kbps) in wireless technology, the smooth signal accesses to the data access (patient).

The Wi-Fi (IEEE 802.11) network is a specification of the Wireless Local Area Network (WLAN). The bluetooth (IEEE 802.15.1) standard is a proprietary open wireless technology standard for exchanging data over a short distance. It uses the short wavelength radio transmission ISM Band in the 2400-2480 MHz. While the zigbee specification was adopted for a low cost, low power digital radios and had found application in areas like home automation, telecommunication services, healthcare and remote control just to mention a few[5].Table 1 shows the different type of wireless standard between Wi-Fi, Zigbee and Bluetooth hardware model.

TABLE 1 : The Wireless Standard between Wi-Fi, Zigbee and Bluetooth

Wireless Technology	Wi-Fi	Bluetooth	Zigbee
Coverage in (meter)	1-100	1-10	10-75
Data Rates (Kbps)	11000	720	250
Power Computation	High	Low	Low
Nodes Per Network	30	7	255/65 kt

The paper suggests a method for developing a hardware that will transmit the readings from sensors to the mobile phone using Internet of Thing (IoT) techniques and Wi-Fi module. Paper presents how the health care management can be done with the help of Android mobile phone.

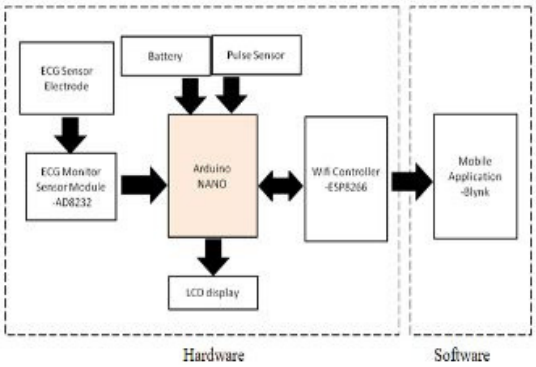

Figure 2: Block Diagram of IoT for Heart Rate Monitoring System for Health Patient

Figure 2 illustrates the block diagram of Heart Rate Monitoring System for Health Patients through IoT. It mainly consists of two sections. The above block diagram can be divide into two sections one consisting of hardware part and the other part is software. In this proposed system it is constrained the process, working space and simplified the gadgets to show the ECG and pulse output. In our system there is a simplified interface for two other parameters ECG and pulse sensor detection. The sensors for secondary parameter detection and are directly interfaced with the Arduino processor. The processes input data from the sensors and concludes the final information using program code. It is finally displayed on LCD. It have sensed the

patient's ECG through 3 lead electrode system via AD8232 which amplifies minor and small bio-signals to the Arduino. We also connect some external parameters pulses calculated in beats per minutes. The materials used in the proposed system are as listed below.

A. Hardware

In this project, the hardware has been used Arduino Nano, heart monitor, pulse sensor and ESP8266Wi-Fi Module.

Figure 3: Arduino NANO(ATmega328)[6]

The Arduino Nano is a small, complete, and breadboard-friendly board. The Nano was designed and is being produced by Gravitech. The Arduino Nano can be powered via the Mini-B USB connection, 10V regulated external power supply. Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions[7]. They operate at 10 volts. Each pin can provide or receive a maximum of 40 mA. Then, the Arduino Nano can be programmed with the Arduino software (download).

Figure 4: AD8232 Heart Monitor

The AD8232 is a cost-effective board used to measure the electrical activity of the heart. The AD8232 acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily.The AD8232 is an integrated signal conditioning block for ECG. Have nine connections from the IC there are SDN, LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino Nano board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach onECG electrode sensors[8] . TABLE 2 show the pin connection between AD8232 with Arduino NANO.

TABLE 2: The Pin Connection between AD8232 with Arduino NANO

AD8232	**Arduino NANO**
Pin 3.3V	Pin 3.3V
Output	Pin A1
L0-	Pin D11
L0+	Pin D10
GND	GND

Figure 5: Pulse Sensor[9]

Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino and Arduino compatibles[9]. It has 3 wires. Provide 5V and GND for brown, red pin (positive) and orangepin (S). These pulse sensor, pin (S) has connect to Arduino Nano at pin (A0). And the negative terminal of pulse sensor has connect to Arduino NANO at pin (GND). The positive terminal of pulse sensor has connect to pin (Vcc) on the LCD display. To display the output reading of pulse. It also have enough of power with just 4mA current draw at 5V so it's great for mobile applications.

Figure 6: ESP8266 Wi-Fi Module[10]

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP address stack that can give any microcontroller access to your Wi-Fi network[10]. The brand is not specified. The chip module is CP2102. The ESP8266 Wi-Fi Module has connection with Arduino NANO at pin (D3) and pin (D2).Which the power input is10V. And the weight of component is 6 gram. With the size 45 x 25 x 6mm/1.77 x 0.98 x 0.23". This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other.

B. Software

The software has been used in this project is Arduino-1.8.1-R3-Windows and Blynk Application. This software is used to give instruction or to control the circuit and to get the reading while to display the output.

Arduino is a free software electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino Software (IDE) on computer, according to its operating system. The Arduino Serial Plotter function has been added to the Arduino IDE, allowing to natively graph serial data from Arduino to the computer in real time[11]. It can be divide into two part one consisting of Arduino Nano part and the other part is NodeMCU. The Arduino Nano part of coding to display the data to LCD for ECG and pulse reading. And also to transfer the data reading direct to NodeMCU (ESP8266). The second part of coding is NodeMCU which is direct transfer data to web server.

Blynk application is a platform with iOS and Android apps to control Arduino the likes over the Internet. Blynk application is simple to set up everything in less than 5 minutes. It can supported board shields for this project[12]. To run Blynk Application, the hardware model that is NodeMCU must have connection with Wi-Fi network. Which is the value of auth token are given in user email. Figure 8 shows that run as account: adlyna95ayub@ymail.comin version of 2.20.0. With the server: Blynk Cloud. The range for download size about 30.63 MB.

III. RESULT AND ANALYSIS

Android mobile are now available with almost all patients and doctors. So accessing the data with android application is much easier. The Android application has several main functions; they are displaying data in graphical form, displaying heart rate, and recording data that has been received from Arduino Nano to NodeMCU connection with blynk application. Figure 7-8 shows the application interface of Android smartphone while receiving ECG data and heart rate from circuit.

Figure 7: Hardware Circuit with dimension 15x10cm

This project can be placed in the pocket and can be clipped to a belt. Because the dimension of hardware circuit is 15x10 centimeter. While this is a system currently used, it does not employ a wireless telemetry system for health monitoring.

Figure 8: Blynk Application

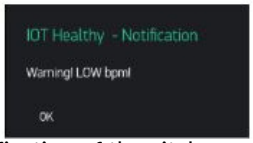

Figure 9: Notification of the vitals generated through NodeMCU

The reading of heart rate ECG and pulse data that is recorded Bpm and display on mode live inside Blynk application. TABLE 3 shows the heart rate reading based on the number of Beats per Minute.

TABLE 3: The data was collected randomly for 30 subjects using Pulse Sensor

Subjects	Measured Value (BPM)	Accepted Value (BPM)
1	80	84
2	85	78
3	82	82
4	82	84
5	86	80
6	84	85
7	80	82
8	82	78
9	80	80
10	85	85
11	80	82
12	85	79
13	80	80
14	80	80
15	86	84
16	80	78
17	80	82
18	88	84
19	85	80
20	80	85
21	86	82
22	88	78
23	80	74
24	85	75
25	86	80
26	84	85
27	80	82
28	82	74
29	80	78
30	86	76
Total Average (BPM)	82.9	80.5

Based on TABLE 3 show the data was collected randomly for 30 subjects using pulse sensor and manually counting the heart rate with stop watch. From the TABLE 3, the graph is generated by the Microsoft Excel, and the graph as shown in Figure 10.

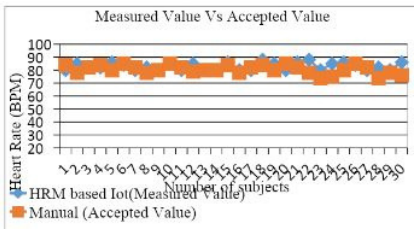

Figure 10: The Graph of Measured Value Vs Accepted Value using Pulse Sensor

The percentage of error is calculated to determine the differences between counting heart rate with using HRM based IoT and manually counting the heart rate with stop watch. From Figure 10, randomly collected data for 30 subjects uses the Pulse Sensor that is displayed on the graph of the measured value versus the accepted value. Based on the graph above, 97% indicated the accuracy readings between Iot based Iot (measured value) and manual measurement (accepted value). Where is the percentage error reading calculated is 2.98.

Percentage of heart rate error can be shown as,

% Error = (Measured Value – Accepted Value / Accepted Value) x 100
% Error = (82.9-80.5 / 80.5) x 100
= 2.98

Whereas, the percentage of accuracy is,

% Accuracy = 100 - 2.98
= 97.0 %

In conclusion, the measured using this HR based IoT method does not show much difference compared to manual reading method.

TABLE 4: The data was collected randomly for 30 subjects using ECG Sensor

Subjects	Measured Value (BPM)	Accepted Value (BPM)
1	85	84
2	88	78
3	78	82
4	85	84
5	83	80
6	88	85
7	86	82
8	80	78
9	84	80
10	86	85
11	80	82
12	84	79
13	85	80
14	85	80
15	85	84
16	88	78
17	78	82
18	85	84
19	83	80
20	90	85
21	86	82
22	80	78
23	85	74
24	82	75
25	82	80
26	86	85
27	84	82
28	80	74
29	82	78
30	80	76
Total Average (BPM)	83.8	80.5

Based on TABLE 4 show the data was collected randomly for 30 subjects using ECG sensor and manually counting the heart rate with stop watch. From the TABLE 4, the graph is generated by the Microsoft Excel, and the graph as shown in Figure 11.

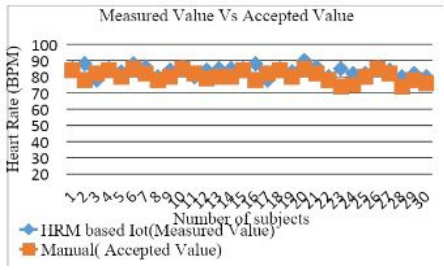

Figure 11: The Graph of Measured Value Vs Accepted Value using ECG Sensor

The percentage of error is calculated to determine the differences between counting heart rate with using HRM based IoT and manually counting the heart rate with stop watch. From Figure 11, randomly collected data for 30 subjects uses the ECG Sensor that is displayed on the graph of the measured value versus the accepted value. Based on the graph above, 95.9% indicated the accuracy readings between IoT based IoT (measured value) and manual measurement (accepted value). Where is the percentage error reading calculated is 4.09.

Percentage of heart rate error can be shown as,

% Error = (Measured Value – Accepted Value / Accepted Value) x 100
% Error = (83.8-80.5/ 80.5) x 100
= 4.09

Whereas, the percentage of accuracy is,

% Accuracy = 100- 4.09
= 95.9 %

In conclusion, the measured using this HR based IoT method does not show much difference compared to manual reading method. Based on the result display the average heart rate reading for a participant in the adult age group was a normal range between 60 - 100 bpm.

IV. CONCLUSION

The proposed healthy monitoring system is useful mainly to improve patient's health care and the quality of life of individuals. This project was successfully implemented of heart rate monitoring system involving low cost effective. The data transmission from Arduino to the smart phone via Wi-Fi module was also achieved. It is a very efficient system and very easy to handle and thus provides great flexibility and serves as a great improvement. Here according to the proposed system doctor does not need to be present while monitoring the heart rate[9]. Android is easily available for doctor and android application easy to use for accessing the data.

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Potensi Papan Partikel Terikat Simen (CBPB) Daripada Sisa Sekam Padi

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Abstract—Papan panel komposit terikat simen (CBPB) telah lama berkembang khususnya di dalam industri pembinaan. Kajian ini dilaksanakan bertujuan untuk mengetahui potensi papan CBPB yang diperbuat daripada sekam padi melalui sifat fizikal dan mekanikal papan tersebut. Kajian ini telah mengunakan nisbah 3:1:1 iaitu 3 bahagian simen, 1 bahagian sekam padi dan 1 bahagian air. Ujian fizikal iaitu kadar pembengkakan dan ketebalan (TS), kadar penyerapan air (WA), ujian mekanikal seperti ikatan dalaman (IB), modulus elastik (MOE) dan modulus kerapuhan (MOR) telah dilaksanakan dan diukur berdasarkan standard Japanese Industrial Standard, JIS A 5908 (versi 1994). Keputusan kajian telah menunjukkan papan CBPB yang diperbuat daripada sekam padi mempunyai potensi yang lebih baik berbanding dengan papan CBPB yang diperbuat daripada sisa habuk kayu terutama bagi kadar penyerapan air (32.8 %) dan kadar modulus elastik (793.02 N/mm2). Kajian ini dapat disimpulkan bahawa sisa sekam padi amat berpotensi digunakan sebagai pengisian fabrikasi (filler) pada papan panel terikat simen (Cement Bonded Particleboard – CBPB) kerana ciri-ciri sekam padi yang mempunyai saiz partikel yang lebih besar, namun prestasi sifat mekanikal perlulah ditambahbaik lagi pada kajian akan datang terutama dari segi nisbah pencampuran bahan tersebut.

Keywords —Papan Terikat Simen, Sisa habuk kayu, Sekam padi

I. PENGENALAN

Cement-bonded particleboard (CBPB) atau papan panel terikat simen merupakan papan komposit yang menggabungkan kayu dan simen bagi mencapai sifat-sifat kekuatan papan komposit yang boleh diperolehi daripada sifat kedua-dua bahan tersebut [1]. Papan partikel terikat simen (Cement Bonded Particleboard - CBPB) biasanya digunakan untuk pembinaan struktur bangunan dan ia telah lama berkembang kerana dikategorikan sebagai produk yang murah dan masih kekal relevan sejak dari awal pengeluarannya. Pembangunan dan penggunaan kayu-simen telah menunjukkan bukti bahawa ia mempunyai daya tarikan sebagai bahan binaan utama di dalam industri pembinaan [2]. Papan partikel terikat simen biasanya diperbuat daripada serpihan habuk kayu, air, simen Portland dan bahan tambahan khas. Ketahanan, kestabilan dimensi yang tinggi, ketahanan terhadap pengaruh alam sekitar seperti biodegradasi atau ketersediaan bahan mentah serta faktor-faktor ekonomi adalah ciri-ciri yang menjadikan papan komposit terikat simen lebih baik berbanding dengan papan komposit terikat konvensional [3]. Papan partikel terikat simen berpotensi untuk menyediakan produk yang sesuai bagi industri pembinaan modular dan menjadi pilihan utama bagi pembinaan berasaskan simen serta membina aplikasi dengan menggunakan pelbagai jenis bahan berasaskan kayu seperti siling daripada campuran kayu dan simen [4].

Selain dari itu, kebolehterimaan produk papan terikat simen ini mempunyai pelbagai ciri dan sifat seperti ketahanan, kestabilan, ketersediaan, relatif ringan, tahan api, pelemah bunyi dan ketahanan terhadap proses pereputan serta serangan dari anai-anai [4]. Dalam tempoh dua dekad yang lalu, permintaan terhadap bahan-bahan berkayu telah digunakan sebagai asas untuk mempertingkatkan lagi sifat-sifat bahan binaan komposit kayu papan simen yang dibuat daripada serat kayu dan campuran simen Portland serta sejumlah kecil bahan tambah yang diolah untuk menjadi papan panel, bata, jubin dan produk-produk lain yang digunakan dalam industri pembinaan [5]. Beberapa kawasan utama

seperti Asia Tenggara, penggunaan CBPB dalam pembinaan bangunan adalah sebagai pelapis dinding dalaman, lekapan, siling, bumbung, dan lain-lain produk [6 – 7].

Simen merupakan debu lembut, apabila dicampur dengan air, ia akan menjadi keras. Ini disebabkan oleh tindak balas kimia yang telah menukarkan debu simen menjadi hablur-hablur yang saling berpaut, sehinggalah ia menjadi keras. Papan terikat simen (CBPB) adalah gabungan simen dan gentian penguat yang telah dibentuk menjadi kepingan dengan ketebalan yang berbeza-beza yang biasanya digunakan sebagai papan penyokong jubin [8].

Sekam padi pula telah dikenal pasti sebagai salah satu sisa pertanian yang mempunyai kandungan silikon yang tinggi iaitu agen simen atau pengikat abu biomas. Komposisi utama sekam padi adalah SiO_2, lignin, selulosa, protein, lemak dan nutrien lain dengan 18.80-22.30%, 9.20%, 28-38%, 1.90-3.0%, 0.30-0.80%, dan 9.30-9.50% berat asas masing-masing [9].

Baru-baru ini, banyak perubahan dalam perumahan dan pembangunan industri pembangunan telah berlaku. Terutamanya pada bahan berasakan kayu dan produk panel komposit yang terikat dengan pengikat organik dan bukan organik. Salah satu bahan komposit yang menarik kepentingan di seluruh dunia adalah produk panel terikat bukan organik. Zarah kayu terikat bersama-sama dengan bahan bukan organik seperti simen Portland biasa (OPC) dirujuk sebagai papan partikel ikatan simen [10].

Salah satu kekurangan papan partikel adalah daya ikatan antara partikel yang mudah dileraikan [11]. Sekam padi adalah sisa pertanian yang dihasilkan oleh kilang pemprosesan beras. Semasa pengilangangan, kira-kira 78% berat diterima sebagai beras, manakala 22% adalah sekam. Sekam ini mengandungi kira-kira 75% yang tidak menentu organik dan baki 25% daripada berat ditukar kepada abu yang dikenali sebagai sekam padi abu (Rice Husk Ash -RHA). Semasa proses pembakaran, sekam padi abu (Rice Husk Ash -RHA) ini pula mengandungi 85% - 90% kandungan silika yang kebanyakannya berada dalam atmosfera, tetapi bergantung kepada suhu dan masa pembakaran. Sekam yang dihasilkan di negara-negara membangun biasanya dibakar sahaja di ladang atau di kilang padi atau dibuang di tempat pembuangan sampah [9]. Sekam padi abu (Rice Husk Ash -RHA), boleh digunakan sebagai bahan tambahan kepada bahan binaan seperti simen yang mana ia akan boleh membawa kepada pengurangan jumlah kadar karbon dioksida (CO2) yang dibebaskan di udara. Komposisi kimia sekam padi didapati berbeza disebabkan oleh adanya perbezaan jenis padi, kekerapan tanaman setiap tahun, iklim dan juga keadaan geografi [12]. Habuk kayu adalah sisa buangan dari kilang papan yang mana meliputi 90% dari sisa kilang [13]. Proses kitar semula bahan sisa hasil buangan pertanian ini kepada bahan produk baharu mungkin dapat mengurangkan pencemaran alam sekitar. Oleh itu, objektif utama kajian ini adalah untuk melihat potensi papan panel terikat simen yang diperbuat daripada sekam padi melalui sifat kekuatan dari segi fizikal dan mekanikal.

II. METODOLOGI

Dalam kajian ini bahan utama yang digunakan ialah sisa habuk kayu dan sekam padi. Habuk kayu yang digunakan diperolehi dari Bengkel Pemesinan Kayu di Politeknik Kota Kinabalu (PKK) yang merupakan spesis pokok Pine. Manakala sekam padi diperolehi daripada Kampung Bayayat, Kota Belud, Sabah. Bahan lain yang digunakan adalah simen Portland, penyerap lembapan (moisture absorber thirsty hippo) dan ammonium klorida yang dibeli daripada pasaran tempatan.

Proses pembuatan papan terikat simen secara ringkasnya boleh dirujuk pada rajah 1 di bawah. Di dalam projek ini, terdapat dua (2) jenis papan partikel terikat simen yang dihasilkan iaitu papan terikat simen yang menggunapakai sisa habuk kayu dan sebagai perbandingannya adalah papan terikat simen yang diperbuat daripada sisa sekam padi.

Rajah 1: Proses pembuatan papan partikel terikat simen (CBPB)

Gambarajah proses pembuatan papan terikat simen ditunjukkan seperti di dalam Rajah 2

Rajah 2: Gambar turutan proses pembuatan papan partikel terikat simen (CBPB)

Di dalam Rajah 2, proses pembuatan papan terikat simen (CBPB) dimulakan dengan proses pengeringan

sekam padi yang telah diambil daripada Kampung Bayayat, Kota Belud, Sabah (Gambar 1), kemudian sekam padi berkenaan akan dibiarkan kering sedikit selama beberapa hari (Gambar 2). Proses penjemuran sekam padi dimulakan pada sebelah pagi dan akan disimpan semula pada sebelah petang. Selepas itu, proses penapisan sekam padi akan dibuat (Gambar 3) bagi mengasingkan habuk kayu yang mempunyai saiz kurang daripada 1 µ meter. Gambar 4 menunjukkan sampel sekam padi yang telah ditapis. Kemudian sekam padi berkenaan akan dikeringkan di dalam ketuhar pemanas yang telah ditetapkan suhunya pada 105 0C sehinggalah sampel mencapai suhu kelembapan (MC) yang ditetapkan iaitu 12 0C (Gambar 5). Setelah itu, sekam padi akan dicampurkan dengan simen pada ratio 3:1:1 iaitu 3 bahan simen, 1 bahagian air dan 1 bahagian sekam padi (Gambar 6). Kadar bahan yang digunakan dikira berdasarkan kepada berat keumpatan rumus berikut:

$$\text{Rumus Ketumpatan } (p) = \frac{\text{mass } (m)}{\text{Volume } (v)}$$

$$M = p \times V$$

Manakala berat air dikira mengikut rumus berikut:

$$Wt = 0.60Ct + (0.30 + MC)\, W$$

Dimana;

W*t*: berat air (g); *Ct*: berat simen (g); MC sampel kayu (%) dan W: berat sampel kayu kering (g).

Bahan tambahan seperti moisture absorber thirsty hippo juga ditambah pada campuran berkenaan bagi menyerap kandungan air dan mempercepatkan lagi proses pengeringan papan panel. Gambar 7-pula menunjukkan papan CBPB yang Berjaya dihasilkan dan akan diberikan tekanan sejuk dengan menggunakan mesin Cool Press selama 24 jam (Gambar 8). Selepas itu, papan CBPB akan dibiarkan kering selama 28 hari (Gambar 9) pada suhu bilik sebelum ia dibuat ujian fizikal dan mekanikal bagi melihat kekuatan papan panel berkenaan. Proses yang sama telah diulang bagi sampel papan panel yang diperbuat daripada habuk kayu. Selepas 28 hari papan CBPB akan dipotong kepada saiz sampel dan diuji dengan berpandukan standard Japanese Industrial Standard, JIS A 5908 (1994) [14].

Dalam kajian ini, ada dua jenis ujian dilaksanakan iaitu ujian fizikal dan ujian mekanikal. Ujian fizikal yang dilaksanakan ialah kadar pembengkakan ketebalan produk (thickness sweeling – TS) dan ujian kadar penyerapan air (water absorption – WA). Manakala ujian mekanikal yang telah dilaksanakan adalah modulus elastik (modulus of elasticity – MOE), modulus kerapuhan (modulus of rupture – MOR) dan ujian ikatan dalaman (internal bonding – IB).

III. KEPUTUSAN DAN PERBINCANGAN

Ringkasan dapatan projek kajian adalah seperti yang dinyatakan di dalam Jadual 1.

Jadual 1: Keputusan kajian bagi Ujian FIzikal dan Ujian Mekanikal yang diperolehi dalam kajian ini.

Jenis Ujian	Jenis pengisi (*Filler*)	
	Sisa habuk kayu	Sisa sekam padi
TS (%)	3.2	2.5
WA (%)	46.7	32.8
MOE (N/mm^2)	150.96	793.02
MOR (N/mm^2)	0.15	1.25
IB (N/mm^2)	0.22	0.23

Nota: Kadar Pembengkakan ketebalan (TS), Kadar Penyerapan Air (WA), Modulus Elastik (MOE), Modulus Kerapuhan (MOR), Ikatan dalaman (IB).

Jadual 1 di atas menunjukkan data kajian yang telah diperolehi dalam penyelidikan ini. Perbandingan di antara dua (2) jenis pengisi (filler) di atas jelas menunjukkan bahawa papan partikel terikat simen (CBPB) yang menggunakan sisa sekam padi mempunyai kekuatan yang lebih baik terutama dari segi pembengkakan ketebalan (TS), kadar penyerapan air (WA), modulus elastik (MOE) dan modulus kerapuhan (MOR). Penggunaan bahan tambahan seperti moisture absorber thirsty hippo ternyata berkesan terhadap papan CBPB yang diperbuat daripada sekam padi kerana mempunyai nilai WA yang lebih rendah (32.8%) berbanding dengan papan CBPB yang diperbuat daripada habuk kayu. Nilai Modulus Elastik (MOE) bagi papan CBPB (793.02 N/mm2 yang diperbuat daripada sekam padi mungkin dipengaruhi oleh nisbah pencampuran bahan tersebut di dalam papan CBPB [15]. Kekuatan ikatan dalaman bagi kedua-dua jenis pengisi (filler) sama ada sisa habuk atau sisa sekam padi tidak mempunyai perbezaan yang banyak. Kadar ikatan dalaman (IB) telah berjaya melepasi tahap minimum yang telah ditetapkan di dalam standard JIS iaitu 0.15 N/mm2. Manakala tahap modulus elastik (MOE) dan modulus kerapuhan (MOR) tidak memenuhi keperluan minimum standard seperti yang dinyatakan di dalam Japanese Industrial Standard (JIS).

IV. KESIMPULAN

Papan partikel terikat simen (CBPB) yang diperbuat daripada sekam padi mempunyai potensi yang lebih baik berbanding dengan papan partikel terikat simen yang dibuat daripada sisa habuk kayu. Penggunaan saiz partikel yang seragam, serta kajian terhadap ratio bahan yang berbeza di antara campuran simen dan bahan sisa kayu perlu dikaji lagi pada masa hadapan bagi meningkatkan kekuatan sifat mekanikal papan CBPB. Walaubagaimanapun sisa sekam padi boleh digunakan sebagai bahan pengisi alternatif bagi pembuatan papan CBPB pada masa hadapan di samping ia akan membantu mengurangkan pencemaran alam sekitar jika digunakan sebagai produk yang mempunyai nilai tambah khususnya dalam pembuatan papan CBPB.

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The Design of Thermacold Home-Use Therapy

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Abstract: The ankle is one of the most common sports injuries and is also the most frequently re-injured. An ankle sprain is also the number one injury in badminton and has high figures in squash too, making foot and ankle specialists in Malaysia very popular. Ankle sprains occur in both athletes and those with sedentary lifestyles, and they can occur during sports or when walking to carry out daily activities. Most people or athlete in every country suffer an ankle sprain. They need to make an appointment when they want to use therapy device at the hospital. The existing technology of hot cold therapy device only monitors temperature at a device. Some device cannot provide an indication of the actual temperature of the circulating fluid. It shows only the set-point temperature. Mostly all devices on the market only have one condition either hot or cold and if both it had is too expensive. So this project uses thermoelectric Peltier to produce two conditions hot and cold. The temperature and time can control by using a mobile application and also it can see from the graph that shows the temperature that has been set is reach or not.

Keywords — Ankle injury, RICE, Thermoelectric Peltier, Hot Cold Therapy

I. INTRODUCTION

INJURY to the lateral ligaments of the lateral lower leg complex is among the most well-known injuries by the athletes[1]. An ankle sprain is one of the most common musculoskeletal injuries [2]. About 25000 people suffer an ankle sprain every day [3]. An ankle sprain is also the number one injury in badminton and has high figures in squash too, making foot and ankle specialists in Malaysia very popular. Injury in sports such as sprain, strain, cramp and other muscle and tissue injuries are unavoidable. This injury requires pre and post-medical treatment for faster recovery. There are three proven effective treatments for patient recovery with muscle and tissue injuries. First is compression - devices with various wraps for arms, legs, and others. Second is local thermal therapy - hot or cold for post-traumatic and postoperative surgery. And the third is contrast therapy - automatically rotates from hot to cold therapies and otherwise. Local thermal therapies such as hot or cold home-based health care are much cheaper than hospital medicine. It helps to reduce swelling, reduces muscle spasms, stabilizes the tissue and relieves injury and reduces pain. The device is capable of reaching a temperature of as low as 0˚C and as high as 60˚C. This temperature range is suitable for common muscle and tissue injuries acquired in sports. The parameters are used in this device, their temperature and timer. These parameters are interfaced to a microcontroller, a type of Arduino that permits checking the parameter readings.

II. LITERATURE REVIEW

An ankle sprain is an injury to the tough bands of tissue (ligaments) that surround and connect the bones of the leg to the foot. The injury typically happens when accidentally twist or turn your ankle in an awkward way. This can stretch or tear the ligaments that hold your ankle bones and joints together. All ligaments have a specific range of motion and boundaries that allow them to keep the joints stabilized. When ligaments surrounding the ankle are pushed past these boundaries, it causes a sprain. Sprained ankles most commonly involve injuries to the ligaments on the outside of the ankle. Some swelling or bruising can occur as a result of these tears. It feels pain or discomfort when placing weight on the affected area. Tendons, cartilage, and blood vessels might also be damaged due to the strain. Ankle sprains can happen to anyone at any age. Participating in sports, walking on uneven surfaces, or even wearing inappropriate footwear can all cause this injury.

Figure 1: Ankle Sprain

Treating a sprained ankle is important to promote recovery and to prevent further discomfort. It's also helpful to apply ice to the injured area as soon as it can to reduce swelling. On the first day, need to apply ice every 20 to 30 minutes, three to four times per day depending on the doctor. Afterward, it should be applied every three to four hours for the next two days.

Two of the simplest, least expensive and most effective methods of pain relief are heat and cold treatments. Cooling therapy helps in vasoconstriction, lower blood flow and decreased metabolism in affected areas. Cooling therapy is used in the acute phase of injury minimize blood loss, inflammation tissue, and can be effective in managing pain. Cold is best for acute pain; it restricts blood vessels, slowing circulation and reducing swelling. It also numbs nerve endings, dulling pain. Thermal heat therapy is effective in the development of blood vessels, thus increasing blood flow in the heated area. Heat therapy has a variety of uses, which are the most common are pain and pain treatment in joints and muscles. Heat treatments, such as heating pads or warm baths, tend to work best for soothing stiff joints and tired muscles. Heat enhances circulation, delivering nutrients to joints and muscles. It's good for getting body limber and ready for exercise or activity.

During the initial days after lateral ankle ligament injury, the therapy aims to control the inflammatory response. In the absence of a fracture, rest and ice application are generally accepted interventions during this inflammation phase. Although it is suggested that ice application might reduce the degree of initial swelling, this is not supported by scientific evidence. The major effect of icing during the initial phase is to reduce pain. Three to four daily sessions of 15 minutes of cooling with a simple plastic bag with ice and water at a temperature between 0 and 7°C will reduce the pain without a significant risk of skin damage or neurological complications [4]

After the injury occurs, ice should be applied to the ankle and the leg should be elevated above the level of the heart for 15 to 20 minutes. After icing, an elastic bandage should be applied to the ankle to provide compression to minimize swelling. The combination of rest, ice, compression and elevation (R.I.C.E.) should continue for a minimum of 48 to 72 hours.

Figure 2: Procedure Treatment R.I.C.E

Rest: Decrease, modify or eliminate weight-bearing and other painful activities. Ice: Apply ice for 15 to 20 minutes several times a day. Compression: Wrap the injured ankle with an elastic bandage. Elevation: It is difficult for the leg vessels (veins) to remove swelling from the foot and ankle, therefore, elevate the limb higher than the level of the heart.

After the initial inflammation phase is over (usually 48 to 72 hours), moist heat may be used to treat an ankle sprain. However, heat should not be used when swelling is present. Compression and elevation should continue as long as swelling is present [5].

Cold compression aids in reducing swelling, bleeding, spasms, and pain. Apply as soon as possible after an injury has occurred and continued for 48 to 72 hours. Heat or Moist Heat Therapy should be used for chronic conditions such as muscle discomfort or stiffness. Applying heat to an area effectively opens up the blood vessels allowing blood to flow freely to the affected area. This increases circulation, delivering an increased supply of oxygen and nutrients and removing waste from sore, fatigued and injured muscles. Many doctors recommend alternating cold and moist heat therapy for chronic pain as well - 20 minutes of cold, 20 minutes off, and then 20 minutes of moist heat. Combination therapy is an effective treatment for repetitive strain injuries and can help with the pain of arthritis [6].

III. METHODOLOGY

This paper proposes a 'smart' Thermacold Home-Use Therapy for an ankle sprain. The device is comprised of a solid-state thermoelectric module based on the Peltier effect..

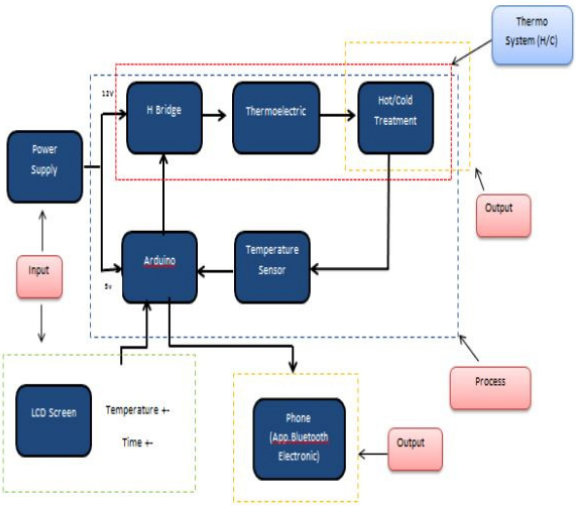

Figure 3: Block Diagram

Shown in Figure 3 is the block diagram of the process of the hot or cold therapy device. In figure 4 show, AC power is converted into 12V and 5V to supply circuit. Arduino is used in the design. It controls H-bridge, Thermoelectric Peltier and receives the data before showing the output in the phone. This microcontroller has their own software and algorithm which is controlled by mobile Application. Mobile Application is developed using application Bluetooth Electronic.

Device control based on microcontroller and have the capability for hot and cold. The direction of the current is being controlled by a microcontroller and it gives either hot or cold temperature on the one side of the Thermoelectric Peltier. A current sense is inserted before the TEM to monitor the amount of current being drawn by the module during the operation and Arduino used to read back the actual temperature of the Thermoelectric Peltier before showing the output. If the temperature is not on the set point, it either increases or decreases the amount of current of the Thermoelectric Peltier until reaching the set point. The circuit has H-bridge to control the condition of thermoelectric either it needs to cold or hot. Besides the temperature sensor to detect the temperature is reached with a setpoint.

The circuit has been controlled by Application Bluetooth Electronic and also can be set as a manual for those who cannot be used by the phone. The application Bluetooth Electronic fetches the data from Arduino, the process to out the output result.

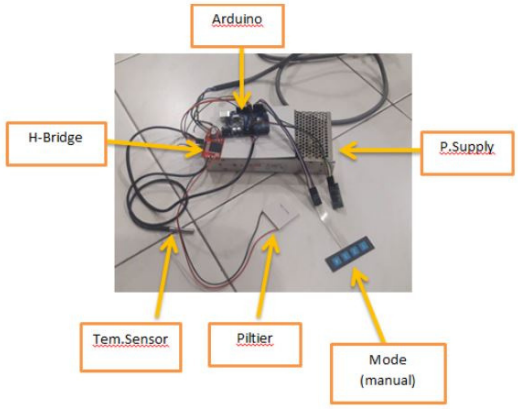

Figure 4: Circuit Diagram For Thermocold Home-Use Therapy

Figure 5 shows the schematic diagram of the circuit. This shows the interconnections of the device.

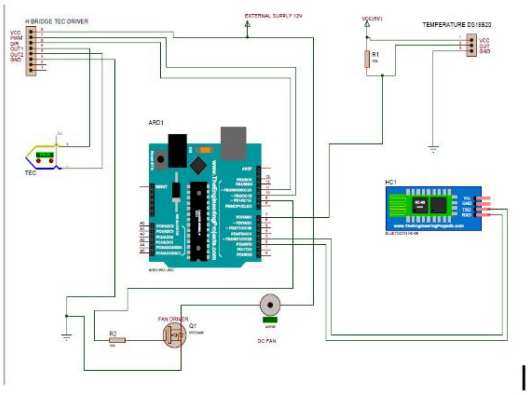

Figure 5: Schematic Diagram For Thermocold Home-Use Therapy

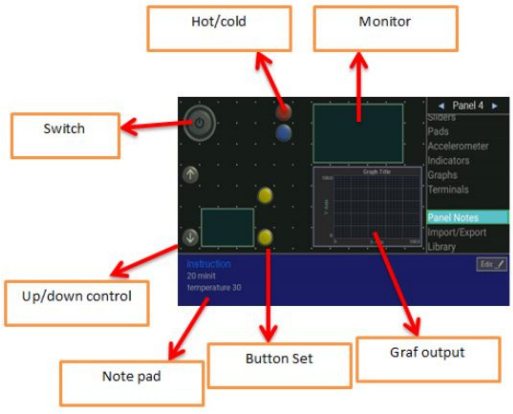

Figure 7: Panel of Bluetooth Electronic

IV. EXPECTED RESULT

Module voltage (V)	Module Current (A)	The surface temperature of therapy unit(C)
Cold therapy conditions		
6	5.3	7.7
8	7.3	3.8
Hot therapy conditions		
1	0.6	37.8
2	1.4	43.9

V. CONCLUSION

For the conclusion, the Thermacold Home-use Therapy is successfully designed and almost developed. The device is capable of reaching a temperature of as low as 5˚C and as high as 60˚C. This temperature range is suitable for common muscle and tissue injuries acquired in sports. This project will help the person who had an ankle sprain to recover and can do the treatment without the need for therapies at home.

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AN INNOVATION OF HAND SUPPORT AND THERAPY

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Abstract: Hand support devices are very helpful for embracing patients for daily living, for example, paraplegic patients, accidental effects and so on that cause limited movement. It is vital for patients with major and minor injuries to undergo a rehabilitation process to improve their condition effects from the injuries. There are a wide range of existing support tools nowadays but the support device only works for one use only as a hand support example. Hand support provides various benefits to the patients which improve their quality of life and fasten the recovery time. There are two functions in one device such as hand support device and therapy can help patients as daily support devices or undergo therapy on their own, with the presence of these hand support devices and therapies can help hand and therapeutic support on their own so can also help the hospital. Hand support device has the potential in providing a supplemental home-therapy device for certain patients and acts as a daily used device for minor injury patients.

Keywords — hand support, movement, therapy

I. INTRODUCTION

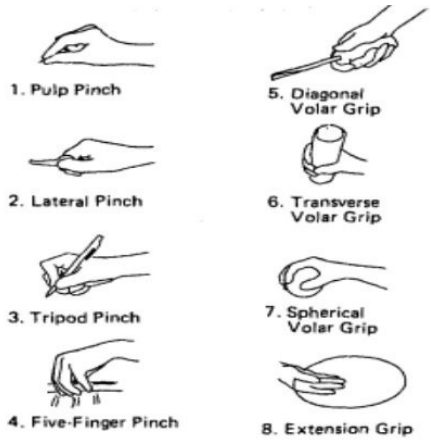
It has been recognized that any damage that includes the nerve framework can bring about an issue with the muscle or sensation. Nerves interface the mind and spinal line to the muscles and skin which give development and feeling. In the event that there is damage to the nerve, there will be an interference in the data being passed on to the skin or muscles to and from the cerebrum[1]. The bigger nerves in your arm and leg, which are about the span of a pencil, are comprised of countless nerve filaments, like the phone link and the nerve strands are assembled together in fascicles. A few nerves like the middle and ulnar nerve in your arm have engine and tactile fascicles giving you development and feeling to your hand [2].

In nerve damage, the nerve will attempt to repair itself by growing recovering nerve units. These crecovering units will then endeavor to become down the nerve to reinnervate muscle or skin. On the off chance that they make a right association, engine nerve to muscle or tactile nerve to skin, at that point recuperation of muscle capacity and skin sensation will happen. Assuming that as it may, the recovering nerve strands don't make a right association then no recuperation will happen [3]. Nerves will recover at the rate of 1 inch for every month. While sensation can be recaptured even after long stretches of denervation, muscle reinnervation won't happen after drawn out stretches of time without nerve innervation. Consequently it is important to inspire nerve to muscle as fast as could be expected under the circumstances on the off chance that it won't recoup alone. The undertaking proposed here is a specialized practicality investigation of electrodiagnostic tests, including electromyography (EMG) and nerve conduction contemplates are utilized to check whether the muscle is recouping [4].

II. HAND FUNCTION

According to Abolfathi (2008), hand work is portrayed as the capacity to utilize the turn in day by day life to perform regular exercises. Hands and fingers assume a crucial part in human life particularly in every single human movement, for example, to bolstering, to get things, to play out certain work, to compose and others. The constraint of hand work is because of the wounds and sicknesses that happened to involvement by a man. An investigation in Denmark demonstrates that the rate of wounds to the hand and wrist was 28.6% of all wounds and this includes 34% of the household mischances, 35% were relaxation mishaps, 26% were word related and 5% were auto collisions. Also, the most incessant reasons for confirmation were breaks (42%), ligament sores (29%) and wounds (12%) [5]. Other than of the wounds, hand work likewise influenced by a malady including osteoarthritis where 90% of ladies and minimal under 80% percent of men has been affirmed to have this illnesses in a gathering of

70-74 years and a gathering of over 80 years, is perceive to have 99% for ladies and more than 95% for men [5]. The measurements of the above demonstrated that hands and fingers are effortlessly cracked and when a man misfortune the capacity to utilize the hand work, it is probably going to influence the people to depend entirely on other individuals to finish every day exercises. The level of freedom is shifted as it relies upon the individual action to compose hand development and function[6]. The principal motivation behind recovery is to help diminish the weaknesses and reestablish practical execution by hand. There are numerous methods and devices acquainted with help encourage and accelerate the recuperation of the hands[6].This incorporates scope of movement works out, reinforcing works out, and oxygen consuming or continuance works out. A scope of movement practice reason to improve the adaptability of joints and alleviate firmness from hands and fingers, while reinforcing exercise included certain weight to build the muscle quality to help and ensure the joints, and oxygen consuming perseverance practice performed to diminish joints swelling at times [5]. Other than this activity, tangible gadgets has been additionally acquainted with increment the functionalities of hands, for example, hold compel estimation gadgets, finger squeeze constrain sensors, virtual reality gloves and exoskeleton framework. The appraisal of hand find that the capacity of hand has concentrated on hold or squeeze quality and scope of hand movement subject to assessment of the exercises. Figure 2.1 showed eight main types of functional grasp played by normal hands in daily activities. This functional grasp is vital in increasing the hand function especially if the person performed during the rehabilitation practice.



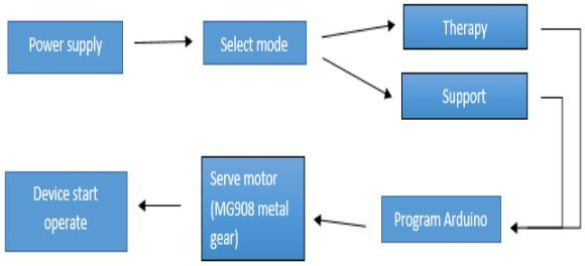
Adapted from Sollerman C. and Ejeskar A. (1994)
Figure 2.1: Eight types of grasp.

It is to take note of that when a man encounters damage to a nerve, they in all probability have issues with the muscle and misfortune in sensation [7]. There are few kinds of nerve damage that influence the hand sensation. First degree damage (neurapraxia) will recoup quick from certain days to 3 months, second degree damage (axonotmesis) slower than initial one as the nerve need to develop to reinnervate the muscle or skin and the nerve grow an inch for every month, third damage encountered an incomplete recuperation and it relies upon a few variables, fourth and fifth degree damage require surgery for recuperation as a tissue has obstructing any recuperation and ultimately the 6th degree damage is a blend alternate sorts of nerve damage and recuperation and treatment will change. Now and again, if a man encounters outrageous damage a surgery is required to enhance the nerve recuperation. A portion of the suggested surgery are nerve repair, nerve unite, nerve exchange or neurolysis [7]. After the surgery, the individual is required to do recovery practice to get back sensation and enhance hand usefulness. In any case, right now not all restoration procedures are satisfactory for a wide range of wounds. This is concurred by Grubisic, Kavanagh and Grazio (2015) as the greater part of the frameworks are lacking for utilization in serious instances of hand inabilities, for example, for patients in the last phases of rheumatoid joint inflammation and osteoarthritis. Distinctive patients may require diverse sorts of recovery or the recuperation would not be worked. Other than recovery, in this high innovation period different mechanical instruments can be utilized by patients to help in restoration. A portion of the preferred standpoint utilizing robots are ready to give therapy to quite a while periods in a steady and exact way without exhaustion, can be modified to perform diverse useful modes, can gauge and record a scope of practices and ready to execute as a remote to human control [8]. Nonetheless, automated is an extremely costly and unyielding device. In this manner, this investigation will recognize satisfactory apparatuses that will enable patients to accelerate the recuperation and increment the hand work. This examination likewise will make and build up a device that is adaptable where patients can use whenever without feeling awkward and cheap.

III. METHODOLOGY

This section describes the investigative focus, research methodology and specific methods used in this study. The methodology used was a mixed methods research framework encompassing both quantitative and qualitative methods and measures. In this part, planning must be in a proper manner in the way of identifying information and requirements, such as hardware and software. Planning is also sometimes can be the way for investigators to identify the problem statement as a reason to proceed with the study. For this project planning phases are done by data collection and requirement of hardware and software. Usually for this early stage, the method of planning was by primary collection, which is more to interview and meeting with outsider to get information. The questionnaires of data collection are distributed to the staff of physiotherapy unit, staff nurse, and neurology specialist doctor. By data collection, requirement for hardware and software

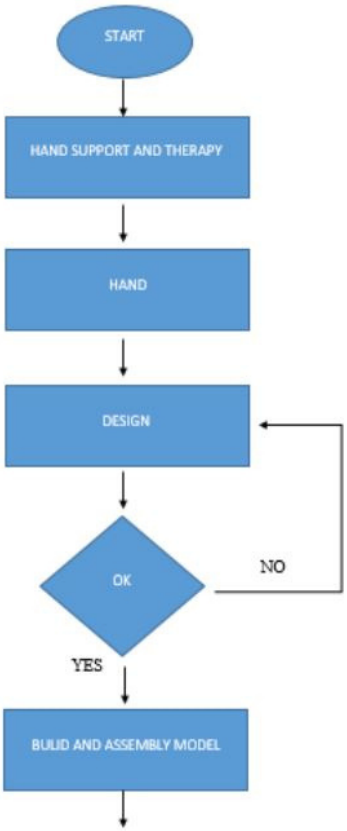
can be plan as well. At this stage, project resources and requirements, literature studies and schedule to get more information in this study are planned. In this study, the subjects are consists of public with or without hand therapy for the usability test and stroke disease patients who desire to heal. The population of subjects are among the Polytechnic Premier Sultan Salahuddin Abdul Aziz Shah, Shah Alam, focusing in Electrical Engineering Department. For stroke patients, will be in Rehabilitation Unit, Pusat Perubatan Universiti Malaya (PPUM).

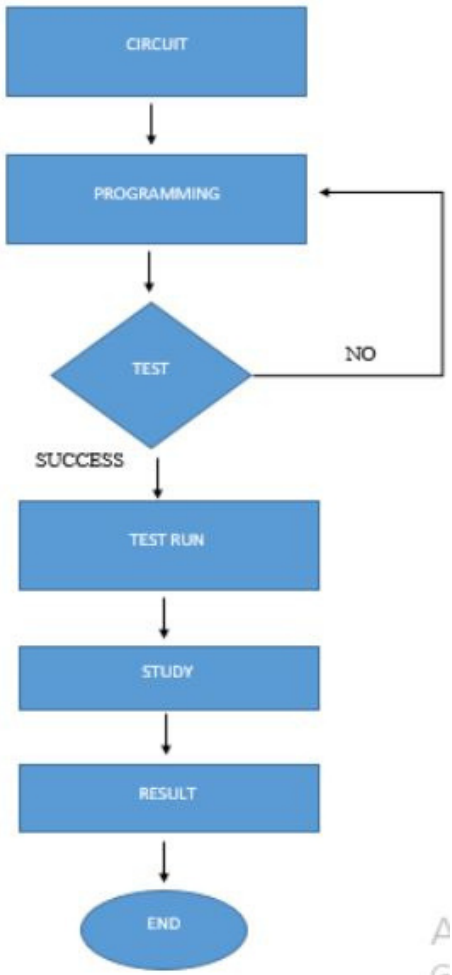


Block diagram 3.1

By using this support device can solve the problems faced on behalf of the patient. This support device operates using power supply sources and has two modes of choice, which is to support the hand side and the therapy, after choosing the program mode will perform the responsibility by using Arduino Uno. In turn, the program will signal to the motor to execute the selected mode (block diagram 3.1)

Flow chart





IV. RECOMMENDATION OF AN INNOVATION

This device can provide support to the hands of patients who cannot perform daily routines and give therapy to patient's hands in one device. The hand of the patient who cannot move the finger to perform the activities can be assisted by this support device. For therapy also, to ensure that the therapy performed at the hospital can be performed at home alone. Usability in terms of this motor device can provide strength to the fingers that cannot be transmitted and also can undergo therapy to the patient's fingers. Lastly survey paper will be given to patient or consumer and to hospital knowing opinion on design and this product applicability and opinion that could be voiced.

V. CONCLUSION

At the end of the conclusion, this device can help patients to support the hand for daily life use and do therapy in one device. More than that, it can analyze a hand support and therapy device in daily life at home. Finally, the design a hand support and therapy device that is more portable, comfortable and suitable for use.

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The Measurement of Force Sensitive Resistor towards Walker Device Application

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Abstract: FSR (Force Sensitive Resistor) sensor allow to detect physical pressure, squeezing and weight bit. In Auto walker using Pressure Sensor project, it control the speed of motor by the weight of patients. It is located from the handle bar of walker. In this project, the speed of patients walk depends on how much the pressure given from the handle bar. Arduino software programmed will be used which is to set the command to control the walker. In data collection, the reading of analog from FSR sensor is taken to see how it works when giving mild and strong pressure.

Keywords — walker; pressure sensor; motor; arthritis

I. INTRODUCTION

In our daily life, many inventor been placed to invent system for easier to do daily activities. Peoples with arthritis now days hard to move because of pain from their knee. So, they may move from one point to other point just using movement device. Many inventors also create a system that more disable or friendly user. In 2009, the world's elderly population (aged 60 and above) which have arthritis had risen to nearly 740 million people [1], [2] and is expected to reach over 2 billion by 2050 [2]. Since mobility impairments increase with age [3], so will the use of mobility aids [4].

Among the external augmentative devices, we will focus our review on the walkers. These devices assume an important role, due to the large number of potential users, considering its simplicity and ambulatory potential. They were designed to improve pathological gait, through a support base for the upper limbs that improves the balance of the individuals and reduces the load on their lower limbs [7].

To overcome this problem, many research have been done about the walker itself and also wheelchair and cane. The research of automatic walker also got the attention such as Dynamical System Approach[10], PAM aid walker [5] and also Online control of a mobility assistance smart walker [9]. This three automatic walker research have their own abilities and advantages which capable of detecting static and dynamic obstacles and also help users with visual problems or to help navigation on environments with multiple obstacles [5], using infrared to control the walker [10] and intended to read the users movement intentions to command the walker using joystick [9] where all the automatic walkers facilitate the patient's movement.

From the research above, it is found that the use of the FSR sensor is got less attention. FSR sensor is a force-sensing resistor. It is a material whose resistance changes when a force, pressure or mechanical stress is applied. They are also known as "force-sensitive resistor" and are sometimes referred to by the initialism. Therefore, this project is appeared to assess the capabilities of FSR sensor towards the walker device application.

Pressure sensor itself will attach to the handle bar walker and give command for motor speed. The pressure that will be given from hand's patient can reduce the speed of motor because their body cannot support body balance and the pressure are high at their hand. In an aging society it is extremely important to develop devices, which can support and aid the elderly in their daily life. This demands means and tools that extend independent living and promote improved health [5].

It is extremely important to develop devices, which can support and assist the elderly in their daily life, since their mobility degrades with age.

In addition, they use the person's remaining locomotion capability in order to move [7], avoiding the early and deteriorative use of wheelchairs. Over the past years, technological advances allowed the incorporation of sensors and actuators in conventional walkers, providing the stability of four-legged walkers, without affecting the resultant naturalness of the users' gait patterns.

Besides, these devices enable to identify the movement intentions of the users and therefore control the mobility assistance accordingly.

II. METHODOLOGY

The solution in this project study is using software and hardware. The result for this project will be tested in terms of technical and clinical for the convenience of consumers. Arduino application system for the software and using DC motor for the hardware part being used. The software program interface is the program and the way of connections between the hardware parts and the Arduino.

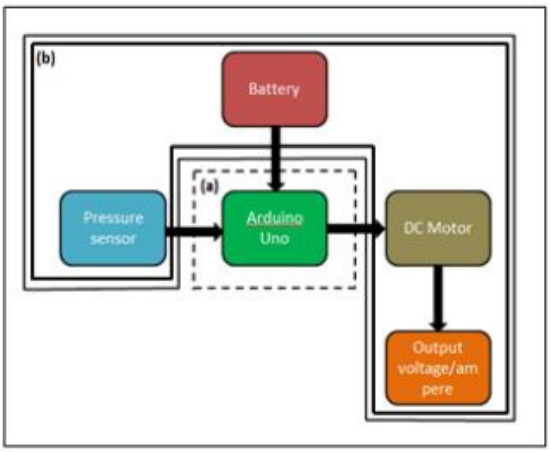

Figure 2: Block diagram of Auto walker project which (a) the software part and (b) the hardware part

From Figure 1, the block diagram shows the part of the project study, which the dot line (a) is the software part and the double straight line (b) is for hardware.

(a) Software

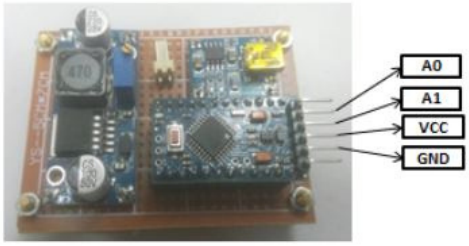

Figure 2: Arduino circuit have been used to simulate the data from the FSR sensor

In this project, Arduino Pro Mini has been used. The input for this software is FSR sensor and the output is DC motor. This project is using 5V of voltage current and 40mAof current.
In Arduino Pro Mini, it uses four pins which is GND, VCC, A1 and A0. The pins that have been used have their own function. GND is for grounding. VCC pin is used to give 5V of voltage. In this configuration the analog voltage reading ranges from 0V (ground) to about 5V (or about the same as the power supply voltage). Both pins A1 and A0 are for the resistor. Its function is used to collect the data from the sensor.

(b) Hardware

Figure 3: FSR sensor that use for Auto walker to get the analog reading

DC motor that have been used in this project is Power Window motor (MO-PW-CL) brand. It supply 12V of voltage and the torque for this motor is 30kgcm (2.9Nm). This motor is 15A of current while the output of this DC motor is forward rotation. This motor helps to rotate the wheels of the walker and it can support up to 100 kg of patients.

The pressure sensor is a touch-activated Bit - give its pad a little squeeze to activate it. The more pressure applied, the more signal it sends out. Its height is 0.5 cm, width 3.75cm and its length is 7.5cm. It weighs about 0.03 kg / 0.06 lbs**.** This pressure sensor model is-FSR (Force Sensitive Resistor) and the input is pressure.

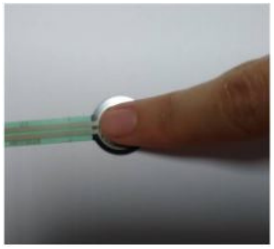

Figure 4: Right hand finger press on FSR sensor to get the reading

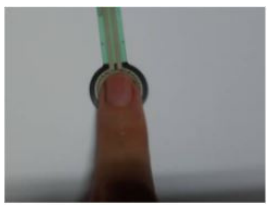

Figure 5: Left hand finger press on FSR sensor to get the reading

III. RESULT & ANALYSIS

This section will discuss the findings of the FSR (Force Sensitive Resistor) experiments. Two experiments have been done to get data from the FSR which Table 1 is analog mean reading of FSR sensor in second and Table 2 is analog reading of FSR sensor using a selected object of different weight.

Table 1: Analog mean reading of FSR sensor in second

Time (s)	FSR Sensor in analog reading			
	Mild		Strong	
	Sensor 1 (Left finger)	Sensor 2 (Right finger)	Sensor 1 (Left finger)	Sensor 2 (Right finger)
2	186	138	862	852
4	193	69	858	815
6	160	213	788	887
8	284	187	810	836
10	118	106	863	864

Table 2: Analog reading of FSR sensor using selected object to different weight

Object	FSR Sensor in analog reading	
	Sensor 1	Sensor 2
Calculator Model : Joinus Two Way Power JS-772 electronic calculator Weight : 120g	494	401
Smart Phone Model : Lenovo Vibe P1 Weight : 189g	538	560
Battery Model : NOKER.BS Serial Number : YB 3L-3S Voltage : 12V/3AH Weight : 1200g	714	737

The experiment from Table 1 is about the pressure of the finger given towards FSR sensor. Two pressures from sensor 1 is from the left finger and sensor 2 is from right finger. The pressure given is about mild and strong pressure against time. From table 2, the experiment is about the weight of the object toward FSR sensor.

Table 1 shows the result of the pressure of the finger using two different pressures from both the left and right finger. The result is taken by the different times in seconds. The result shows the different readings from both sensors. Table 2 shows the result of the FSR sensor reading given from the different weight of the object. The selected object is taken to test both sensors. The reading of FSR sensor is different from the three objects.

Sensor 1 represents the location of FSR in the left handle bar while sensor 2 represents the location of FSR in the right handle bar.

From the reading of FSR sensor, it shows that the sensor is very sensitive and it depends on the pressure given from the finger. When the time increases, the reading of FSR sensor is higher even though the pressure given is the same. This is because the resistance from FSR sensor depends on the pressure and time. Then, from the data of the object, the reading from analog is high when the weight of the object increases.

IV. CONCLUSION

For the conclusion, we got the result of FSR sensor reading in analog. From the result, we can conclude that the weight of the object and the time given affects the reading of pressure. FSR (force-sensing resistor) sensor allows to detect physical pressure, squeezing and weight. Weight is the force acting on the body due to its mass falling due to gravity. This force is F = mg. Where m is mass of the body and g is acceleration due to gravity.

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IoT for Blood Pressure and Temperature Monitor

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Abstract—Computer and electronic science fields exist joined to prepare a standout most significant technologies progress in the form of Internet realization (IoT). Therefore, long-distance health care observation services, assisted by IoT, are likely to be valuable. Hypertension is another name for high blood pressure. It can lead to severe complications and increases the risk of heart disease, stroke, and death. Blood pressure is the force exerted by the blood against the walls of the blood vessels. The pressure depends on the work being done by the heart and the resistance of the blood vessels. The high blood pressure problems that require frequent health monitoring. Furthermore, the demanded of the times to make an appointment with a doctor regularly. The objective of this paper is to design a device that allows measuring blood pressure, pulse rate, and body temperature of a patient. This project is designed for the convenience of hypertension patients and the patient with heart disease to monitor the current situation continuously at home. This device can be used by someone suffering from high blood pressure or not which is intended to monitor their current condition. A device designed specifically with IoT technology to facilitate patient-dealing with a doctor. Applications will be built on smartphones to send data to doctors only for observation.

Keywords — Internet of Thing, health care, hypertension, temperature

I. INTRODUCTION

The Internet of Things (IoT) is inter-communication of embedded devices using networking technologies. The IoT also is one of the buzzwords in the Information. The IoT will be one of the important trends in future. In addition, IoT can affect the networking, business, and communication. IoT regularly anticipated that would propose the propelled high data transfer capacity network of embedded devices. The IoT aims to unify everything in our world under a common infrastructure, giving us not only control of things around us but also keeping us informed of the state of the things [1].

Blood pressure can be likened to lifting a burden for the heart, and high blood pressure means your heart has to work harder to pump blood. As with the arms or legs, this hard work makes the heart bigger. The heart can become so large that oxygen delivery does not adequately meet the extra demands of the heart and causes oxygen flow disruption, leading to a heart attack. A Heart Attack occurs when the blood flow that brings oxygen to the heart muscle is severely reduced or stopped. This happens because coronary arteries that supply the heart with blood can slowly become thicker and harder from a build-up of fat, cholesterol, and other substances, called plaque. This slow process is known as atherosclerosis. If the plaque breaks open and a blood clot forms that blocks the blood flow, a heart attack occurs.

Nowadays, in Malaysia have an expanded number of heart diseases including the expanded danger of heart attack. The research of Human-Health monitoring systems has moved from the basic reasoning of the wearable sensor [2]. Depress becomes the cause of increased blood pressure and can cause stroke without our consciousness. Diagnosis of high blood pressure disease can only be done by a doctor after monitoring blood pressure and cardiovascular risk assessment. The high blood pressure problems that require frequent health monitoring [3]. The goal of this project is to develop a device that can measure the blood pressure and body temperature which then gather information on the body and send the parameters through wireless technology. Three parameters are used in this device, there is a pulse rate per minute, blood pressure and temperature for measuring and observing will send data through wireless technology. These three parameters are then interfaced to a microcontroller a type of Arduino that permits checking the parameter readings and capable of transmitting information directly to the doctor using a smartphone. This project aims to design a device that enables patients to screen their wellbeing condition regardless of the possibility that the individual is at home or in a continuous.

A. Auscultatory method of measuring blood pressure as a conventional method.

The auscultatory method (also known as the Riva Rocci korotkoff or manual method for blood pressure measurement) is the listening of korotkoff sounds in the brachial artery[4]. Initially, the cuff is inflated to a level higher than the systolic pressure. Thus the artery is completely compressed, there is no blood flow, and no sounds are heard. The cuff pressure is slowly decreased. At the point where the systolic pressure exceeds the cuff pressure, the Korotkoff sounds are first heard and blood passes in turbulent flow through the partially constricted artery. Korotkoff sounds will continue to be heard as the cuff pressure is further lowered. However, when the cuff pressure reaches diastolic pressure, the sounds disappear. Now at all points in time during the cardiac cycle, the blood pressure is greater than the cuff pressure, and the artery remains open.

B. The relationship between temperature, high blood pressure, and heart attack

When a person is exposed to heat or high temperature, he sweats profusely, leading to dehydration. Dehydration reduces the volume of blood, which also results in falling off the blood pressure [5]. Secondly, people suffering from any illness where fever is one of the symptoms, experience rise in blood pressure, i.e., fever increases the blood pressure.

High blood pressure is a common condition in which the long-term force of the blood against your artery walls is high enough that it may eventually cause health problems, such as heart disease [6]. Blood pressure is always recorded as two numbers, such as 120/80 (normal condition), where the top number is the systolic pressure and the bottom number is the diastolic pressure. Systolic pressure is the pressure on the arteries as the heart contracts and pumps blood. The diastolic pressure is the pressure on the arteries when the heart is at rest in between heartbeats.

Table 1: The category of Blood Pressure

Blood Pressure Category	SYSTOLIC	DIASTOLIC
Normal	less than 20	less than 80
Elevated	120-129	less than 80
hypertension Stage 1	130-139	80-89
Hypertension (stage 2)	140 or higher	90 or higher
Hypertensive crisis	Higher than180	Higher than 120

A Heart Attack occurs when the blood flow that brings oxygen to the heart muscle is severely reduced or stopped[7]. This happens because coronary arteries that supply the heart with blood can slowly become thicker and harder from a build-up of fat, cholesterol, and other substances, called plaque. This slow process is known as atherosclerosis. If the plaque breaks open and a blood clot forms that blocks the blood flow, a heart attack occurs.

C. ZigBee Device Access Control and Reliable Data Transmission in ZigBee Based Health Monitoring System

ZigBee is used to communicate between sensor devices and the mobile system [8]. Sensor devices measure the physiological signals of the patient and send the data to the mobile system using ZigBee. The mobile system can display the physiological signal data from sensor devices and send them to a healthcare service provider system by using WLAN or CDMA. The ZigBee technology is designed to carry small amounts of data over a short distance while consuming very little power [1]. As opposed to Wi-Fi, it's a mesh networking standard, meaning each node in the network is connected to each other. There are a few common household products that use ZigBee chips. This technology also has a low-channel bandwidth of 1MHz. It's restricted to wireless personal area networks (WPAN) and reaches an average 10 to 30 meters for usual applications. ZigBee's data transfer speed is lower than Wi-Fi. It is maximum speed is just 250kbps, much lower than the lowest speed Wi-Fi offers.

C. Health Monitoring and Management Using Internet-of-Things (IoT) Sensing with Cloud-based Processing: Opportunities and Challenges

IoT can facilitate an evolution in medical practice, from existing diagnostic and academic paradigms, to proactive frameworks for early disease prognosis, coupled with prevention, cure, and overall health management rather than disease [9]. Additionally, it helps to reduce healthcare costs and at the same time increase yields. In this journal, the researcher concentrate especially on the clinical field and look at the open doors managed by accessible and up and coming advances and the difficulties that must be tended to keeping in mind the end goal to permit coordination of these into the act of prescription. Data Acquisition is performed which are sensors connected to the network through an intermediate data aggregator or concentrator, which is typically a smartphone located in the vicinity of the patient. Data Transmission components of the system are responsible for conveying recordings of the patient from the patient's house to the data center of the Healthcare Organization (HCO) with assured security and privacy, ideally in near real-time. The researcher reviewed the wearable sensors, especially those furnished with IoT insight, offer appealing choices for empowering perception and recording of information in home and workplaces, over any longer terms than are right now done at office and research facility visits devices are getting enough receptiveness because of patient mind set with these devices and also allergy diseases need to

be considered with this wearing.

II. METHODOLOGY

Block Diagram of Project

The block diagram in figure 1 shows that the operation of the Arduino module and Node MCU module combining with the pressure sensor, pulse sensor, and temperature sensor.

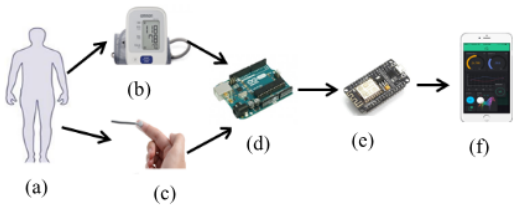

Figure 1: Block Diagram

Where,

(a) User
(b) Pressure sensor and pulse sensor
(c) Temperature sensor
(d) Arduino UNO
(e) Node MCU (WiFi ESP8266)
(f) Smart phone with application

Figure 1 shows the block diagram of the proposed systems. The system functionality is divided into major three modules, they are:

1. *Sensing module*
2. *The main module*
3. *Interaction module*

- ***Sensing module***

Sensing module consists of the pressure sensor, pulse sensor, and temperature sensor. The sensors are attached to the patient's body to collect the health data from the patient. The pressure sensor and pulse sensor which are attached to the patient's arm is the part to collect the reading of blood pressure and pulse rate and then store to the EPROM. The temperature sensor is attached to the oral cavity and start reading. When the temperature has done and got the output, then the data from temperature sensor have to gather with the data extracted from EPROM to send to the main module by using Arduino Uno interfaced with Node MCU ESP8266.

- ***The main module***

The main module is Arduino Uno interfaced with Node MCU ESP 8266. Arduino intermediaries with the three sensors for transmit data to the Node MCU ESP8266 and then send the data to the smartphone that have been built with the application.

- Interaction module

This paper using Wi-Fi Module Node MCU ESP8266 connect with the smartphone. Connect the ESP8266 module with Arduino. ESP8266 runs on 3.3V, so need to power from the 3.3V output of Arduino. Connect VCC and CH_PD of ESP8266 module to the 3.3V output of Arduino and the ground of ESP8266 to the ground of Arduino. The RX pin of the ESP8266 is not 5V tolerant so, need to reduce the 5V TX output of Arduino to 3.3V using voltage dividing resistors. Here, using three 1KΩ resistors connected in series for that. So, connect pin 10 (TX) of Arduino to RX of ESP8266 module via voltage dividing resistors. Can directly connect the TX pin of ESP8266 to 9th (RX) of Arduino as it will detect 3.3V as logic HIGH according to TTL Voltage specification.

Blynk is an open source IoT application where the application we can build directly from a smartphone. This application is used to store and retrieve data from the 'thing' via the internet.

Figure 1 shows the block diagram of the proposed system, there are three modules in the proposed system as discussed above. Initially, the main module collects the data through the sensors. the data then temporary save in the Arduino. the proposed system will create an application to store the data to cloud through the internet.

III. EXPECTED RESULT

Figure 2 shows the results are to illustrate that all the modules are operating correctly without any data loss and each sub-module in all modules are performing their function. The Pressure Sensor, Pulse Sensor and Temperature Sensor of sensing module should extract the accurate readings and should be able to send the data to the Arduino. The Wi-Fi module which is also a part of the sensing module must send the values to the server without any delay and without any data loss. The Server should store all the data sent by the Wi-Fi module and display the same on the Smartphone.

This device was developed by the addition of IoT systems to facilitate dealings between doctors and patients. This IoT system is used to transmit blood pressure reading and patient temperature to doctors even when the patient is at home using the internet. Patients and doctors only need smartphones and the internet to see devices work. Figure 2 below shown to see the process of data is sent.

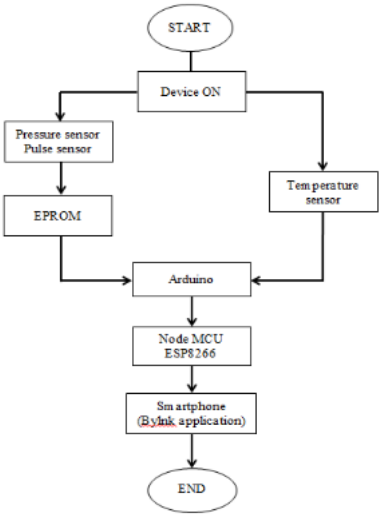

Figure 2: Flowchart of data process

The effectiveness of this device in terms of time savings can be seen through the comparison between how to measure blood pressure using manual and automatic methods. In terms of cost reduction can be seen when the patient meets the doctor to pay the inspection fee, instead, the patient needs to use the device with the consent of the patient's doctor data to be sent directly to the doctor. Others, the patient may also reduce the cost of transportation or petrol oil when making an appointment with the doctor if the patient's home is away from a health clinic or hospital. Lastly, in terms of energy capability, here is a clear disability for stroke patients whose movement is limited. This device is designed to make it easier for patients who experience one of the diseases such as stroke patients.

IV. CONCLUSION

Developed a system that measures blood pressure, pulse rate and body temperature of the patient, send the data to the user by using a microcontroller with reasonable cost and great effect. Use three different sensors and these are mainly under the control of the microcontroller. For pressure sensor measurement use arm, it is in mmHg (millimeters of mercury). These calculated rates will have stored in the server by transferring through Node MCU ESP8266 via the internet. This device can measure the human body temperature, use a thermistor, the measured data is given to transmitter module, it interns transfer these data to the server through the wireless system due to this notice avoided the use of wires. Finally, the stored data in the application will be displayed for further analysis by references for the patient itself or doctor to provide better aid. From the results, the proposed system is user-friendly, reliable, economical.

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Pregnancy Back Pain Treatment: A Review

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Abstract—The back pain that women experienced during pregnancy could affect their daily routine. There are many causes of back pain that experienced by adults or teenagers nowadays. But the for the pregnancy women, they experienced the back pain because of the growing uterus shift the center of gravity giving more strain on the back. Having a back pain during pregnancy is a common thing and it is quite difficult to overcome immediately and permanent. Then, they need a treatment so that they can do their daily routine without any stress and it will make their emotion more stable. The solution to reduce the back pain is give massage treatment to the back pain so it will help them to do their daily routine without stress. In this review, we will discuss about pregnancy and its treatment.

Keywords — back pain, pregnancy, massage

I. PREGNANCY

Pregnancy happens when an egg is treated by a sperm, becomes inside a women's uterus (womb), and forms into a child. In human, this procedure takes around 264 days from the date of preparation of the egg, however the obstetrician will date the pregnancy from the principal day of the last menstrual period (280 days 40 weeks). There are some symptoms in pregnancy which is:

- Breast tenderness
- Nausea, vomiting, or both
- Missing period or having an abnormal period
- Weight gain
- Urinating more frequently than usual

All those symptoms that listed above will be experience by women who is having pregnancy. If they feel some of these symptoms, they should make an appointment with doctor to confirm if they are having pregnancy or not.

II. BACK PAIN IN PREGNANCY

Everyone having an experience in back pain and it is a common problem that we face every day in our life. Back pain occurs at the same time during pregnancy in almost every second. Many women experience back pain during pregnancy. There are a few types of back pain in pregnancy such as low back pain (LBP) and pelvic pain (PP) [2]. The causes are complex: their weight gain in other perspective, and the particular physiology of the spine on the other. During pregnancy, weight gain is 15 to 25 percent and this indicates greater burden on the tendons, ligaments, and joints [3]. Furthermore, relaxin hormone and estrogen relax the ligaments and thereby create additional tendencies for injury. When the uterus is enlarged and the increase in the number of breasts shifts the center of gravity forward.

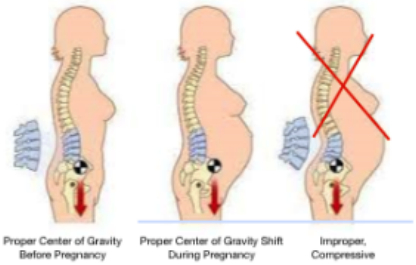

Figure 1. Position of Center of Gravity during Pregnancy

Pelvis is leaning at the same time, and lumbar lordosis increases. Therefore, the shear force between the vertebrates is reduced, and they are able to move backwards to offset the weight gain in the forefront without damaging the spine. In the course of evolution, it is quite difficult to overcome the back pain while pregnant immediately and permanently. All this problem leads to stress and unstable emotion while affect them to do daily routine. So, with having a massage treatment, it will reduce the back pain and give a relief discomfort to make them feel more comfortable while they get to do their daily routine without

complaining having a back pain.

III. TYPES OF BACK PAIN TREATMENT

A. Massage

Massage can be characterized as the efficient control of delicate tissues of the body for torment decrease or other helpful purposes. Manual palpation included can likewise be utilized for indicative purposes. 'Classic' ('Swedish') massage includes effleurage (stroking and gliding), petrissage (manipilating), and tapotement (percussion) [4].Massage treatment may serves in as a successful intercession for prenatally discouraged ladies since it has been noted to help related conditions [5]. As example, massage treatment amid work has decreased work tension and length of work. Massage treatment has diminished post birth anxiety and additionally discouragement related hormones including cortisol and norepinephrine.

At beginning of the second trimester, the massage assembles got two 20-min of massage every week more than four months. Trained back massage therapist instructed the back massage to the 'significant others' of the ladies, who at that point directed the twice-week after week of massages for the 16-week time span. Every session started with the mother in a side-lying position, with cushions situated in the face of her good faith and between her legs for help. The back massage was regulated in the accompanying arrangement for 10 min [6]. After treatment, the discoveries propose that massage treatment is compelling for diminishing pregnant ladies' stress hormones, stressful mood states, leg and back soreness and for reducing obstetric and postnatal complication, thus enhancing neonatal outcomes. They additionally propose the viability of utilizing a noteworthy different as massage specialist. Additionally inquire about is expected to investigate the fundamental components for these progressions [7].

B. Physical Exercise

In the previous study on 2 years ago demonstrates an assortment of concentrates on exercise during pregnancy. Some clinical preliminaries have been led to assess the impact of activity on maternal result, for example, low back/pelvic agony, depression during pregnancy and baby blues, gestational weight put on and over the top weight pick up, gestational diabetes and insulin opposition, urinary incontinence indications, cardiovascular fitness, and the effect of activity on personal satisfaction and wellbeing status recognition. Musculoskeletal distresses, for example, bring down back, pelvic, or potentially joint agony are basic grumblings amid pregnancy related with the anatomical adjustments amid pregnancy and past dangers factors . A research by Kluge J, Hall D, Louw Q, et al. in a South African populace confirmed that a 10-week practice program diminished back torment power and expanded useful capacity amid pregnancy [15]. A similar way, A Cochrane audit demonstrates that particularly custom fitted fortifying activity, sitting pelvic tilt practice programs, physiotherapy intercessions, and water vaulting, all had helpful, albeit little, impacts when contrasted and standard pre-birth mind [33]. Stafne et al. [3] found no distinction in the pervasiveness of lumbo pelvic torment at 36 weeks in pregnant ladies submitted to 12 weeks of heart stimulating exercise and reinforcing exercise contrasted and controls.

Be that as it may, an active women could better deal with the condition. Musculoskeletal pain can likewise be constricted with physical action in a few ladies who exhibit mild pelvic and lumbar uneasiness [33]. During and after pregnancy, anatomical changes and birth injury could prompt high rate of pressure urinary incontinence that was engaged in three research [34]. In the past research demonstrated that pelvic floor muscle practices were successful in treating pressure incontinence, in any case, regardless of whether antenatal pelvic floor muscle exercise could anticipate incontinence during pregnancy and baby blues period still stays questionable [14– 16]. Consistently performed and particular activities were more viable than general activities and home exercise guiding [16]. Most likely the most ideal approach to counteract incontinence identified with the gestational period is to propel pregnant ladies to practice pelvic floor muscles each day following a vaginal evaluation of right constriction [15].

Weight and corpulence related comorbidities are extraordinary medical issues overall including ladies of childbearing age. The over the top weight put on and maintenance of weight after birth, both increment the danger of heftiness, gestational diabetes, and pregnancy-initiated hypertension [38]. It is by all accounts the accord that physical exercise anticipates exorbitant weight pick up . There are three critical angles to note. To begin with, administered practice programs are more compelling than home exercise guiding [8,9]. Women that activity as often as possible, for example in Haakstad and Bo's [9] consider, those going to 24 sessions, have a lower mean weight pick up and bring down baby blues maintenance. Second, ladies with higher BMI preceding pregnancy are impervious to accomplish the objective weight increase as indicated by IOM [8, 10]. Third, the mix of activity and dietary mediation are the most ideal approach to control weight pick up [7, 8, 10].

Furthermore, physical exercise is an adjuvant intercession suggested for gestational diabetes control [39]. Three examinations assessed the impact of an assortment of activity programs on gestational diabetes [11– 13]. Two of them submitted sound pregnant ladies to an activity program and demonstrating conflicting

outcomes [11, 12]. The biggest investigation including 855 patients found no confirmation that 12 weeks of standard exercise forestalls gestational diabetes or enhances insulin opposition [11], though Barakat et al. [12] demonstrated that direct physical exercise performed amid the whole pregnancy enhanced levels of maternal glucose resistance (50 g maternal glucose screen 24– 28 weeks) without any instances of gestational diabetes. Besides, obstruction practice in patients with gestational diabetes was viable in diminishing the quantity of ladies who required insulin and in enhancing glycemic control [13]. Physical exercise could anticipate preeclampsia as guessed in ongoing surveys and observational examinations, despite the fact that no ongoing clinical preliminary was incorporated into these audits [40, 41]. Similarly vital, the mental effect of activity had been considered. Clinical preliminaries discover beneficial outcomes of physical exercise on depressive side effects amid pregnancy and baby blues [5,6], personal satisfaction, mostly with respect to physical and torment segments [8,19,20], and maternal impression of wellbeing status [18]. Ladies who practice amid pregnancy related that this training had profited them somehow [19].

C. Low-impact Aerobic Exercise

Low-impact aerobic exercise increasing the blood flow and supports healing from an injury without shaking the spine. Low-impact aerobic exercise can incorporate utilizing stationary bicycles, circular or step machines, walking, and water therapy. Individuals with low back pain who regularly do aerobic exercise report fewer recurring pain period and are more likely to remain active and functional when pain flares.

IV. REDUCING PAIN BY MASSAGE

Massage has brought about reduce pain in every one of the examinations that have directed on chronic pain conditions from lower back pain amid pregnancy, migraine headaches, premenstrual syndrome, chronic fatigue, fibromyalgia, carpal passage disorder and rheumatoid joint pain [8]. In a large portion of these investigations the moderate pressure massage was centered on the painful area, for example, the lower back, and the 20-min sessions were given twice every week for 5 weeks.

In a current survey, most of the 25 studies about that were secured utilized a comparable massage enduring 20e30 min and given twice-week by week more than 5 weeks with evaluations previously, then after the fact the to begin with and last session (toward the finish of the treatment time period) [9]. These authors revealed predictable single treatment diminishments in salivary cortisol and heart rate and different treatment diminishment in diastolic blood pressure.

V. ATTENTIVENESS ON MUSCLE MONITORING BY EEG

Expanded attentiveness has been noted in a research facility examine by our gathering following 15-min chair massages[8].EEG examples of elevated alertness/attentiveness happened following the massage sessions including expanded beta and theta waves and diminished delta waves. These EEG designs were identified with better execution after the massage on math calculations incorporating playing out the figuring in less time and with more prominent exactness quickly after the massages.

The massage consequences for attentiveness may be intervened by expanded vagal activity. The vagus nerve branch to the heart moderates heart rate [10]. Expanded vagal action has been related with upgraded attentiveness, and in a few examinations improved attentiveness has been related with diminished heart rate [10]. The increment of pressure receptors by direct versus light pressure massage is related with diminished heart rate and EEG designs that, thus, are identified with upgraded attentiveness[11]. Expanded vagal action may intervene the impacts of direct pressure incitement on attentiveness.

VI. EEG MONITORING ON VAGUS ACTIVITY

Depressed people regularly have more prominent right than left frontal flap EEG activity[10]. Greater right frontal EEG activation is related with negative feelings and with withdrawal or less approach conduct [10]. Constantly depressed people appear this EEG design notwithstanding when they are never again indicating behavioural side effects [11].Thus, right frontal EEG has been noted as a physiological marker for chronic depression. Frontal EEG has moved from right to left in depressed youths [11]and adults even after a short session of direct massage therapy[12]. Other changes following massage treatment incorporate expanded vagal action that is commonly low in depressed people [12].

The flat facial articulations and vocal intonation form noted in depressed people could be clarified by low vagal action given that the vagus nerve stimulates the face and voice muscles [12]. Cortisol levels that are frequently high in depression have diminished following moderate pressure massage [13] as have neurotransmitters related with pressure, i.e. norepinephrine levels [14]. Furthermore, serotonin (the body's normal energizer) and dopamine (an actuating neurotransmitter) have expanded after direct pressure massage [14].

VII. CONCLUSION

There is expanding interest in understanding the significant of back pain treatment in pregnancy period.

Given the review from previous studies in this paper, there is a need for higher methodological qualities of research studies to create a strong evidence base for massage therapy. Any additional research studies could be improved to validate any back pain treatment during pregnancy as effective treatment so that it could help women in pregnancy to reduce the back pain experience in consistent method. Last but not least, any self-care for back pain treatment need to get advice from doctor or physician.

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Automated Ultramodern Room Acclimatization (A.U.R.A.)

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Abstract—This project focuses on creating a room or hospital ward which has the capability to switch on or off the light and fan automatically. Additionally, a system which helps the patient to sleep also added along others. This project can be very helpful for nurses and doctors in the hospital. In addition, this project also can be fixed to home, where patients with specific disabilities can reduce their strain. By having a relaxing music and fresh air around, any patient with sleeping disorders can sleep well which will increase their health condition indirectly.

Keywords — automated, hospital ward, light, air-conditioner, sleep inducer

I. INTRODUCTION

An automated ward is clarified as providing comfort, energy efficiency with convenience and low operating cost. That is a term commonly used to explicit a ward that has appliances such as lighting, heating, air conditioning, camera and other devices that are able to connect with one another and can be controlled remotely by a time schedule. Automated ward also defines that highly advanced smart technologies and interconnects many devices in a ward to enhance the quality of hospital facilities. Apparently, this concept, in Malaysia is not been used before and it is in need for modifications to be applied to hospital wards. In this prototype, the ward will be fixed with automated light dimmer, air-conditioner, and also added with music and air-conditioner for the purpose of inducing sleeps for patients.

Hospitals that are operating these days are following the old-fashioned manual control of light and air-conditioner. There should be a person to control the all the facilities. In this paper, availability of automated systems will reduce the needs of nurses to take care of them. Other than that, most of the patients have problems of having a good sleep under hospital environments. In this condition, patients will be unstable mentally and physically. To overcome this issue, staffs usually use drug therapy to make the patients feels relaxed or sleep. Research have proved that practicality of non-drug therapy such as music-therapy or aromatherapy can be very useful for the patients to relax their mind, hence such system is also discussed in this paper. Even with modern technologies, it is difficult for these facilities to be kept functioning well. With the aid of monitoring system for this prototype, these systems can be assured to be tracked all the time, and in case if there is any malfunction, the problem can be figured out easily.

Based on previous studies, few researches were done regarding automated light control and air-conditioning. Using Digital Addressable Lighting Interface (DALI-Controller) is one of them which specifies simple bi-directional interface for electronic device in the lighting applications[1]. Along with it, Digital Serial Interface (DSI-Controller) was linked together which is applied in digital controlled ballasts[1]. Also added, presence detector for automatic light switching and a light sensor to control the light intensity or dimming[1]. In another study, Lighting Automatic Control System (LACS) was used[2]. It adjust the light intensity based on external lighting effects and incorporates user illumination requirements according to activities performed[2]. This setup involves Home Light Control Module (HLCM), which is very suitable for home or small office[2]. For its installation, the room uses one sensor and is placed at the area which the light controlled does not fall on the sensor[2]. While for air conditioning, a study uses thermostat to activate the air conditioner automatically at specific temperature[3][4].

From previous researches for music-therapy and aromatherapy as substitute for drug therapy, slow rhythmic without a heavy beat were used to make the user sleep[5]. Another study made, user have to listen to music for the purpose of fall asleep “as fast as you

can" or "whenever you want" theory, while the music involved were low-mental load and high-mental load[6] [7]. For aromatherapy, lavender oil is majorly used since it is relaxing, sedative effects and carminative characteristics[8]. It also helps the patients recover from their sleep disorder. Another approach involves inhalation of essential oil mixture of basil, juniper, lavender and sweet marjoram along with hand massage using sweet almond oil for patients in hospitals[9].

II. METHODOLOGY

This chapter will explain about the whole research method approach for this prototype. There are 2 main systems that are involved which is combined to be fixed in a hospital ward. First system consists of light dimming control and automatic air-conditioning based on environmental temperature. While second system comprises speakers for music and air-freshener for aromatherapy. For this paper, only the first system will be discussed thoroughly. System 1 have 2 sensors fixed to which is LDR and infrared thermometer. LDR in the circuit detects low lighting environment and sends signal to arduino to activate the light. On the other hand, infrared thermometer will sense the temperature of its surroundings and sends signal to arduino to control and adjust the air-conditioner cooling level.

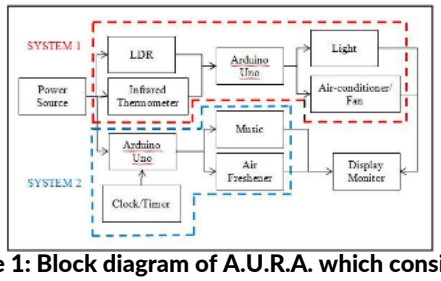

Figure 1: Block diagram of A.U.R.A. which consists of two systems, System 1 controls light and air-conditioner and System 2 activates music and air freshener

A. Software

The software that is used to do programming for this prototype is Arduino IDE, version 1.8.5. This is an open-source software and is compatible with all programming languages. Language used for this prototype is C and C++. Since Arduino can adapt to most of the software, the program language was referred online, depending on the needs of this prototype with some modifications. Sample programs that was referred demonstrates use of LDR as switch, whereby each time it is covered the LED is turned ON[13][14]. While another programming was done to check the temperature and each time new reading is taken, a LED fixed with it will blink[14].

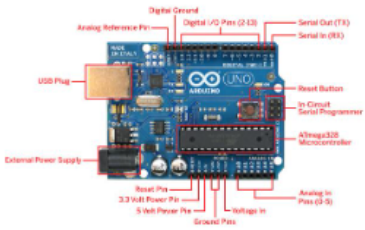

Figure 2: Arduino Uno R3

(i) Arduino Uno R3

Arduino Uno R3 is a microcontroller board based on ATMmega328[8]. The advantage of this board compared to Raspberry Pi is it is a simple computer that can run one program at a time repeatedly and it is easy to use[9]. It is also compatible for Windows, Mac and Linux but Raspberry Pi usually works on Linux only[8]. Arduino is inexpensive and the programs can easily be found online. Input voltage that have been used for this prototype is in between 5 to 12 voltage. Output voltage of this board are in the range of 3.3, 5 and 9 voltage. Pins that are involved for the fixing are 5V power, ground, analog input (A3, A4, A5), digital I/O (11, 12) and digital ground.

(ii) MLX90614

MLX90614 is an infrared thermometer which can detect objects or environmental temperature. This sensor is small in size and its cost is not that expensive too. It is easy to integrate and installed with power saving mode usage. This sensor is factory calibrated temperature for the range of -40 to 125°C while for object temperature is -70 to 380°C. The distance spot ratio is 1.25 (8 cm spot at 10 cm distance) with a viewing angle of 45°. Its temperature reading resolution is about 0.1°C and it takes less than 1 seconds to read temperature. Its temperature reading is precise which will makes the reading is accurate so that it is easy to control the cooling of environment. This sensor is fixed to ground pin, analog input A4 and A5, with an input of 5 voltage.

(iii) Ambient Light Sensor

Ambient Light Sensor(ALS) is a type of light-dependant resistor where it have high resistance in dark, when there is lights, the resistance LDR will falls. This is because its resistance will reduce to allow current flow at dark environment. ALS is small in size and the cost is also cheap. This sensor is connected to analog input A3, ground pin and supplied with 5 voltage source.

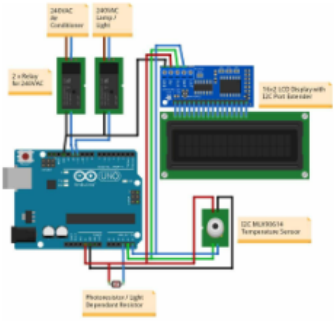

Figure 3: Circuit diagram of System 1 which controls light and air-conditioner

(iv) Light

Lights that used in this project will be LED's since it is cheap and the brightness can be adjusted for dimming control. The light will be connected to a relay so that it can be controlled efficiently and that relay will be connected to digital pin 11 and 12. Power source value that will be supplied is 12 voltage. The relay will also be linked with the 16x2 LCD display monitor to track its functionality.

III. RESULTS

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A Review on Gesture Recognition for Deaf and Mute

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Abstract—Language is the prime means of communication of people. The Sign language is very important for people who have hearing and speaking deficiency generally called Deaf and Mute. Sign is the oldest way of communication of the primitive man when there is no proper dialect. It is the main method of correspondence for such individuals to pass on their messages and it turns out to be imperative for individuals to comprehend their language. Conceivable outcomes are less in understanding the gesture-based communication of the deaf dumb individuals by ordinary individuals in such places like bank, booking counters, restaurants and so forth. Conversion of sign language into text or voice reduce the problems arise there. Hard of hearing individuals influence utilization of communication via gestures or signals to make to comprehend what he/she endeavoring to state however it is difficult to comprehend by hearing individuals. It is based on the need of developing an electronic device that can translate sign language into speech in order to make the communication take place between the mute communities with the public possible

Keywords —Deaf, Mute, Sign Language, Sensors

I. INTRODUCTION

Each ordinary individual sees, tunes in, and reacts to enveloping. In any case, there are some less honored people who are precluded from claiming this vital gift. Such people, chiefly tragically challenged, they rely upon gesture based communication to speak with others. Measurement demonstrates that around 9 billion individuals in this world are hard of hearing and unable to speak[1]. In Malaysia, there are around 2.8 million individuals who have inabilities. Interaction between hard of hearing imbecilic individuals and ordinary individuals have dependably been a troublesome task. For the most part, few out of every odd common individuals understand the correspondence through communication via gestures used by the debilitated. . This makes a no space for them as correspondence is one of the need of life. Besides, this will cause an issue for the almost totally senseless groups to associate with others, especially when they endeavoring to arrange into informational, social and work environments. To overcome this issue, a gesture based communication acknowledgment framework must be created with a particular true objective to slaughter the basic between the customary and weakened person.

The principle objective of this task is to create gesture based communication interpretation framework that can make an interpretation of the communication via gestures into content and sound. Since only one out of every odd run of the mill individuals being instruct with correspondence through marking, this framework will help them to grasp the dialect of deaf and mute individuals so will give purposes important to them in directing their day by day errands ahead.

When the deaf and mute can't communicate verbally and this is a predicament when they are socializing with people who are not well verse in sign language[2]. The understanding are mainly affected due to insufficient knowledge about sign language. As the language is being a barrier the work space for the deaf & mute is been very much affected, their sign language are commonly interpreted wrongly.

The scope for this project are as followed:

- Sign language recognition system for deaf and mute people.
- This will improvise the communication between disabilities people and normal people

II. LITERATURE REVIEW

A. *Deaf*

Deaf, also known as hearing impairment is a partial or total inability to hear[2]. A deaf person has little to no hearing. Hearing loss may occur in one or both ears[4]. Hearing loss is diagnosed when hearing testing finds that a person is unable to hear 25 decibels in at least one ear[1]. There are three main types of hearing loss, conductive hearing loss, sensorineural hearing loss, and mixed hearing loss[5]. Human hearing extends in frequency from 20-20,000 Hz, and in amplitude from 0 dB to 130 dB or more. Zero dB does not represent absence of sound, but rather the softest sound an average unimpaired human ear can hear; some people can hear down to -5 or even -10 dB. 130 dB represents the threshold of pain. However, the ear does not hear all frequencies equally well; hearing sensitivity peaks around 3000 Hz[4]. There are many qualities of human hearing besides frequency range and amplitude that can't easily be measured quantitatively. As of 2013, hearing loss affects about 1.1 billion people to some degree. It causes disability in 5% (360 to 538 million) and moderate to severe disability in 124 million people[6]. Of those with moderate to severe disability, 108 million live in low and middle-income countries. Of those with hearing loss, it began in 65 million during childhood[7]. Those who use sign language and are members of Deaf culture see themselves as having a difference rather than an illness.

B. *Mute*

Mute is an inability to speak, often caused by a speech disorder, hearing loss, or surgery[2]. Someone who is mute may be so due to the unwillingness to speak in certain social situations. Selective mutism previously known as "elective mutism" is an anxiety disorder very common among young children, characterized by the inability to speak in certain situations. It should not to be confused with someone who is mute and cannot communicate due to physical disabilities. Selectively mute children are able to communicate in situations in which they feel comfortable. About 90% of children with this disorder have also been diagnosed with social anxiety[8]. It is very common for symptoms to occur before the age of five and do not have a set period. Not all children express the same symptoms. Some may stand motionless, freeze in specific social settings, and have no communication. Alalia is a disorder that refers to a delay in the development of speaking abilities in children[9]. In severe cases, some children never learn how to speak. It is caused by illness of the child or the parents, the general disorders of the muscles, the shyness of the child or that the parents are close relatives. Anarthria is a severe form of dysarthria[10]. The coordination of movements of the mouth and tongue or the conscious coordination of the lungs are damaged. Aphasia can rob all aspects of the speech and language[11]. It is a damage of the cerebral centres of the language. Aphonia is the inability to produce any voice. In severe cases, the patient loses phonation[12]. It is caused by the injury, paralysis, and illness of the larynx. Conversion disorder can cause loss of speaking ability. Feral children grow up outside of human society, and so usually struggle in learning any language. Some people with autism never learn to speak. Most intellectually disabled children learn to speak, but in the severe cases, they can't learn speech. Children with down syndrome often have impaired language and speech[13].

III. GESTURE RECOGNITION

C. *Sign Language*

Sign language (also signed language) is a language which chiefly uses manual communication to convey meaning, as opposed to spoken language. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express a speaker's thoughts[14]. Sign languages share many similarities with spoken languages (sometimes called "oral languages"), which depend primarily on sound, and linguists consider both to be types of natural language. Although there are some significant differences between signed and spoken languages, such as how they use space grammatically, sign languages show the same linguistic properties and use the same language faculty, as do spoken languages. They should not be confused with body language, which is a kind of non-linguistic communication. Wherever communities of deaf people exist, sign languages have developed, and are at the cores of local deaf cultures. Although primarily the deaf use signing, others also use it, such as people who can hear but cannot physically speak, or have trouble with spoken language due to some other disability. The following list is grouped into three sections[15]:

- Deaf sign languages, which are the preferred languages of Deaf communities around the world; these include village sign languages, shared with the hearing community, and Deaf-community sign languages.
- Auxiliary sign languages, which are not native languages but sign systems of varying complexity, used alongside spoken languages. Simple gestures are not included, as they do not constitute language.
- Signed modes of spoken languages, also known as manually coded languages, which are bridges between signed and spoken languages.

D. Data Glove.

The data glove approach use a one of a kind gathered electronic glove, which has fabricated sensors that used to recognize the hand position[16]. Most commercial sign dialect interpretation frameworks utilize the information glove strategy, as it easy to get information

on the twisting of finger and 3D introduction of the hand utilizing gloves . The system require less computational power, and nonstop understanding is considerably less complex to fulfill. The data glove is sketched out with ten flex sensors, two on each finger . The flex sensors work as factor protection sensor that change protection as showed by the sensor's flexing . These sensors can perceive the twisting purpose of each joint of the fingers and send the data to microcontroller. It is mounted in the external layer of the information glove, from the affiliation joints of fingers and palm to fingertips. Moreover, to grow the precision in perceiving the hand represent, a 3-pivot accelerometer is used to recognize the difference in speeding up of hand's development in particular course. The accelerometer is appended on the back of the information glove. The information glove is outstandingly reasonable in seeing both fingerspelling and sign movements, which incorporate static and development signs. Be that as it may, these information glove can be costly. While it is possible to make more affordable information glove, they are substantially more powerless to commotion. On the off chance that the measure of the sensors utilized is diminished, it will achieve loss of fundamental information about the hand position. This will brings about the loss of precision in sign understanding . The data glove likewise can be less agreeable to be worn by the signer.

E. *Visual Glove*

With late progression in PC and information advancement, there has been an extended respect for visual-based approach. Pictures of the endorser is caught by a camera and video preparing is done to perform affirmation of the communication via gestures. Stood out from information glove approach, the principal favorable position of visual-based philosophy is the flexibility of the system[17]. The acknowledgment of outward appearance and head developments moreover can be joined to the system and perform lip-examining. This framework can be isolated into two system, which are usage hand made shading gloves and in light of skin-shading acknowledgment. For the extraordinarily made glove, the endorser is outfitted with shading coded gloves. The shading will give the extraction of data from the pictures of the endorser through shading division. These gloves are basically ordinary match of glove with specific shading on each fingertip and palm. Somehow, these gloves are more affordable differentiated with electronic information gloves. This framework is utilize unimportant gear by using just basic webcam and essential glove. Webcam is utilized to gain pictures from the underwriter in sort of still pictures and video streams in RGB (red-green-blue) shading[18] .For the acknowledgment in view of skin-shading, the structure require only a camera to get the photos of the endorser for the typical joint effort amidst human and PC and no extra contraptions are required. It is end up being more typical and accommodating for steady applications. This framework use a revealed hand to focus data required for acknowledgment, and it is basic, and the client specifically speak with the framework.

- *Selection of hand gesture method*

IV. CONCLUSION

Vision based or picture handling technique and sensors and microcontroller based glove. In the picture handling strategy, the camera is utilized to catch the motions. These signals are caught as far as pictures and these pictures are broke down utilizing distinctive calculations to perceive the importance of a specific signal. One such strategy is talked about in, where a coveted hand signal succession is made by quickening the relating key motion outlines with the help of separated data. The weakness of picture preparing based system is that it requires creation of complex computational calculations keeping in mind the end goal to recognize the motions. Promote this strategy likewise requires appropriate lighting conditions, appropriate foundations and field of view constraints. The following methodology is to utilize Accelerometers and Flexsensors to distinguish the development of hands. In, the creators did not utilize propelled microcontrollers and accordingly a different ADC configuration was required to quantify sensor readings. Advance avoidance of remote transmitters makes the framework complex in view of wires. In, the rationale levels of LCD what's more, MSP430F149 did not coordinate for interfacing purposes. Thusly, the creators utilized ATMEGA16 for interfacing LCD. So, for this project data glove will be the perfect choice for hand gesture which produce audio and visual aid for gesture produced by the gloves.

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An Innovation of Hygienic Mechanical Percussor for Respiratory Therapy

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Abstract—Hygienic Mechanical Percussor (HMP) is used to help those with respiratory problems such as asthma, cough, flu, mucus and others respiratory problem on their chest. There are patients who have a dangerous health problem that can spread the disease through infections such as HIV patients, eczema patients and senior citizens. So the fabric found on the Mechanical Percussor is not suitable because it cannot be washed to keep the hygiene. This HMP develop a portable handle tool to replace the existing fabric on Mechanical Percussor. Second, when the Mechanical Percussor is used, the vibrations in the hands of the respiratory therapist are also felt. This means that the vibrations are not fully affected by the patient. Then the HMP will analyze the Mechanical Percussor holders who also vibrate on the hands of respiratory therapists. Third, the existing Mechanical Percussor has a design that cannot be opened to facilitate the process of cleaning the Mechanical Percussor. HMP suitable for machine that can be disinfected so that percussion chest is not damaged and hygiene is maintained. This HMP has the vibrations that can put on the patient chest in 15 minutes therapy and after 15 minutes the HMP will shut down. The HMP are often used together to help loosen and remove mucus from the lungs. At the end on the therapy session, patient will cough and the mucus will get out.

Keywords —Lung, Hygiene, Vibration, Mechanical Percussor, Percussor

I. INTRODUCTION

Hygienic Mechanical Percussor (HMP) are often used together to help loosen and remove mucus from the lungs. These airway clearance techniques help people who have a spinal cord injury, cystic fibrosis, or another condition that makes it hard for mucus to drain from the lungs. When mucus collects in your lungs, it increases your risk for lung infections. It's also uses clapping of the chest with a cupped hand to vibrate the airways in the lungs. This vibration moves the mucus from smaller airways into larger ones where it can be coughed up. HMP is done with the help of a partner, special electronic devices designed to vibrate the chest, or other instruments that a person can use to vibrate the chest safely. This HMP is available in the Rehabilitation section and is used in Physiotherapy Unit.

Figure 1: The Mechanical Percussor (Source: Punithavathi Narayanan, 2014)

Percussion has for some time been held as the best strategy for slackening caught bodily fluid inside the lungs. Conventional Chest Physiotherapy (CCPT) is the present standard treatment for sputum preparation in patients with gainful hack [1]. It is generally supported as a backbone of administration for this ceaseless illness. In any case, chest physiotherapy is tedious, may need the help of an advisor or other parental figure and might be awkward or, then again offensive. Then, Mechanical Percussors could be used to give applauding or percussion to the outer chest divider to mirror manual hand percussion.

The gadget could permit more self-sufficiency for patients, better consistence and less weakness for the administrator. Percussors are named Class II 510 (k) medicinal gadgets by the U.S. Food and Drug Administration (FDA). The gadgets convey predictable,

programmable (i.e., speed is adjustable) profound heartbeats. The machine is moved over the patient's chest while the patient expect an assortment of waste positions [2].

Cystic Fibrosis (CF) is a genuine autosomal latent issue than happens every now and again in Caucasian populaces, with a commonness of 1 of every 3500 live births [3]. The anticipation for this condition includes an abbreviated life expectancy, intermittent diseases furthermore, forcing medicinal costs [4]. When initially analyzed in 1931, the normal future was under two years.4 Due to more present day hones, the present middle anticipated period of survival has expanded to 37 years for populaces in North America and European countries [3]. Among youngsters, CF is more typical than phenulketonuria and galactosemia and less regular than innate hypothyroidism and sickle cell disease [5]. While treatment has fundamentally enhanced the life traverse of CF patients, the pathophysiology of the condition is still oppressive to treat with current treatments and includes a multidisciplinary way to deal with give an abnormal state of care.

CF starts as a passive hereditary change affecting more than 1,000 qualities that create a transmembrane conductance protein. This outcomes in irregular salt transportation in epithelial cells, making an assortment of different harmful impacts the ordinary capacity of the body [3]. Conclusion of CF is essentially made not long after birth utilizing the sweat test (pilocarpine inotophoresis). While the conclusion of CF isn't instantly hazardous, there are life threatening wellsprings of worry because of strange lung work what's more, pancreatic deficiency which depend vigorously upon appropriate cell discharge.

The wellbeing of the lungs is of specific significance to CF patients since they deliver thick, sticky bodily fluid that can square little aviation routes prompting intense irritation, incessant respiratory diseases, and aviation route obstructions. The relative significance of lung capacity can be exhibited by the reality that constrained expiratory volume (FEV1) is the most grounded pointer for mortality from CF. The other real indicator for lung work in CF is crest oxygen take-up (crest VO2) [6]. These two estimations are enhanced through expanded movement furthermore, diminished occurrence of aspiratory contamination, both of which are innately constrained by the incessant deterrent seen in CF.

The importance of clearance of sputum from the lungs in patients with cystic fibrosis and other forms of bronchiectasis is widely appreciated [9]. The value of physiotherapy in encouraging sputum expectoration has been well established, some, holding the view that all of the recognized manoeuvres of postural drainage, vibrations, deep breathing, forced expiratory technique and coughing are important, whilst others doubt the value of any of these techniques if coughing alone yields little sputum.

Antibiotics and chest physiotherapy have been associated with significant improvements in the survival of patients with cystic fibrosis [2].The main aim of chest physiotherapy in cystic fibrosis is to assist in the removal of tenacious pulmonary secretions. Postural drainage (including head down tilt) and manual techniques of percussion and vibrations have been conventional mainstays for patients in many cystic fibrosis specialist centers.

II. PROBLEM STATEMENT

Conventional Chest Physiotherapy (CCPT) remains the mainstay of treatment for sputum mobilization in patients with productive cough such as bronchiectasis and “Chronic Obstructive Airway Disease” (COPD). However CCPT is time consuming requires the assistance of a physiotherapist and limits the independence of the patient. Mechanical Percussors which are electrical devices used to provide percussion to the external chest wall might provide autonomy and greater compliance [1]. First, there are patients who have a dangerous health problem that can spread the disease through infections such as HIV patients, eczema patients and senior citizens. So the fabric found on the Mechanical Percussor is not suitable because it cannot be washed to keep the hygiene. Second, when the Mechanical Percussor is used, the vibrations in the hands of the respiratory therapist are also felt. This means that the vibrations are not fully affected by the patient. Third, the existing Mechanical Percussor has a design that cannot be opened to facilitate the process of cleaning the Mechanical Percussor.

The new innovation that will make is HMP has a portable handle tool to replace the existing fabric on Mechanical Percussor. Then, that the vibrations are not fully affected by the patient. The HMP will be analyze the Mechanical Percussor holders who also vibrate on the hands of respiratory therapists. HMP suitable for machine that can be disinfected so that percussion chest is not damaged and hygiene is maintained.

III. METHODOLOGY

This area depicts the investigative concentration, look into strategy and particular techniques utilized as a part of this examination. The system utilized was a blended techniques inquire about structure enveloping both quantitative and qualitative strategies and measures. It’s also part of study an information and requirement, such as hardware and software. After that, the data will colleting by the questionnaire that will two times, at the first time data will collect at the Bachelor of Electronic Medical student. Then, the last one data will collect with patient who have and the Physiotherapy Unit and Nurse Staff.

Study of Population

The population will get from the Politeknik Sultan Salahuddin Abdul Aziz, focusing on the 50 subject of Bachelor of Electronic Engineering Technology (Medical Electronics) with Honours. For Cystic Fibrosis or other respiratory problem, they from the Physiotherapy Unit. The criteria that will do is the usability, design of the HMP.

Sample Size and Sampling Technique

For the 50 subject of Bachelor of Electronic Engineering Technology (Medical Electronics) with Honours, the sample size is the 44 subject.

Block Diagram

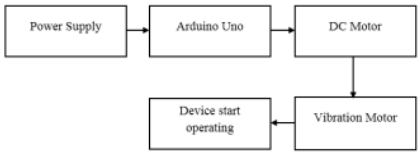

Figure 2 Block Diagram Project

Based on the figure above, power supply will be connected to the Arduino Uno, Arduino Uno are programming to set the timer about 15 minutes and the functioning the DC motor and vibration motor.

Flow Chart

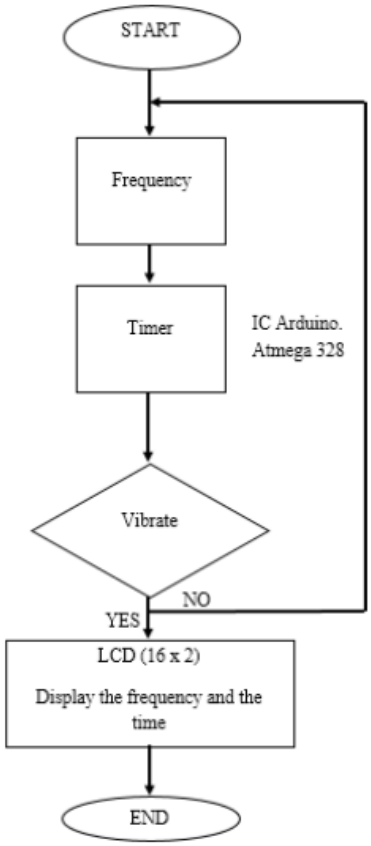

Figure 3 Flow Chart Design

When start the HMP, frequency will be selected which is 15Hz until 30Hz or 30Hz until 60Hz depends on the conditions of the patient. Motor vibration vibrate when the frequency are selected and the therapy are start. The default timer are 15 minutes after 15 minutes the HMP will off and the therapy have be done. LCD will display the frequency and the timer.

IV. EXPECTED RESULT

At the end of this project, the HMP will keep clean by throwing the cloth on the appliance and replacing it with a portable handle. Then the problem on the MP holders who also vibrate on the hands of respiratory therapists will settle with put the spring on the HMP. Finally, the design of HMP suitable for machine that can be disinfected so that percussion chest is not damaged and hygiene is maintained. Testing on casing will be made and HMP applicability will pass technical assistant from hospital.

V. CONCLUSION AND SUGGESTION

At the end of this project, the HMP will keep clean by throwing the cloth on the appliance and replacing it with a portable handle. Then the problem on the MP holders who also vibrate on the hands of respiratory therapists will settle with put the spring on the HMP. Finally, the design of HMP suitable for machine that can be disinfected so that percussion chest is not damaged and hygiene is maintained.

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Development of Bed Therapy for Comatose

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Abstract—The Bed therapy was developed for comatose patient or the patient who was in intensive care unit (ICU). Ventilation issues are very important for a patient that need a mechanical ventilation. This bed are used to relief the pressure for prevent any sore for comatose. This bed will be rotate 360 degree by using some special electronic device designed to rotate the bed automatically for certain time in prone position. For that time, comatose will stay upside down to relief the pressure and also reduce soreness. This bed therapy is also capable of accommodating the weight of patient up to 120 kg to be reversed as a therapy to reduce pain. There also has the programming to setup the time for being upside down depend on the patient's need and for sure there is precaution to handle to prevent others accidents.

Keywords — Comatose, ventillation, pressure, sore, upside down, bed

I. INTRODUCTION

Coma may be defined as a state of profound unconsciousness which the patient cannot wake up from profound sleep by ordinary treatment [1].

In fact, coma is not sleep at all, but a state of unconsciousness usually caused by injury or illness. In general, unlike patient who are experience even very deep sleep such as narcolepsy (sudden uncontrollable sleep attack and cataplexy, often accompanied by visual or auditory hallucinations at the onset of sleep).

The comatose patient display no spontaneous eye movement, nor ability to speak. There are however, degrees of conscious impairment in patients which may not rise to the level of coma as measured by Glasgow come scale. Under that scale, in which best motor response, best verbal response and minimum stimulus to cause eye opening are tested and scored the score may range from 3 to 15.

A score of 3 indicates no motor response (regardless of cause) no vocalization even in response to noxious stimulus, and no eye opening in response to noxious stimuli. Scores of 7 or less on the Glasgow scale quality as coma.

TABLE 38-2
Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	*Best response*	15
	Comatose client	8 or less
	Totally unresponsive	3

TABLE 1: Glasgow coma scale
(Source: John Furst ,19 2013)

In addition, the effect for coma patient's body should be worried too, because the body also effected by laying down for too long. While the comatose in unconscious condition, they produce the pressure sore behind their body.

Pressure sore occur most often in elderly patients and immobile patients for example patients who are in intensive care unit (ICU) [2]. Bed therapy was created for comatose patient or the patient who was in intensive care unit (ICU) frequently exhibit pulmonary function worsening, especially in cases of pulmonary infection.

One investigation of geriatric nursing problems in hospital on 1959 until 1960 shown that the sore cases in elderly patients is high and it increase with age [3]. They are particularly at risk because they are relatively immobile [4]. Prolonged pressure, shearing forces, friction and moisture are all etiological factors [5]. They usually formed over bone prominences, such as the base of spine, hips and heels. Prevention depend on excellent nursing care that concentrates on meticulous skin care and relief of pressure. Pressure ulcer commonly happened in certain area, where is soft tissue injury resulting from compression between bone prominences. There is similar on use of the pressure term ulcer that is synonyms which is decubitus ulcer or bed sore. The most common place for decubitus ulcer was hips, buttocks, back and ankle. This condition is common among the people who spend long periods in bed or a wheelchair, for disable people and the people who cannot move the certain body parts without supporter.

Normal capillary pressure varies between 12 and 32 mm Hg. The human body can withstand extremely high pressure when equally distributed over the body, which is demonstrated by the deep sea divers who regularly withstand pressure of 1000 mm Hg without injury. When external pressure are applied to a localized area of the body such as a bony prominence, however, interstitial pressure increases. Once this has exceeded the capillary venous limb pressure of 12 mm Hg, a marked increase in total pressure is produced. This result in increased capillary arteriolar pressure, capillary leakage, edema and eventually autolysis.

The position of patient are the most important to prevent of pressure ulcers [6]. This bed are used to relief the pressure for prevent any sore for comatose. This bed will be rotating 180 degree by using some special electronic device design to auto rotate the bed which is 30 minute upside down. For 30 minutes, comatose will stay upside down to relief the pressure and also reduce soreness [7]. Decubitus or pressure sore are one of the most difficult management problems [8].

II. BACKGROUND OF RIPPLE MATTRESS

Ripple mattress or pressure mattress has been carried out by Geriatric Research Unit at the Whittington Hospital, was reported [9]. These mattress was shown to be effective and have since been widely used in this country, mainly in the form of Ripple Beds.

Two types are, marketed, the large and small celled beds, with tubes 4 inches and 1 inches in diameter respectively. In the trials, the large cells were found to be more efficient at lifting the body and preventing and healing pressure sore than the small cells.

In June 1976, ten year after report, a survey was carried out of all the ripple beds in used in geriatric. Besides that the effect of rolling bed to decubitus patients which turns the patient 15 degree inclined lateral position with an inflating ripple mattress and the result was no totally successful and size that had been measured with before are no significant difference. [10].

Come out with that, the bed therapy which is developed to reduce the pressure for comatose that causes by the pressure and the patient who has not enough of ventilation mechanical.

III. REVIEW OF PREVIOUS WORK

There are several different type of rotating bed which is by manually. This manually bed therapy are quite difficult and complex to used cause of need more staff energy that is more than 1 person to make it rotate. With this new bed therapy was develop to reduce of staff energy by make it rotate automatically.

Besides that, the bed therapy that has been develop was able to rotate by itself after setup the timing of laying before use it. It help the bed to rotate automatically compared to the bed that has to rolling the gear to rotate. It quite difficult for the hospital who need to nurse the patient with pressure sore carefully because of the limited number of nurse.

Air wave system has been used to. The cells are kept in register by polystyrene like mould along each side. Pressure is alternates caused by deflating every third cell in turn, each cycle taking 7 and half minutes. To help ease the problem caused by the patient laying on skin soaked with sweat or urine the mattress is ventilated with numerous pinholes through which a continuous flow of air passes. The air is dispersed by means of a washable wool fleece which is placed on top of the mattress. No plastic draw sheets are used, since they hinder the flow of air through the pinholes [11].

Relief of pressure over decubitus air cushion bed which turns the patient to a 15 degrees inclined lateral position with an inflating ripple mattress, a longitudinal aligned air inflatable tube. The position of the patients was change between right and left laterals and to supine every 15 minutes automatically. The position changes every 2 hours by care givers.

IV. METHODOLOGY

This area depicts the investigative concentration, look into strategy and particular techniques utilized as a part of this examination. The system utilized was a blended techniques inquire about structure enveloping both quantitative and qualitative strategies and measures. It's also part of study an information and requirement, such as hardware and software. After that,

the data will colleting by the questionnaire that will two times, at the first time data will collect at the Bachelor of Electronic Medical student. Then, the last one data will collect with patient who have and the Technologist and Nurse Staff.

Study of Population

The population will get from the Politeknik Sultan Salahuddin Abdul Aziz, focusing on the 50 subject of Bachelor of Electronic Engineering Technology (Medical Electronics) with Honours. Sample Size and Sampling Technique For the 50 subject of Bachelor of Electronic Engineering Technology (Medical Electronics) with Honours, the sample size is the 44 subject.

Block Diagram

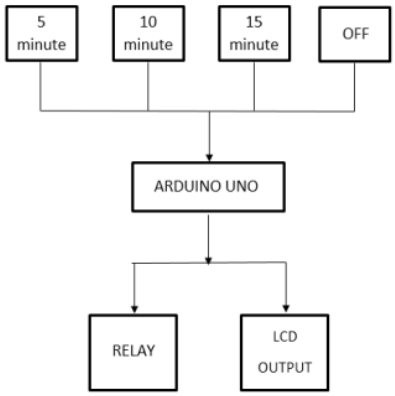

Figure 1 Block Diagram Project

Based on the figure above, we using the Arduino Uno, that are programming to set the timer about 15 minutes and to get the output. First step is, we have to choose the time that needed for the comatose which is 5 minutes, 10 minutes and the last one is 15 minutes.

After we choose the right time needed, the time will be display on the LCD Screen to show the time choosen to prevent any mistaken.

Next, after the confirmation about the selection time, the bed will rotate , and the speed was depend on the weight of comatose, and the comatose will staying upside down for the time choose. The last process which is after having enough time of upside down , the bed will back to it normal.

In case there is any emergency case like have something happened to the comatose, then we can push the off button to reset the programming and the bed automatically return back to normal.

Flow Chart

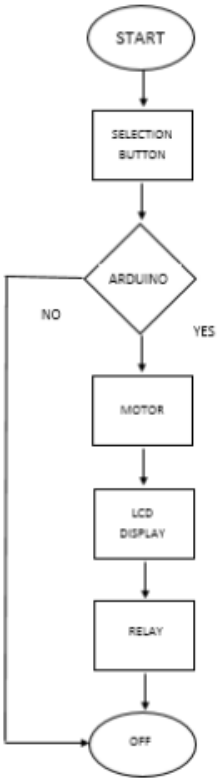

Figure 2 Flow Chart Project

The flow chart above are the process how the bed therapy functioning. It just the 1 set time has been shown because for the second and third, the process was same. It just repeat the same process.

V. EXPECTED RESULT

While various modifications have been attempted, there presently does not exist the way how to prevent the pressure sore or also the decubitus for comatose who are having the prolonged sleep which is they having not enough of ventilation mechanical that should had for every person. According to our research, we designed the bed therapy for comatose which considers treatment to prevent the sore. According to medical researches warming hand could help people who suffer from pressure sore, this fact encouraged us to develop the bed therapy for comatose.

Bed Therapy is capable to rotate automatically after setting the time needed and also able to afford 120 kg of load and this bed also using programming to make it happened fully automatically rotate.

VI. CONCLUSION

The goals of this paper was to investigation of the problems, faced by the comatose who having pressure

sore. The target user group chosen consisted of comatose and also consisted by public to trying the ability of this bed and the effectiveness towards comatose. In these article, we seek to address these problems. Also, a new idea presented for better design of bed therapy for developing a better design in future.

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Development of RO System - Tank for Hemodialysis (HD) Running System

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Abstract—This report presents the findings of a research project on development of Reverse Osmosis (RO) system - tank for Hemodialysis running system for the alternative device and idea for teaching aid in demonstrating the hemodialysis SOP to student during practical work. This product is revolutionized in reducing the cost for servicing and maintenance for the RO machine. Most importantly, the recycle water filter for the system an also can contribute a supply water to others machine like autoclave steam sterilizers, that uses steam under pressure to kill harmful bacteria, viruses, fungi, and spores on items that are placed inside a pressure and are typically used for healthcare or industrial applications. Developing the RO system tank for a hemodialysis running system is to provide a safe, reliable, and efficient source of purified water that meets the stringent quality standards required for hemodialysis procedures.

Keywords — Reverse Osmosis, Hemodialysis Teaching aids

I. INTRODUCTION

BEU40133 Biomedical Instrumentation and Measurement course is a semester 4 course for degree programs (BEU4). This course is introducing the medical device or machine device in the hospital. There is many equipment provided in the medical laboratory at Sultan Salahuddin Abdul Aziz Shah Polytechnic such as Hemodialysis (HD), defibrillator, Electrocardiograph (ECG), glucose meter, spirometer and others. All the equipment is sophisticated and complex circuit with double layer design and have their own practices during practical work in the class. Among the equipment, hemodialysis is one of the Standard Operation Procedures (SOP) quite difficult to demonstrate because of the special equipment need to run the machine. Reverse Osmosis (RO) is the machine required to supply the RO water for the machine hemodialysis during patient treatment [1]. Therefore, a simple design need to as an alternative device or teaching aid tool to innovate and design in the laboratory for training used. The RO system - Tank is a replacement for the RO machine to run the complete cycles of the system operation hemodialysis treatment.

HD is a medical procedure used to filter waste and excess fluids from the blood when the kidneys are not functioning properly. Figure 1 (a) and (b) shows the HD machine with difference model that used for practical work during experiment class. HD machines and water treatment systems as well as the development of strict protocols to monitor various aspects of the HD treatment [3]. In hemodialysis system, the RO system is often used to purify water before it is used in the dialysis process. The RO system helps ensure that the water used for hemodialysis is free from impurities and contaminants, as even small amounts of toxins in the water can be harmful to patients with kidney failure [4].

(a)

(b)

Figure 1 (a) and (b) HD machine with 2 difference model

Study of Population

Teaching aids are tools, resources, and materials used by educators to enhance the learning experience and make concepts more understandable and engaging for students [5]. It has a positive effect on increasing the teacher's confidence in the subject [5] and on increasing student satisfaction and cohesiveness [6]. As a result, students' interest in and improved their understanding of the scientific concepts and processes resulting to more productivity and achievement [6]. Specifically, in medical instrumentation subjects where the experiments are most commonly used as practical work, which in a real practice in the hospital for diagnosis and treatment the patient. Some teaching aids and methods that can be used to effectively convey information about RO water in hemodialysis. When creating teaching aids, it's important to consider the specific needs and preferences of target audience. SOP materials to be easily comprehensible and engaging, and ensure that can cover essential information about RO water in hemodialysis systems. Furthermore, essential tools to help educate healthcare professionals, patients, and caregivers about the RO water system used in hemodialysis.

A RO tank, also known as a pressure tank or storage tank, serves a crucial function in a RO water purification system. Its primary function is to store and deliver purified water to meet the demands of users.

Figure 2: The sample of real RO system-Tank for HD system at the hospital

Figure 2 shows the sample of real RO system tank for HD at the hospital. The RO system typically starts with a water source, which can be tap water or another water supply. Pre-Treatment stage is embedded, *including filtration to remove larger particles and carbon filters to remove chlorine and other chemicals that could damage the RO membrane. The heart of the RO system is the RO membrane. It uses a semi-permeable membrane to separate impurities, minerals, and contaminants from the water. The water is pressurized and forced through the membrane, leaving behind impurities while producing purified water.*

II. METHODOLOGY

The RO system - Tank is an alternative teaching aid other than a field trip to the hospital. The idea is also as a solution to save time, cost and repeated practical work as much can do in anytime compared to field trip to the hospital. Now because of covid endemic, filed trip to hospital are not suggested. Identify problem related to preparing the material aid during practical work, do research about design of the alternative innovation and the pros and cons. The problem that is always faced with RO machines is that often break down because the water source is not clean and contains rust (stain).

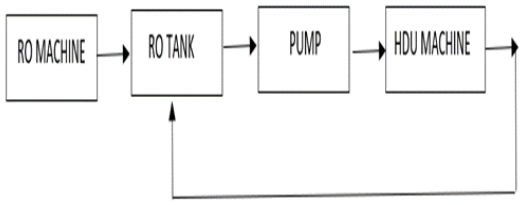

Figure 3: Block Diagram of RO system-Tank for HD system.

Develop the idea to design the RO system - Tank that user and eco-friendly. Figure 3 illustrated the block diagram of RO system – Tank for HD system. The function of RO machine system is a water purification technology that removes impurities and contaminants from water by using a semi-permeable membrane. The primary function of RO system is to produce high-quality, purified water suitable for various applications. The second block is RO tank purposely is to store purified water. The tank stores the purified water until it's needed. RO tank is a critical component of a reverse osmosis water purification system. Its main functions include storing purified water, maintaining pressure, reducing wastewater, ensuring consistent flow rates, and improving user convenience. It plays a vital role in optimizing the overall performance and efficiency of the RO system as an inlet RO water to HD during treatment, RO tank pressurizes the stored water with the help of a bladder or diaphragm and compressed air. This pressurized storage allows for a consistent water flow when users dispense water. It eliminates the need for the RO membrane to operate continuously, extending the membrane's lifespan.

From the RO tank, the purified water is distributed to the hemodialysis machine, because of RO systems produce water at a relatively slow rate, and users may require water at a faster flow rate, therefore pump is functioning to ensure steady and readily available supply to HD machine through the inlet supply of the HD machine. Meanwhile the outlet water from HD machine will cycling into the RO tank. Therefore, the tank helps minimize wastage by allowing the system to store water when it's not in use. This stored water can be used later, reducing the overall amount of wastewater generated by the system.

In summary, the RO tank is a critical component of a reverse osmosis water purification system. Its main functions include storing purified water, maintaining pressure, reducing wastewater, ensuring consistent flow rates, and improving user convenience. It plays a vital role in optimizing the overall performance and efficiency of the RO system.

Figure 4 shows the portable RO filter at the laboratory. Portable Reverse Osmosis (RO) water systems are compact, mobile water purification units that use a process called reverse osmosis to filter and purify water. Portable RO water systems offer a convenient and reliable way to access purified drinking water in various settings. They use reverse osmosis technology to effectively filter contaminants from water, making it a suitable for handle during the experiment. However, the system not compatible to innovate the tank system because of built in system. Therefore, to solve the problem the RO system outdoor were provided or suitable in innovation of the tank system used as a tool for teaching aid of the SOP, especially on the hands on in the practical work for HD machine operation as shown in figure 5.

Figure 4: the portable RO filter

Figure 5: The RO filter supply for the tank

III. I.RESULT AND ANALYSIS

The objective of developing a RO system tank for a hemodialysis running system is to provide a consistently high-quality source of purified water that prioritizes water sources clean, safety and meets regulatory standards. The system should be reliable, efficient, and cost-effective while allowing for easy maintenance and integration into the healthcare environment. RO tanks play a role in optimizing the operation of the entire RO system. They help maintain pressure levels within the system, which is crucial for the proper functioning of the RO membrane and other components.

Figure 6: The RO System - Tank for Hemodialysis (HD) Running System

Figure 6 shows the RO System - Tank for Hemodialysis (HD) Running System at clinical Laboratory at Polytechnic Sultan Salahuddin Abdul Aziz Shah. It is convenience to student to use as a simulation for principle of RO water supply used with the Hemodialysis machine. The innovation on RO system – Tank is useful for lecturers and students in practically used for training and practical work in the laboratory session. This innovation not only for practicing in hemodialysis machine, but it can be in use during service and maintenance for disinfection of machine and supply the water treatment for other equipment like autoclave as a source of steamer network.

Student can apply with the theory in the class how to identify, design and observe the procedures during practical Figure 3 show the RO system machine at the hospital and figure 4 shows the RO system -Tank at clinical Laboratory at Polytechnic Sultan Salahuddin Abdul Aziz Shah. It is convenience to student to use as a simulation for principle of RO water supply used with the Hemodialysis machine. The innovation also contributes to the other course such as BEU253: Dental Equipment maintenance.

IV. CONCLUSION

Overall, RO system – Tank has been utilized for learning process as a teaching aid especially during covid endemic. The tank provides users with immediate access to purified water at conveniently purified water. Without a tank, users would have to wait for the RO system to produce water on-demand Researchers have also been involved in

advancing the research at the national level and recognize the innovation device is successful and valuable for teaching aid in teaching and learning process. A suggestion is to publish the research in any conference or journal then copyright the device. In additional, may produce skilled students in medical engineering area that full fill the TVET mission.

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