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CALORIES COUNTER MACHINE

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This Report Is Submitted In Partial Of The Requirement For Diploma Electronic Engineering (Medical)

Jabatan Kejuruteraan Elektrik

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ENDORSEMENT

"I hereby acknowledge that I have read this report and I find that its contents meet the requirement in terms of scope and quality for the award of the Diploma in Electronic Engineering (Medical)"

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DECLARATION

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ABSTRACT

A calories is a unit of energy in nutrition and everyday languange. According to Medilexicon's medical dictionary, a calories is a unit of heat content or energy. Calories refer to energy consumption through eating and drinking and also usage through physical activity . Calorie is being replaced by joule, the SI unit equal to 0.239 calorie. Not everybody requires the same number of calories each day. Our ideal calorific consumption depends on several factors, including our overall general health, physical activity demands, sex,weight,height and shape. So with this machine maybe it can help the people around the world especially Malaysia can control their food or meal intake.

This project is generally on rice only because rice is the main meal and basic for Malaysian people. In this machine we used load cell sensor because that can measures weight of rice precisely.

ABSTRAK

A kalori ialah unit tenaga dalam pemakanan dan bahasa sehari-hari. Menurut kamus perubatan Medilexicon kanak, kalori ialah unit kandungan haba atau tenaga. Kalori merujuk kepada penggunaan tenaga melalui makan dan minum dan juga penggunaan melalui aktiviti fizikal. Kalori sedang digantikan oleh joule, unit SI yang bersamaan dengan 0,239 kalori. Tidak semua orang memerlukan jumlah kalori yang sama setiap hari. penggunaan kalori ideal kita bergantung kepada beberapa faktor, termasuk kami kesihatan keseluruhan, permintaan aktiviti fizikal, jantina, berat badan, ketinggian dan bentuk. Jadi dengan mesin ini mungkin ia dapat membantu rakyat di seluruh dunia terutama Malaysia boleh mengawal makanan mereka atau pengambilan makan.

Projek ini adalah secara amnya mengenai beras hanya kerana beras adalah makanan utama dan asas untuk rakyat Malaysia. Dalam mesin ini kita menggunakan sensor sel beban kerana yang berat langkah tin beras dengan tepat.

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Introduction

1.1 Background of study

"**A calorie is a calorie**" is a tautology used to convey the speaker's conviction that the concept of the "calorie" is in fact a sufficient way to describe energy content of food.

It has been a commonly cited truism since the early 1960s.[1] The tautological phrase means that regardless of the form of food calorie a person consumes (whether a carbohydrate, protein or fat calorie) the energy chemically extracted from the food, or the work necessary to burn such a calorie, is identical to any other. One dietary calorie contains 4.184 kilojoules of energy. With this knowledge, it is easy to assume that all calories have equal value.[2]

In 1878, German nutritionist Max Rubner crafted what he called the "isodynamic law".[3] The law claims that the basis of nutrition is the exchange of energy [4] and was applied to the study of obesity in the early 1900s by Carl Von Noorden had two theories about what caused people to develop obesity. The first simply avowed Rubner's notion that "a calorie is a calorie". The second theorized that obesity development depends on how the body partitions calories for either use or storage.[3] Since 1925, a calorie has been defined in terms of the The definition of a calorie changed in 1948, which became one calorie is equal to approximately 4.2 joules.[5]

1.2 Problems Statement

Based on the problems, we know that many people do not know about their calories needed per day as example consuming the rice per day. They do not know how much the calories of rice is needed by their body. Besides that, we cannot measure the calories of rice properly in our daily calories intakes per day accurately. This can caused the obesity and diabetes if not take a prevention because rice has their own calories numbers.

1.3 Objectives

(1) The scope of this project to educate people to take properly amount of rice

(2) To develop the machine that help to reduce amount of obesity and diabetes patient in Asia becaused our project can teach people consuming a total ingredients that need accurately

(3) To count the value of calories needed for each intake of rice per day .

1.4 Scopes of study

The scope of this project are understanding the overview concept of rice calories counter machine because our project machine is to educate and help obesity people to lose weight and diabetes people to reduced the risk of thier illness. Besides that, can educate people around the world. By understanding it operation and knowledge, we can create a rice calories counter machine greatly. This machine use a load cell for weighing the rice in grams and converts into calories and also use the arduino to make a programming of rice calories counter machine.

1.5 Sampling Technique

We measure the calories through our products. We take data with parameters of weight, height, age and gender to calculate the number of calories required by a person.

By that way, rice consumption will be controlled regularly and systematically. Conclusion her disease can be reduced by reducing the intake of rice a day.

1.6 Significant of study

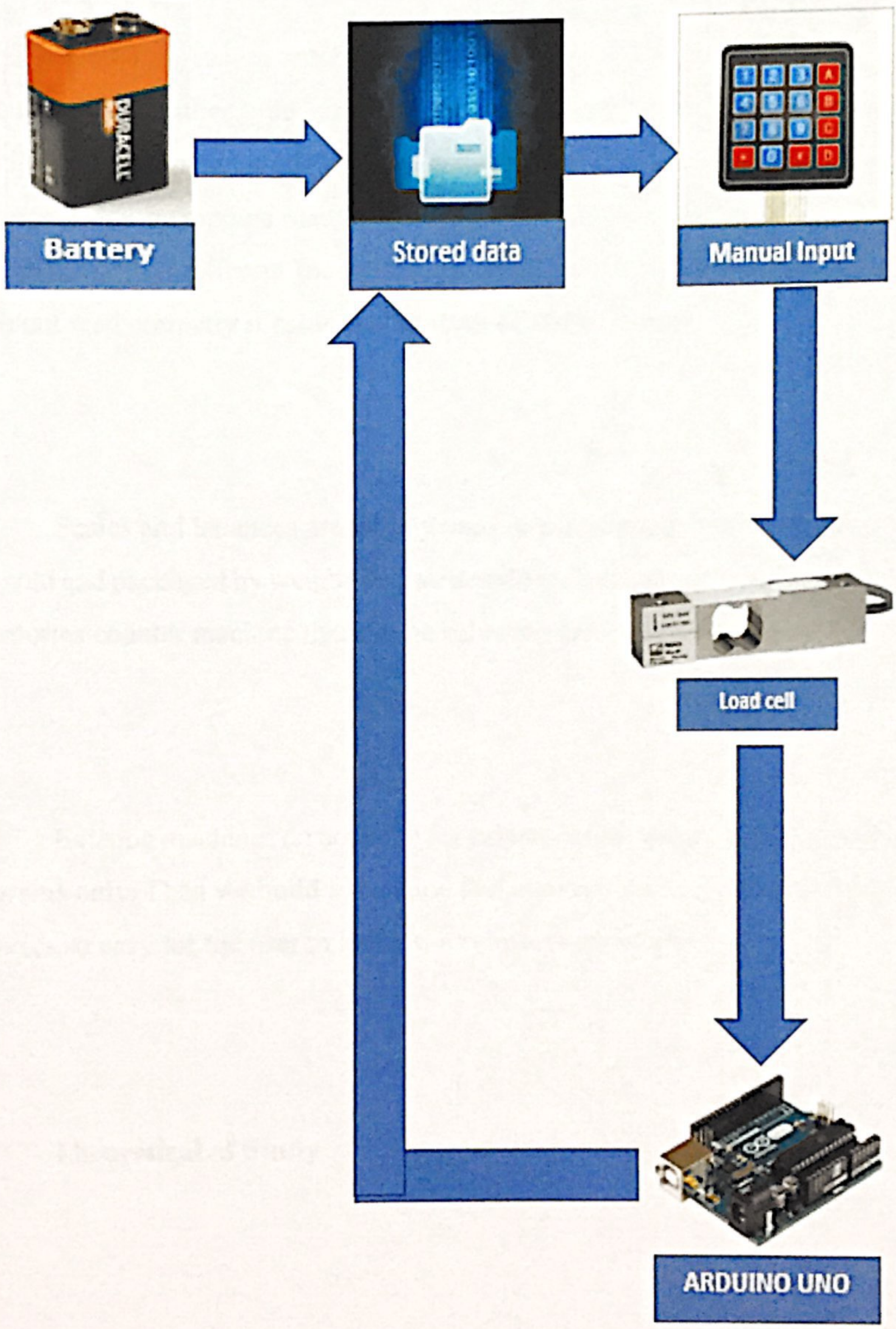

Figure 1.1 Block diagram of significant study

1.6.1 Innovation Calories Counter Machine

Weighing scale machine are devices to measure weight or calculate mass. Either type can be calibrated to read in units of mass such as kilograms or grams, but the balance or pair of scales using a traditional balance beam to compare masses will read correctly for mass even if moved to a place with a different (non-zero) gravitational field strength but would then not read correctly if calibrated in units of force of mass

Scales and balances are widely used in commerce, as many products are sold and packaged by weight. So, we decide to develop new product which is calories counter machine that can be calculate calories needed in a day.

Existing machines do not have the calorie count. It only makes reading in grams only. Then we build a machine that converts direct gram reading on calories so easy for the user to know the calories needed per day.

1.7 Theoretical of Study

The difficulty in this calorie counter machine cannot produce an accurate reading. In addition, data were included for the first time not read properly and need to update the data in a second time in order to get an accurate reading. The voltage entered does not conform to the required readings cause the engine to overlook this problem calorie counter.

Therefore, we have added a component which is an analogue voltage to make the reading accurately. So, we turn on the machine calorie counters, we need to enter the data input request which is weight, height, age and gender. Then the LCD will be display and a written the remaining calories needed.

CHAPTER 2

Literature Review

2.1 Introduction

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and do not report new or original experimental work. Most often associated with academic-oriented literature, such reviews are found in academic, and are not to be confused with book reviews that may also appear in the same publication.

Literature reviews are a basis for research in nearly every academic field· A narrow-scope literature review may be included as part of a peer-reviewed journal article presenting new research, serving to situate the current study within the body of the relevant literature and to provide context for the reader. In such a case, the review usually precedes the methodology and results sections of the work.

The proposal that we produced needed a few factor that should be taken consideration until the project implemented. To get quality project result, we needed to study about the type of material, design. Components that we used, framework installation, installation method, structural strength, project size and so on that we need make it and consider the result that we get. This is all ensures that no any problems would arise during the completion or even when presenting the project.

2.2 Food weight scale

Figure 1.2 Food weight scale

Weighing scales (or weigh scales or scales) are devices to measure weight or calculate mass. Spring balances or spring scales measure weight (force) by balancing the force due to gravity against the force on a spring, whereas a balance or pair of scales using a balance beam compares masses by balancing the weight due to the mass of an object against the weight of a known mass or masses.

Either type can be calibrated to read in units of force such as newtons, or in units of mass such as kilograms, but the balance or pair of scales using a traditional balance beam to compare masses will read correctly for mass even if moved to a place with a different (non-zero) gravitational field strength (but would then not read correctly if calibrated in units of force), while the spring balance would read correctly in *force* in a different gravitational field strength (but would not read correctly if calibrated in units of mass).

Scales and balances are widely used in commerce, as many products are sold and packaged by weight. Very accurate balances, called analytical balances, are used in scientific fields such as chemistry. Our objective will be to change the scales is becoming a tool to calculate the weight of the food with the calories we should take for a day

2.3 Rice

Figure 1.3 Sample of Rice

Rice is a staple in the diets of many cultures and provides a good source of energy in the form of carbohydrates. There are many types of rice; all are carbohydrate-dense and eating too much may cause you to eat too little of the other nutrients needed to ensure optimal health. Rice also contains small amounts of iron, phosphorus, potassium, thiamin and folate as well as several other micronutrients. Rice has very little sodium and has no vitamin C.

The minimal amounts or total absence of many micronutrients would create a nutritional deficiency if your diet consisted largely of rice. Rice is fairly low in calories but is very high in carbohydrates. The daily recommended percentage of calories you should get daily from carbohydrates is between 45 to 65 percent, which is 900 to 1,300 calories for someone eating an average 2,000 calories-per-day diet. Eating too much rice may adversely affect glucose metabolism and insulin production in your body. Rice, the lifeblood of so many nations' cuisines, is perhaps the most ubiquitous food in the world.

In Asia, where an estimated 90 percents of all rice is consumed, the pillow grains are part of almost every meal. In the Caribbean, where the starch is often mixed with beans, it's a staple too. Even here in the United States, where people eat a comparatively modest amount of rice, plenty is still consumed.

Rice is popular because it's malleable—it pairs well with a lot of different kinds of food—and it's relatively cheap. But like other starch-heavy foods, it has one central flaw: it isn't that good for you. White rice consumption, in particular, has been linked to a higher risk of diabetes. A cup of the cooked grain carries with it roughly 200 calories, most of which comes in the form of starch, which turns into sugar, and often thereafter body fat.

Not all starches, as it happens, are created equal. Some, known as digestible starches, take only a little time to digest, are quickly turned into glucose, and then later glycogen. Excess glycogen ends up adding to the size of our guts if we don't expend enough energy to burn it off. Other starches, meanwhile, called resistant starches, take a long time for the body to process, aren't converted into glucose or glycogen because we lack the ability to digest them, and add up to fewer calories.

A growing body of research, however, has shown that it might be possible to change the types of starches found in foods by modifying how they are prepared. At the very least, we know that there are observable changes when certain foods are cooked different ways.

So, we already know that rice is a major food for every people in Asia and around the world have rice in their country. Now we know that the rice has many goodness but if we take too much of quantity of the rice per day it can cause a diabetes. Every people has different calories of rice to take per day and they didn't know how much calories of rice that they should take per meal. Thus, we decide to makes a project which is about the "RICE CALORIES COUNTER MACHINE" to help and educate people to take the calories of rice properly. Besides that, to prevent people from getting diabetes and obesity.

2.3.1 Calories Counting

Calorie amounts found on food labels are based on the Atwater system.[6] The accuracy of the system is disputed, despite no real proposed alternatives. For example, a 2012 study by a USDA scientist concluded that the measured energy content of a sample of almonds was 32% lower than the estimated Atwater value.[7] Furthermore, it is known that some calories are lost in waste, without ever having been chemically converted or stored. The driving mechanism behind caloric intake is absorption, which occurs largely in the small intestine and distributes nutrients to the circulatory and lymphatic capillaries by means of osmosis, diffusion and active transport. Fat, in particular is emulsified by bile produced by the liver and stored in the gallbladder where it is released to the small intestine via the bile duct. A relatively lesser amount of absorption, composed primarily of water, occurs in the large intestine.

Furthermore, the facts is one dietary Calorie contains 4184 joules of energy, this may cause individuals to believe that all calories are the same. The human body is a highly complex biochemical system that undergoes processes which regulate energy balance. The metabolic pathways for protein are less efficient than the metabolic pathways for carbohydrates and fat. Protein contains four calories per gram, although a large part of the calories are lost as heat when metabolised by the body.[2]

It may be easy to consume 500 calories worth of ice cream or chocolate in one sitting, although it may be difficult to eat 500 calories of eggs or carrot in one sitting.[2]

2.3.2 There are two types of calories:

(1) **A small calorie** (symbol: cal) - 1cal is the amount of energy required to raise one gram of water by one degree Celsius.

(2) **A large calorie** (symbol: Cal, kcal) - 1Cal is the amount of energy required to raise one kilogram of water by one degree Celsius.

1 large calorie (1kcal) = 1,000 small calories

In this project, we will discuss what a calorie is, how many calories humans need on a daily basis and some other important facts about calories.

2.3.3 Calories and human health

Human body needs calories to survive, without energy our cells would die, our hearts and lungs would stop, and we would perish. We acquire this energy from food and drink. If we consume just the number of calories our body needs each day, every day, we will probably enjoy happy and healthy lives. If our calorie consumption is too low or too high, we will eventually experience health complications.

The number of calories food contains tells us how much potential energy they poses. Below are the calorific values of the three main components of the food we eat:

- 1 gram of carbohydrates contains 4 calories
- 1 gram of protein contains 4 calories
- 1 gram of fat contains 9 calories.

2.3.4 How many calories do we need each day?

Not everybody requires the same number of calories each day. Our ideal calorific consumption depends on several factors, including our overall general health, physical activity demands, sex, weight, height, and shape. A 6ft tall, 25-year-old professional soccer player needs many more calories each day than a 5ft 4ins sedentary woman aged 75.

Health authorities around the world find it hard to agree on how many calories their citizens should ideally consume. The US government says the average man requires 2,700 calories per day and the average woman 2,200, while the NHS (National Health Service), UK, says it should be 2,500 and 2,000 respectively.

The FAO (Food and Agriculture Organization) of the United Nations says the average adult should consume no less than 1,800 calories per day.

2.3.5 Recommended daily calories intakes

Recommended daily calorie intakes vary across the world. According to the National Health Service (NHS), UK, the average male adult needs approximately 2,500 calories per day to keep his weight constant, while the average adult female needs 2,000. US authorities recommend 2,700 calories per day for men and 2,200 for women.

. The NHS stresses that rather than precisely counting numbers (calories), people should focus more on eating a healthy and well balanced diet, being physically active, and roughly balancing how many calories are consumed with the numbers burnt off each day. If you eat your five portions of fruits and vegetables per day, you will probably live longer .Swedish researchers reported in the *American Journal of Clinical Nutrition* (July 2013 issue).

According to the United Nations' Food and Agriculture Organization (FAO), the average person's minimum calorie requirement per day globally is approximately 1,800 kilocalories (7,500Kj)

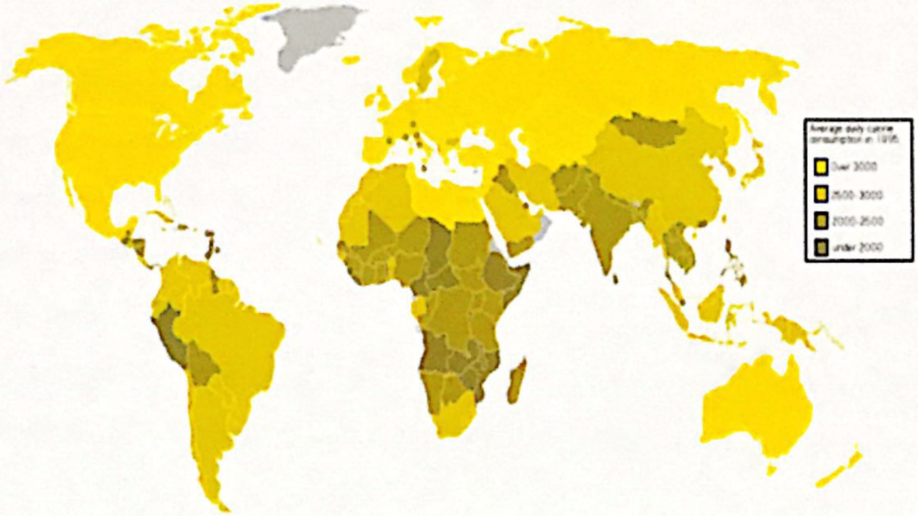

Figure 1.4 Daily calorie consumption varies considerably around the world

Over the last twenty years, sugar has been added to a growing number of foods we consume. Unfortunately, food labels in the USA and Europe do not include details on how much added sugar there is. Dr Aseem Malhotra, a cardiologist, wrote in *BMJ* in June 2013 that "(it has become) almost impossible for consumers to determine the amount of added sugars in foods and beverages."

2.4 Glycemic index (GL)

The glycemic index or glycaemic index (GI) is a number associated with a particular type of food that indicates the food's effect on a person's blood glucose (also called blood sugar) level. A value of 100 represents the standard, an equivalent amount of pure glucose.[1]

The GI represents the rise in a person's blood sugar level two hours after consumption of the food. The glycemic effect of foods depends on a number of factors, such as the type of starch, physical entrapment of the starch molecules within the food, fat and protein content of the food and organic acids or their salts in the meal. The GI is useful for understanding how the body breaks down carbohydrates [2] and only takes into account the available carbohydrate (total carbohydrate minus fiber) in a food.

The glycemic index is usually applied in the context of the quantity of the food and the amount of carbohydrate in the food that is actually consumed. A related measure, the glycemis load (GL),[3] factors this in by multiplying the glycemic index of the food in question by the carbohydrate content of the actual serving. Watermelon has a high glycemic index, but a low glycemic load for the quantity typically consumed.[4] Fructose, by contrast, has a low glycemic index, but can have a high glycemic load if a large quantity is consumed.

GI tables are available that list many types of foods and their GIs. Some tables also include the serving size and the glycemic load of the food per serving.

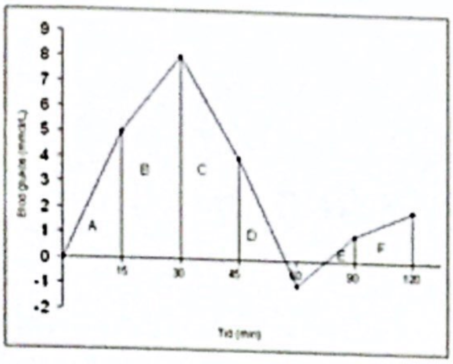

Figure 1.5 The rise of blood sugar after meals

A practical limitation of the glycemic index is that it does not measure insulin production due to rises in blood sugar. As a result, two foods could have the same glycemic index, but produce different amounts of insulin. Likewise, two foods could have the same glycemic load, but cause different insulin responses. Furthermore, both the glycemic index and glycemic load measurements are defined by the carbohydrate content of food. For example, when eating steak, which has no carbohydrate content but provides a high protein intake, up to 50% of that protein can be converted to glucose when there is little to no carbohydrate consumed with it.[5] But because it contains no carbohydrate itself, steak cannot have a glycemic index. For some food comparisons, the "insulin index" may be more useful.

2.4.1 Classification of GI

GI values can be interpreted intuitively as percentages on an absolute scale and are commonly interpreted as follows:

Classification	**GI range[11]**	**Examples[11]**
Low GI	55 or less	fructose; beans (black, pinto, kidney, lentil, peanut, chickpea); small seeds (sunflower, flax, pumpkin, poppy, sesame, hemp); walnuts, cashews, most whole intact grains (durum/spelt/kamut wheat, millet, oat, rye, rice, barley); most vegetables, most sweet fruits (peaches, strawberries, mangos); tagatose; mushrooms; chilis
Medium GI	56–69	white sugar or sucrose, not intact whole wheat or enriched wheat, pita bread, basmati rice, unpeeled boiled potato, grape juice, raisins, prunes, pumpernickel bread, cranberry juice,[12] regular ice cream, banana, sweet potato[13]
High GI	70 and above	glucose (dextrose, grape sugar), high fructose corn syrup, white bread (only wheat endosperm), most white rice (only rice endosperm), corn flakes, extruded breakfast cereals, maltose, maltodextrins, white potato (83).

Table 1.1 Classification of GI

So we can see rice have the high Glycemic Index on it. That the first reason we develop this calorie counter machine. Moreover , others have pointed out that foods generally considered to be unhealthy can have a low glycemic index, for instance, chocolate cake (GI 38), ice cream (37), or pure fructose (19), whereas foods like potatoes and rice have GIs around 100 but are commonly eaten in some countries with low rates of diabetes.[21][13]

2.5 Load cell

Figure 1.6 Load cell

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The output is proportional to the force or load applied.The conversion is achieved by the physical deformation of strain gauges, which are bonded onto the load cell structure. The strain gauges are connected into a Wheatstone Bridge circuit with four strain gauges (full bridge), two gauges (half bridge) or one gauge (quarter bridge).

With half and quarter bridges, the bridge is completed using precision monitors.Additional bondable resistors are configured within the bridge circuit to compensate for the effects of temperature on the zero or no-load signal and the sensitivity (output due to applied load, plus a further resistor to enable the bridge to be nulled at no load).

Using the strain gauge load cell, measures the deformation (strain) as a change in electrical resistance, which is a measure of the strain and hence the applied forces. A load cell usually consists of four strain gauges in a wheatstone bridge configuration. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer. Sometimes a high resolution ADC, typically 24-bit, can be used directly.

The heart of any weighing system is the load cell.Whilst they are not exciting to watch, load cells are highly accurate transducers which provides the user with information not generally obtainable by other technology due to commercial factors. Load cells are designed to sense force or weight under a wide range of adverse conditions; they are not only the most essential part of an electronic weighing system, but also the most vulnerable. In order to get the most benefit from the load cell, the user must have a thorough understanding of the technology, construction and operation of this unique device. In addition, it is imperative that the user selects the correct load cell for the application and provide the necessary care for the load cell during its lifetime.

Understanding these important issues and properly maintaining the load cells will ensure trouble free weighing for a long period of time.

2.5.1 Strain gauge scale

In electronic versions of spring scales, the deflection of a beam supporting the unknown weight is measured using a strain gauge, which is a length-sensitive electrical resistance. The capacity of such devices is only limited by the resistance of the beam to deflection. The results from several supporting locations may be added electronically, so this technique is suitable for determining the weight of very heavy objects, such as trucks and rail cars, and is used in a modern weighbridge.

2.5.1.1 Physical operation

A strain gauge takes advantage of the physical property of electrical conductance and its dependence on the conductor's geometry.

When an electrical conductor is stretched within the limits of its elasticity such that it does not break or permanently deform, it will become narrower and longer, changes that increase its electrical resistance end-to-end. Conversely, when a conductor is compressed such that it does not buckle, it will broaden and shorten, changes that decrease its electrical resistance end-to-end.

From the measured electrical resistance of the strain gauge, the amount of induced stress may be inferred. A typical strain gauge arranges a long, thin conductive strip in a zig-zag pattern of parallel lines such that a small amount of stress in the direction of the orientation of the parallel lines results in a multiplicatively larger strain measurement over the effective length of the conductor surfaces in the array of conductive line and hence a multiplicatively larger change in resistance than would be observed with a single straight-line conductive wire

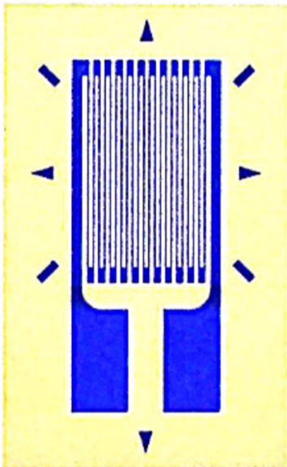

Figure 1.7 The typical of strain gauge

Typical foil strain gauge. The gauge is far more sensitive to strain in the vertical direction than in the horizontal direction. The markings outside the active area help to align the gauge during installation

2.5.1.2 Testing and Certification

Most countries regulate the design and servicing of scales used for commerce. This has tended to cause scale technology to lag behind other technologies because expensive regulatory hurdles are involved in introducing new designs. Nevertheless, there has been a recent trend to "digital load cells" which are actually strain-gauge cells with dedicated analog converters and networking built into the cell itself. Such designs have reduced the service problems inherent with combining and transmitting a number of 20 millivolt signals in hostile environments.

Government regulation generally requires periodic inspections by licensed technicians using weights whose calibration is traceable to an approved laboratory. Scales intended for non-trade use such as those used in bathrooms, doctor's offices, kitchens (portion control), and price estimation (but not official price determination) may be produced, but must by law be labelled "Not Legal for Trade" to ensure that they are not re-purposed in a way that jeopardizes commercial interest.[*citation needed*] In the United States, the document describing how scales must be designed, installed, and used for commercial purposes is NIST . Legal For Trade (LFT) certification usually approve the readability as repeatability/10 to ensure a maximum margin of error of 10%.

Because gravity varies by over 0.5% over the surface of the earth, the distinction between force due to gravity and mass is relevant for accurate calibration of scales for commercial purposes. Usually the goal is to measure the mass of the sample rather than its force due to gravity at that particular location.

Traditional mechanical balance-beam scales intrinsically measured mass. But ordinary electronic scales intrinsically measure the gravitational force between the sample and the earth, i.e. the weight of the sample, which varies with location. So such a scale has to be re-calibrated after installation, for that specific location, in order to obtain an accurate indication of mass.

2.5.1.3 Source of Error

Some of the sources of error in weighing are:

(1) Buoyancy – Objects in air develop a buoyancy force that is directly proportional to the volume of air displaced. The difference in density of air due to barometric pressure and temperature creates errors.
(2) Error in mass of reference weight
(3) Air gusts, even small ones, which push the scale up or down
(4) Friction in the moving components that causes the scale to reach equilibrium at a different configuration than a frictionless equilibrium should occur.
(5) Settling airborne dust contributing to the weight
(6) Mis-calibration over time, due to drift in the circuit's accuracy, or temperature change

(7) Mis-aligned mechanical components due to thermal expansion or contraction of components

(8) Magnetic fields acting on ferrous components

(9) Forces from electrostatic fields, for example, from feet shuffled on carpets on a dry day

(10) Chemical reactivity between air and the substance being weighed (or the balance itself, in the form of corrosion)

(11) Condensation of atmospheric water on cold items

(12) Evaporation of water from wet items

(13) Convection of air from hot or cold items

(14) Gravitational differences for a scale which measures force, but not for a balance.[9]

(15) Vibration and seismic disturbances

2.5.1.4 Common shape

There are several common shapes of load cells:

(1) Shear beam, a straight block of material fixed on one end and loaded on the other

(2) Double-ended shear beam, a straight block of material fixed at both ends and loaded in the center

(3) Compression load cell, a block of material designed to be loaded at one point or area in compression

(4) S-type load cell, a S-shaped block of material that can be used in both compression and tension (load links and tension load cells are designed for tension only)

(5) Rope clamp, an assembly attached to a rope and measures its tension. Rope clamps are popular in hoist, crane and elevator applications due to the ease of their installation; they have to be designed for a large range of

loads, including dynamic peak loads, so their output for the rated load tends to be lower than of the other types

(6) Load pin, used for sensing loads on e.g. axles

2.5.2 Piezoelectric Load cell

Piezoelectric load cells work on the same principle of deformation as the strain gauge load cells, but a voltage output is generated by the basic piezoelectric material - proportional to the deformation of load cell.

Useful for dynamic/frequent measurements of force. Most applications for piezo-based load cells are in the dynamic loading conditions, where strain gauge load cells can fail with high dynamic loading cycles. It must be remembered that the piezoelectric effect is dynamic, that is, the electrical output of a gauge is an impulse function and is not static.

The voltage output is only useful when the strain is changing and does not measure static values. However, depending on conditioning system used, "quasi static" operation can be done. Using a so-called "Charge amplifier " with "Long" time constant allow accurate measurement lasting many hours for large loads to many minutes for small loads.

Another advantage of Piezoelectric load cell, conditioned with a Charge amplifier, is the wide measuring range that can be achieved. Users can choose a load cell with a range of hundred of kN and use it for measuring few N of forces with the same Signal/Noise ratio, again this is possible only with the use of a "Charge amplifier" conditioning.

2.5.3 Hydraulic Load cell

The cell uses conventional piston and cylinder arrangement. The piston is placed in a thin elastic diaphragm. The piston doesn't actually come in contact with the load cell. Mechanical stops are placed to prevent over strain of the diaphragm when the loads exceed certain limit.

The load cell is completely filled with oil. When the load is applied on the piston, the movement of the piston and the diaphragm results in an increase of oil pressure. This pressure is then transmitted to a hydraulic pressure gauge via a high pressure hose. The gauge's Bourdon tube senses the pressure and registers it on the dial.

Because this sensor has no electrical components, it is ideal for use in hazardous areas. Typical hydraulic load cell applications include tank, bin, and hopper weighing. By example, a hydraulic load cell is immune to transient voltages (lightning) so these type of load cells might be a more effective device in outdoor environments. This technology is more expensive than other types of load cells. It is a more costly technology and thus cannot effectively compete on a cost of purchase basis.

2.5.4 Pneumatic Load cell

The Load cell is designed to automatically regulate the balancing pressure. Air pressure is applied to one end of the diaphragm and it escapes through the nozzle placed at the bottom of the load cell. A pressure gauge is attached with the load cell to measure the pressure inside the cell. The deflection of the diaphragm affects the airflow through the nozzle as well as the pressure inside the chamber

2.5.5 Common issues of handling Load Cell

(1) **Mechanical mounting**: the cells have to be properly mounted. All the load force has to go through the part of the load cell where its deformation is sensed. Friction may induce offset or hysteresis. Wrong mounting may

result in the cell reporting forces along undesired axis, which still may somewhat correlate to the sensed load, confusing the technician.

(2) **Overload**: Within its rating, the load cell deforms elastically and returns to its shape after being unloaded. If subjected to loads above its maximum rating, the material of the load cell may plastically deform; this may result in a signal offset, loss of linearity, difficulty with or impossibility of calibration, or even mechanical damage to the sensing element (e.g. delamination, rupture).

(3) **Wiring issues**: the wires to the cell may develop high resistance, e.g. due to corrosion. Alternatively, parallel current paths can be formed by ingress of moisture. In both cases the signal develops offset (unless all wires are affected equally) and accuracy is lost.

(4) **Electrical damage**: the load cells can be damaged by induced or conducted current. Lightning hitting the construction, or arc welding performed near the cells, can overstress the fine resistors of the strain gauges and cause their damage or destruction. For welding nearby, it is suggested to disconnect the load cell and short all its pins to the ground, nearby the cell itself. High voltages can break through the insulation between the substrate and the strain gauges.

(5) **Nonlinearity**: at the low end of their scale, the load cells tend to be nonlinear. This becomes important for cells sensing very large ranges, or with large surplus of load capability to withstand temporary overloads or

shocks (e.g. the rope clamps). More points may be needed for the calibration curve.

2.6 Arduino

Arduino is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical

world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analogue input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

2.6.1 Arduino Mega 2560

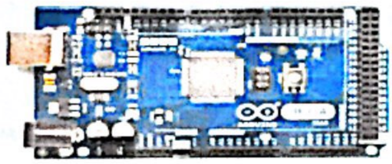

Figure 1.8 Arduino Mega

The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Serial data to the MCU is clocked on the rising edge and data from the MCU is clocked on the falling edge. Power is applied to V_{CC} while RESET and SCK are set to zero. Wait for at least 20ms and then the Programming Enable serial instruction 0xAC, 0x53, 0x00, 0x00 is sent to the MOSI pin. The second byte (0x53) will be echoed back by the MCU.

Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started	does not use the FTDI USB-to-serial driver chip.
The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).	The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).
Each of the 54 digital pins on the Mega can be used as an input or output	Each of the 14 digital pins on the Uno can be used as an input or output
Microcontroller: ATmega2560 Operating Voltage: 5V Input Voltage: 7-12V	Microcontroller: ATmega328P Operating Voltage: 5V Input Voltage: 7-12V

(recommended)	
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB

(recommended)	
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by

EEPROM	4 KB		bootloader
Clock Speed	16 MHz	SRAM	2 KB (ATmega328P)
LED_BUILTIN	13	EEPROM	1 KB (ATmega328P)
Length	101.52 mm	Clock Speed	16 MHz
Width	53.3 mm	LED_BUILTIN	13
Weight	37 g	Length	68.6 mm
		Width	53.4 mm
		Weight	25 g

Table 1.2 Comparisons between Arduino Mega and Arduino Uno

CHAPTER 3

Methodology

3.1 Introduction

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques

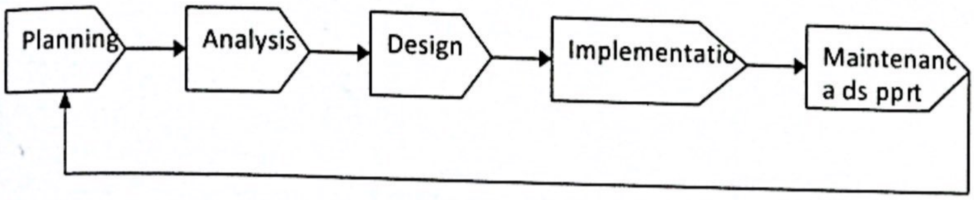

Figure 1.9 SLDC Phase

This final year project used three major steps to implement project starting from planning, implementing and testing. All the methods used for finding and analyzing data regarding the project related.

To identify all the information and requirement such as hardware and software, planning must be done in the proper manner. The planning phase have two main elements namely data collection and the requirements of hardware and software.

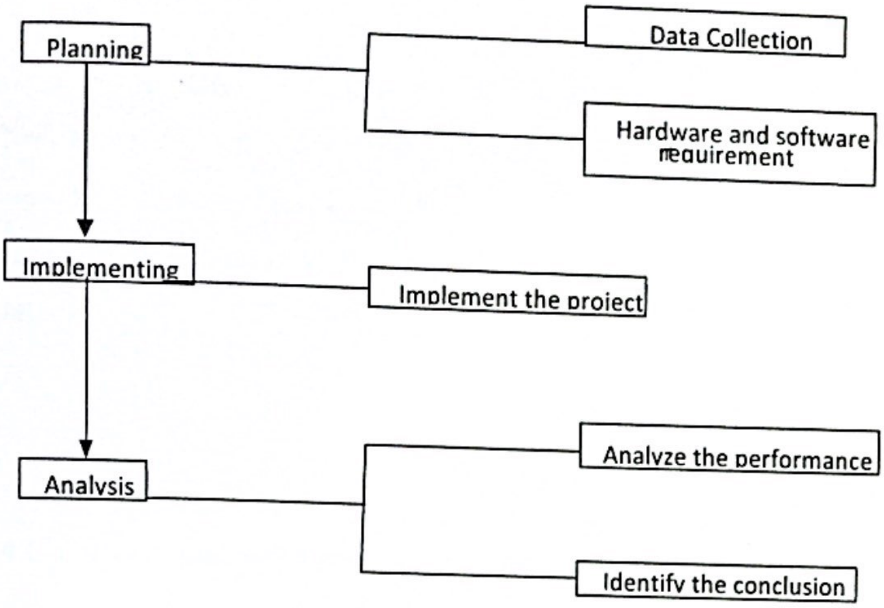

Figure 2.0 Steps of Methodology

3.3 Data Collection

Data collection is a stage in any area of study. At this stage I planned about the projects resources and requirements, literature studies and schedule to get more information in this study. All the materials are collected from journal, texts book and research papers gathered from libraries and Internet.

Within the data collection period I have found the study about the calories of rice and the in the Internet and do some research about the project related. Once I got the project manual, I tried to find out the electronic component and other materials and some of equipment to be used.

While planning, I have done the research about the project related, which including with study about the electronic component such as Arduino Mega, LCD , Keypad 4x4, and Load cell . The study is not just for the function of the component but the types of circuit build by each component related.

3.4 Hardware and software requirement

3.4.1 Hardware

Below is the list of the entire electronic components and the other material that will support to complete this project

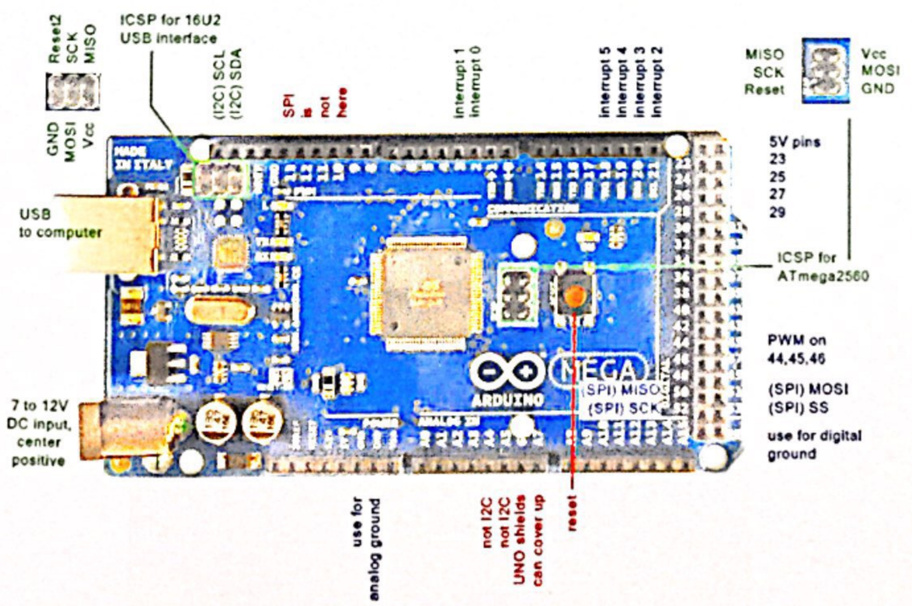

Figure 2.1 Arduino Mega 2560

Arduino is a hardware and software company, project, and user community that designs and manufactures computer hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.

3.4.2 LCD

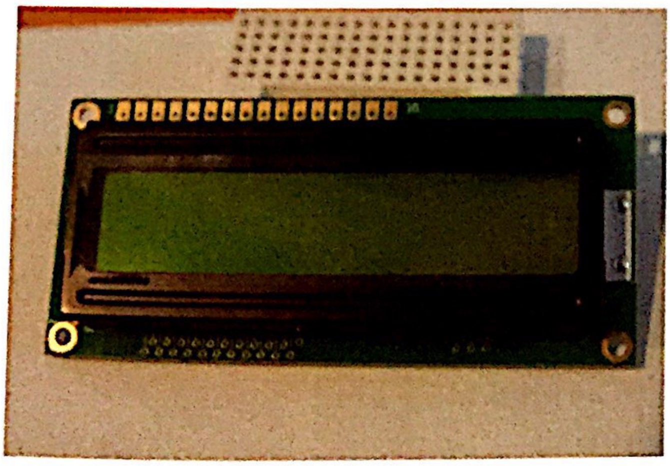

Figure 2.2 LCD

A **liquid-crystal display (LCD)** is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.[1] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets.

3.4.3 Keypad

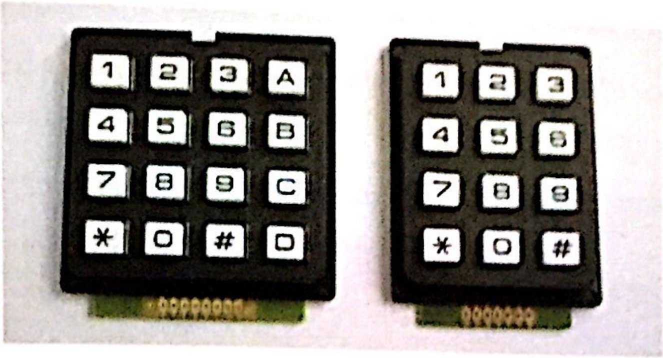

Figure 2.3 keypad 4x4 and 3x4

A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly containing numbers are called a numeric keypad. Numeric keypads are found on alphanumeric keyboards and on other devices which require mainly numeric input such as calculators, push-button telephones, vending machines, ATMs, Point of Sale devices, combination locks, and digital door locks. Many devices follow the E.161 standard for their arrangement.

A computer keyboard usually has a small numeric keypad on the side, in addition to the other number keys on the top, but with a calculator-style arrangement of buttons that allow more efficient entry of numerical data. This number pad (commonly abbreviated to "numpad") is usually positioned on the right side of the keyboard because most people are right-handed.

3.4.4 Software

For software requirement, I have choose Proteus 8 Professional Software. Proteus 8 Professional is a software tool suite used primarily for electronic design automation. The software is used mainly to create electronic prints for manufacturing of printed circuit boards, by electronic design engineers and electronic technicians to manufacture electronic schematics and diagrams, and for their simulation.

The name Proteus is a portmanteau, reflecting the software's origins : Proteus 8 Professional, since this software can do the simulation of the schematic diagram, waveform for the output and can perform the PCB layout for the further step of this project.

After the process of gathering all the related information about this final year project, a step of designing the circuit consist of pulse rate was done. Using the Proteus 8 Professional software, where several basics process of designing the circuit was done.

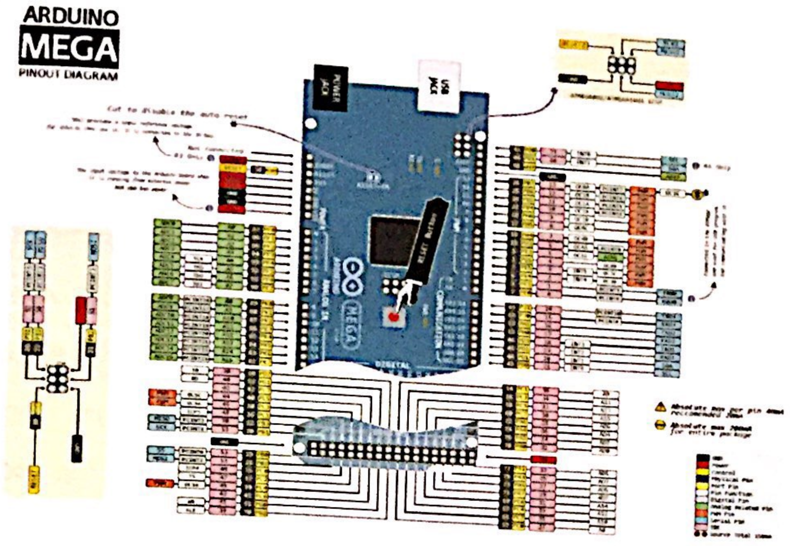

Figure 2.4 PCB Layout

3.5 Implementing

3.5.1 Project Board Circuit

When Proteus 8 Professional Software did the process of designing the electronic circuit diagram, the process of produce project board circuit (PCB) is followed. The layout diagram circuit from Proteus 8 Professional Software was produce by own. That the etching process.

3.5.2 Etching

Etching is a "subtractive" method used for the production of printed circuit boards. Acid is used to remove unwanted copper from a prefabricated laminate. This is done by applying a temporary mask that protects parts of the laminate from the acid and leaves the desired copper layer untouched. Etching is where the excess copper is removed to leave the individual tracks or traces as they are sometimes called. Buckets, bubble tanks, and spray machines lots of different ways to etch, but most firms currently use high pressure conveyerised spray equipment. Many different chemical solutions can be used to etch circuit boards. Ranging from slow controlled speed etches used for surface preparation to the faster etches used for etching the tracks. Some are best used in horizontal spray process equipment while others are best used in tanks.

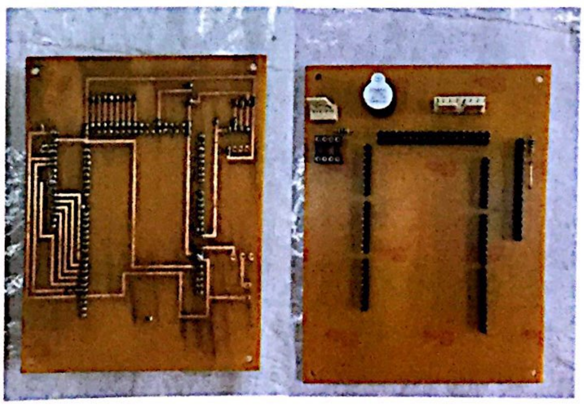

Figure 2.5 Etching board

3.5.2.1 Etching Process

Etching is the process of using acid to remove coppers that not need on the PCB (PRITED CIRCUIT BOARD). This acid is Acid Ferric Chloride III. Acid Ferric Chloride III is used to remove that coppers.

The steps of the etching process are:

I. Print the schematic onto transparent paper and cut it with the same size of PCB board.
II. Stick the schematic diagram on PCB board.
III. Paste the etching circuit onto transparent paper with UV Board using expose machine. It's to make PCB paper joined with board.
IV. This process takes about 30 second.
V. Dilute the acid with a little hot water and make sure that the mixture is not too liquid and too concentrated.
VI. Then, put the board into the mixed (Acid Ferric Chloride III + Hot water) to remove the useless copper.
VII. When PCB was soaked into this mix, we must always shake the container with the acid so that the unwanted copper will remove.
VIII. After Acid remove unused copper, take the PCB to wash with clean water.
IX. Then, use sand paper to rub the lines colors. In addition, detergent powder can also be used to remove the ink. Next, just leave only the desired circuit PCB only.

3.5.3 Soldering

Soldering is defined as "the joining of metals by a fusion of alloys which have relatively low melting points". In other words, we use a metal that has a low melting point to adhere the surfaces to be soldered together. Soldering is more like gluing with molten metal than anything else. Soldering is also a must have skill for all sorts of electrical and electronics work. It is also a skill that must be taught correctly and developed with practice.

Steps to Solder:

i. Quickly remove the tip of the soldering iron from Heat up the soldering iron for five to 10 minutes, allowing the iron to reach maximum operating temperature. If the soldering iron has two temperature settings selectable with a switch, select lower temperature when soldering small electronic components to a board and select the higher temperature when soldering heavier wires. Apply a small amount of solder to the tip and rotate so the entire tip becomes lightly covered with a thin layer of solder. This is called "tinning" the tip.

ii. Connect the two surfaces to be soldered together so the metal parts are touching. If soldering wires, simply twist the two wire ends together so they don't pull apart while being soldered. If soldering electronic components, simply seat the component wires into the holes of the circuit board where the component is to be placed.

iii. Touch the hot tip of the soldering iron to all metal parts touching together so they are evenly heated. Allow the surface to heat for just three to five seconds, then touch the tip of the solder to the heated metal objects, not directly to the tip of the soldering iron. Allow a small amount of solder to flow onto the metal components or wires until just enough solder has been applied to cover the entire surface of the wires or components.

iv. The soldered surface and wipe the tip of the iron on a wet sponge immediately to remove solder. Wiping the solder off the tip will prevent it from burning and forming a black coat on the soldering iron tip.

v. Allow the solder joint to cool for several minutes before applying power to the wires or the device soldered.

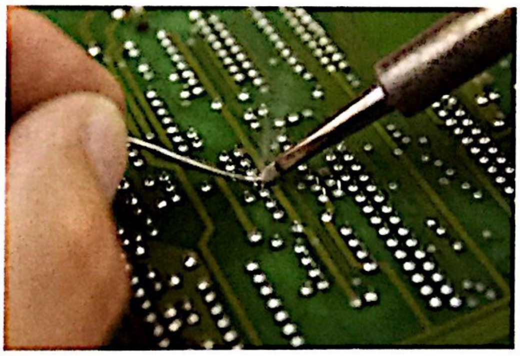

Figure 2.6 Soldering board

3.5.4 Checking

After the parts of mounting the components at PCB finished, I need to check the continuity track of the circuit. This part of job is to ensure that the operation of this circuit will run smoothly.

The tools related with the checking parts is multimeter and the continuity checking involve with every circuit tracks and the point of soldering. By using the buzzer multimeter, it's will alert the failed continuity. The failed continuity will recover with the solder again the lake of components related.

After the parts of mounting the components at PCB finished, I need to check the continuity track of the circuit. This part of job is to ensure that the operation of this circuit will run smoothly.

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3.5.5 Analysis

The analysis stage is the final stage in this methodology where the two points will be done. The analysis is base on the performance of the circuit related where the output must be performed well and successful and the second is identifying the conclusion.

3.6 Component

3.6.1 Load cell

We disconnect the load cell of the weighing scale for the purpose of identifying load cell that used by these scales. After that we connect directly with our arduino, arduino mega at the input port. By using wires to connect our weighing scales with our mega arduino. We connect it with arduino scales due to the load cell that reacts with the readings taken by the arduino.

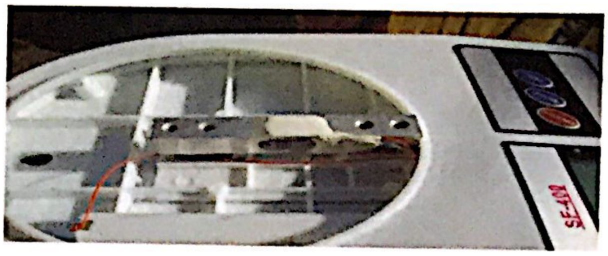


Figure 2.7 Load cell in weighing scale

3.6.2 Arduino Mega

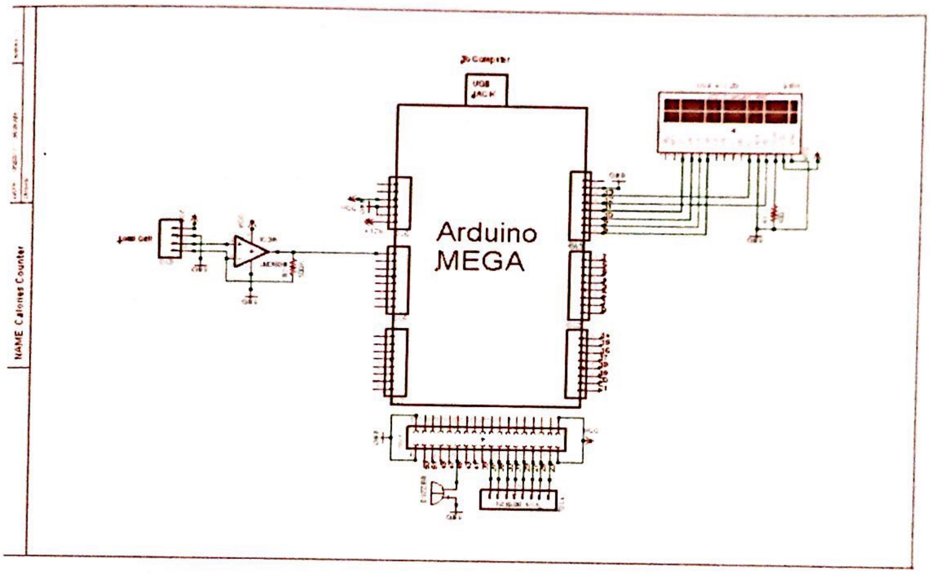


Figure 2.8 Schematic Diagram

We using Arduino mega has many ports to connect all input and output from the keypad and LCD. It is packed with 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analogue inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, USB connection, a power jack, an ICSP header and a reset button.

Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila. The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board.

The recommended range is 7 to 12 volts.The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the ATmega16U2 (ATmega8U2 in the revision 1 and revision 2 boards) programmed as a USB-to-serial converter.

Mega2560 board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Revision 3 of the board has the following new features:

(1) 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin,that is reserved for future purposes.
(2) Stronger RESET circuit.
(3) Atmega 16U2 replace the 8U2.

3.6.3 Keypad 4x4

Keypad is a library for using *matrix* style keypads with the Arduino. As of version 3.0 it now supports mulitple keypresses.This library is based upon the Keypad Tutorial.It was created to promote Hardware Abstraction. It improves readability of the code by hiding the pinMode and digitalRead calls for the user.Keypad library is part of the Hardware Abstraction libraries. Version 3.0 has just been posted (19 July 2012) and was rewritten to support multi-keypresses by default. But for those who still need the original single-keypress functionality, the library is fully backwards compatible.

Program for keypad

```
const byte ROWS = 4; //four rows
const byte COLS = 4; //three columns
char keys[ROWS][COLS] = {
{'1','2','3','A'},
{'4','5','6','B'},
{'7','8','9','C'},
{'*','0','#','D'}
};
byte rowPins[ROWS] = {37, 35, 33, 31}; //connect to the row pinouts of the
kpd
byte colPins[COLS] = {29, 27, 25, 23}; //connect to the column pinouts of
the kpd

Keypad kpd = Keypad( makeKeymap(keys), rowPins, colPins, ROWS,
COLS );
```

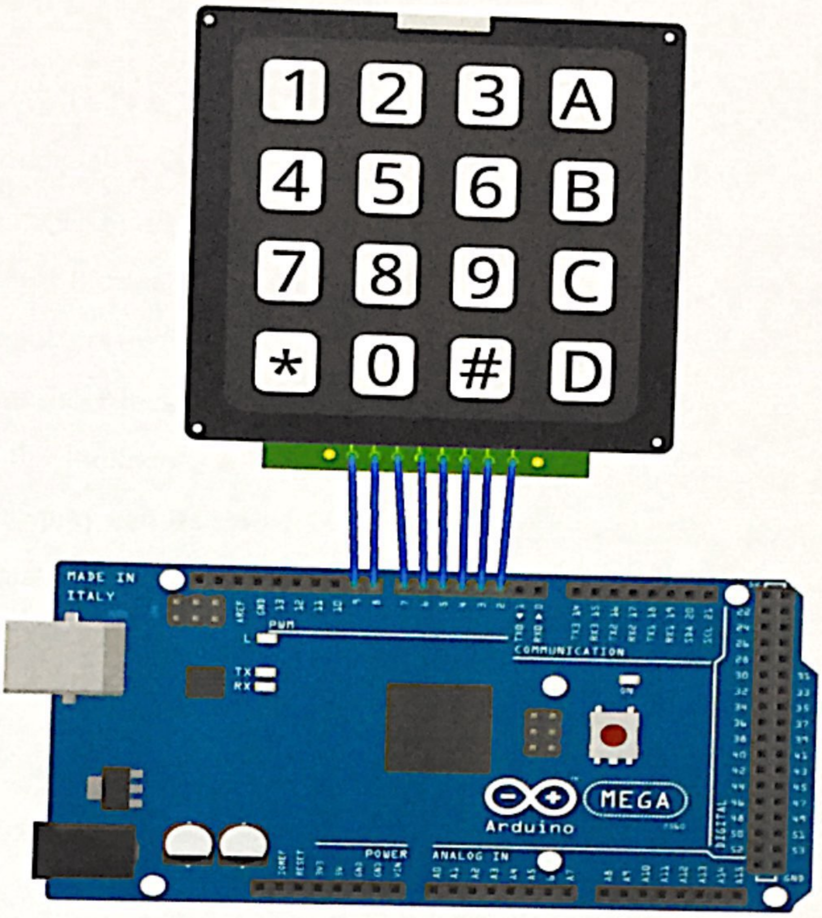


Figure 2.9 Keypad connection to Arduino Mega

3.6.4 LCD

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.

An LCD is made with either a passive matrix or an active matrix display display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time (your mouse will appear to move more smoothly across the screen.

<u>Program for LCD</u>

```
LiquidCrystal lcd(12, 13, 8, 9, 10, 11);

void setup()
{
 // put your setup code here, to run once:
 /*
 EEPROM.write(0, Weight[0]);
 EEPROM.write(1, Weight[1]);
 EEPROM.write(2, Weight[2]);
 EEPROM.write(3, Weight[3]);
 EEPROM.write(4, Height[0]);
 EEPROM.write(5, Height[1]);
 EEPROM.write(6, Height[2]);
 EEPROM.write(7, Height[3]);
 EEPROM.write(8, Age[0]);
```

```
EEPROM.write(9, Age[1]);
EEPROM.write(10, Age[2]);
EEPROM.write(11, Age[3]);
EEPROM.write(12, Sex[0]);
EEPROM.write(13, Sex[1]);
EEPROM.write(14, Sex[2]);
EEPROM.write(15, Sex[3]);
EEPROM.write(16, Calories[0]);
EEPROM.write(17, Calories[1]);
EEPROM.write(18, Calories[2]);
EEPROM.write(19, Calories[3]);
EEPROM.write(20, Balance[0]);
EEPROM.write(21, Balance[1]);
EEPROM.write(22, Balance[2]);
EEPROM.write(23, Balance[3]);
*/
```

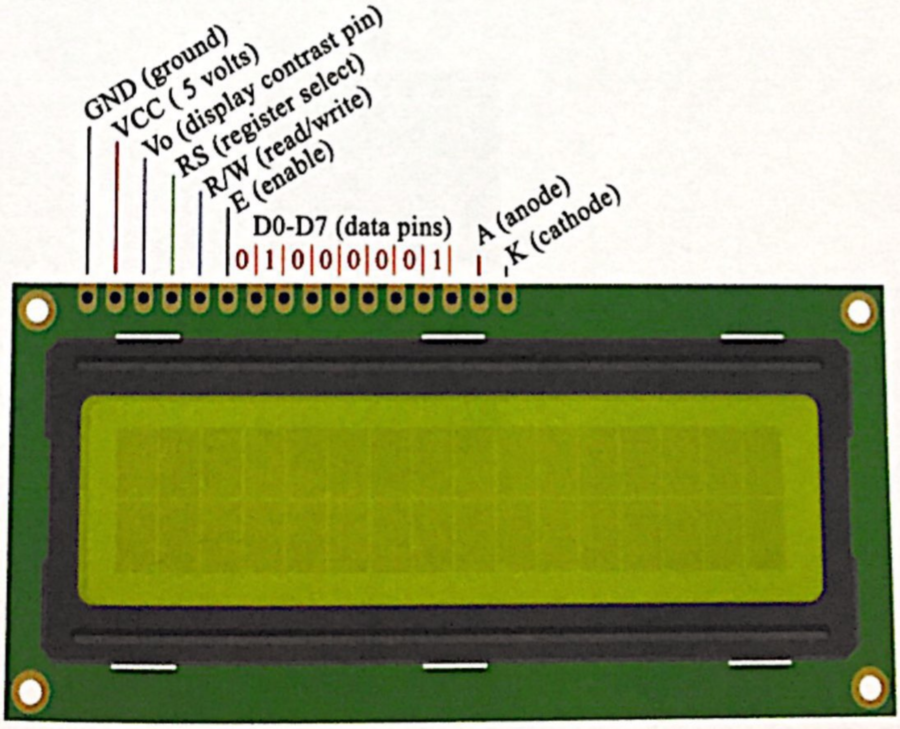
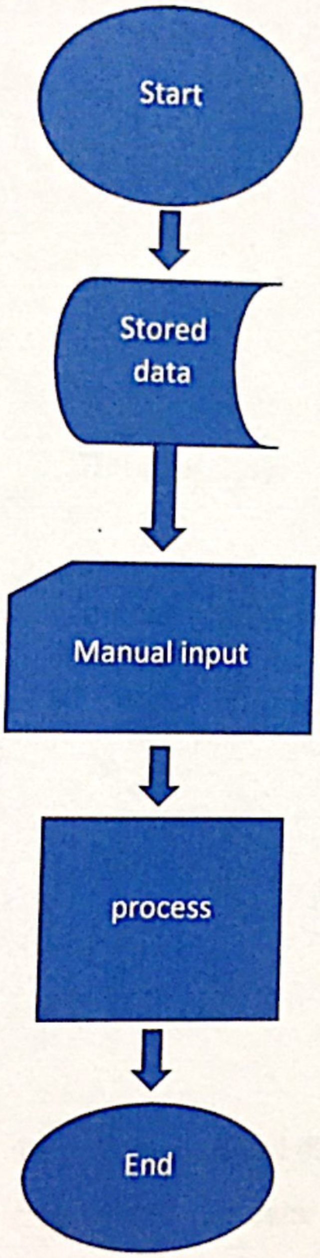


Figure 3.0 LCD

3.7 Flowchart of project



CHAPTER 4

Data Analysis

4.1 Introduction

In this chapter, the information and data from the project is collected. To ensure there is no errors from the data, we had set up a guidelines or objectives that need to be achieve in order for us to get the required data. There is a few steps:

(1) To ensure the project is completely develop and can be used by other people

(2) Require few testing to ensure the performance of the project run smoothly

(3) Product can produce an output that count the calories

(4) The reading of the calories has been identified

4.1.1 Pie chart of Respondent

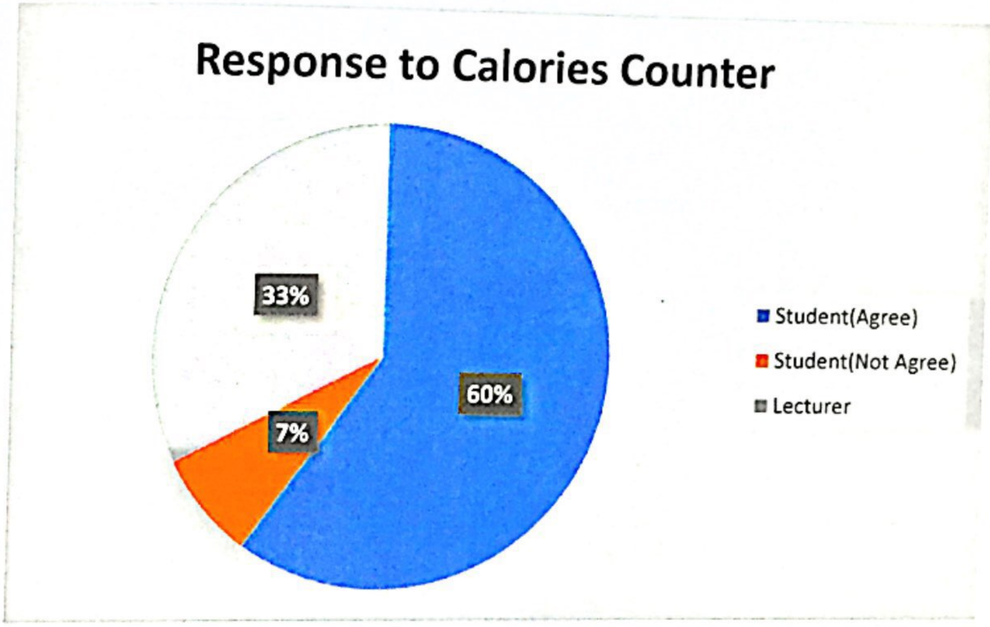


Figure 3.1 Response to Calories Counter

4.1.2 Parameter Calories Counter

Amount rice in gram (g)	**Amount rice in scoop**	**Calories counter (kcal)**
94.25	**1**	**377**
187.5	**2**	**750**
282.75	**3**	**1131**
377	**4**	**1508**
463.75	**5**	**1885**

Table 1.3 Parameter calories counter

4.2 Result

Person	Weight	Height	Age	Sex	Calories (taken)	Calories (Balance)	Calories(All)
1	77	171	21	M	248	1576	1824
2	60	172	21	M	248	1250	1498
3	54	174	21	F	248	1331	1580
4	120	180	21	M	248	1385	1634

Table 1.4 Result

CHAPTER 5

Conclusion and Recommendation

5.1 Commercial potential

This product is a target for our project machine is to educate and help obesity people to lose weight and diabetes people to reduced the risk of thier illness. Besides that, can educate people around the world. By understanding it operation and knowledge, we can create a rice calories counter machine greatly. This machine use a load cell for weighing the rice in grams and converts into calories and also use the arduino to make a programming of rice calories counter machine.

5.2 Potential Marketing

We look forward to marketing our products in Malaysia. This is because our products can help people Malaysia reduce obesity or diabetes patients in the country. Not only that we will also market all over the world to obesity and diabetes can be prevented.

REFERENCE

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