THE DEVELOPMENT OF SMELL THERAPY DEVICE FOR AUTISM CHILD

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DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

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ABSTRACT

Autism is an abnormal developmental disability that come from disorder of neurological which effect the brain function. Olfactory Dysfunction is considered a Sensory Processing Disorder involving an altered sensitivity to smells may and may cause by Autism Spectrum Disorder (ASD). Development of this smell therapy device is to replace the traditional therapy with a sophisticated device for autism child to have a fun therapy thus make them improves their smell focusing sensitivity. Another purpose of this study is to analyse the therapy device and do validate the efficiency. The reliability of the device was tested on 6 subjects which are the autism child caretaker by answer the questionnaire after use the product at least once. 3 subjects which are the severe autism child, mild autism child and also normal child age from 4 to 9 years old was tested to validate the efficiency of the product. The child was tested for 6 days by inhale the smell that spread out from the device and try to guess the scent. For reliability of the device, all 6 subjects are agreed that this device is effective to help autism child smell focusing. It is also comfortable to use. Moreover it have an attraction element for autism child, and the design of the device is compatible for a children. All tested child show improvement of their smell focusing sensitivity day by day. It shows that the device is efficient to improve the smell focusing sensitivity of the autism child. This device is successfully developed with positive feedback and it also succeed to improve the smell focusing sensitivity of the autism child.

ABSTRAK

Autisme merupakan kecacatan perkembangan yang tidak normal yang datang dari gangguan neurologi yang menganggu sebahagian fungsi otak. Kelmahan deria bau dianggap sebagai gangguan terhadap deria yang melibatkan kepekaan bau yang mungkin disebabkan oleh *Autism Spectrum Disorder* (ASD). Kegunaan alat terapi bau ini adalah untuk menggantikan terapi tradisional dengan sebuah alat yang lebih canggih bagi kanak-kanak autisme dapat melalui proses terapi yang menyeronokkan di samping membuatkan proses terapi menjadi lebih bagus. Antara tujuan yang berikutnya bagi kajian ini adalah untuk menganalisis alat terapi dan juga mengesahkan kecekapan alat tersebut. Kebolehpercayaan alat telah diuji kepada 6 subjek yang merupakan pengajar atau penjaga kanak-kanak autism. Mereka diuji dengan menjawab borang soal selidik selepas menggunakan produk ini sekurang-kurangnya sekali. 3 orang subjek yang terdiri daripada kanak-kanak autisme yang teruk, kanak-kanak autisme ringan dan juga kanak-kanak normal berumur 4 hingga 9 tahun telah diuji untuk mengesahkan kecekapan produk. Kanak-kanak itu telah diuji selama 6 hari dengan menghidu bauan yang keluar daripada alat dan kemudian mereka akan cuba meneka bau tersebut. Untuk kebolehpercayaan alat, ke semua 6 subjek yang terdiri daripada penjaga kanak-kanak autism telah bersetuju bahawa peranti ini adalah berkesan untuk membantu deria bauan kanak-kanak autisme. Ia juga selesa untuk digunakan. Tambahan pula ia mempunyai elemen tarikan untuk kanak-kanak autisme, dan reka bentuk peranti ini serasi untuk kanak-kanak autisme. Kesemua subjek yang diuji telah menunjukkan peningkatan terhadap kepekaan deria bau mereka dari hari ke hari. Ia membuktikan bahawa peranti ini mempunyai kecekapan untuk mempertingkatkan kepekaan terhadap deria bau bagi seseorang kanak-kanak autisme. Peranti ini berjaya dibangunkan dengan maklum balas yang positif dan ia juga telah berjaya untuk meningkatkat kepekaan bau bagi seseorang kanak-kanak autisme.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorder
NASOM	The National Autism Society of Malaysia
RGB LED	Red Green Blue Light Emitting Diode

CHAPTER 1

INTRODUCTION

1.1 TITLE

The Development of Smell Therapy Device for Autism Child

1.2 PROBLEM STATEMENT

Olfactory dysfunction is a sensory disorder that involving altered smell sensitivity that can come from many factors such as exposure to chemicals, viral infections, age and also neurodevelopmental disorder like Autism Spectrum Disorder (ASD) [22]. In term of Autism Spectrum Disorder (ASD), it will affect the child in many ways that never be aware of. They will have a bad ability in social as they may have a problem with other person's breath or perfume. The worst case is they cannot tell the danger. In Autism Center, the autism child will have their therapy session to improve their sense of smell. However, the smell therapy at the autism center are using conventional method and tools which are lack of attraction and non-friendly user. As a result, the process of smell therapy cannot attract the autism child to stay focus and this method need more time and energy to be prepared.

1.3 INTRODUCTION

Autism is an abnormal developmental disability that come from disorder of neurological which effect the brain function [15]. Autism is consider as a rare disorder as it affecting very few person in the community [20]. It became worldwide issue and the research of autism has increased in the past decade. On 3rd March 1987 at Malaysia, an organization of national charitable called NASOM (The National Autism Society of Malaysia) have registered to give support services for autism children and members of their family. There are a few characteristics that show the difficulties of the autism. As example they have trouble to have a conversation with others, lack of focus and also olfactory dysfunction [15] [12].

1.4 OBJECTIVES

a) To innovate a smell therapy device in order to make it more practical such as by using application on the smartphone and also have attraction element such as sounds and lighting.
b) To analyze the development of autism child smell sensitivity.

1.5 SCOPE AND LIMITATION

The smell therapy device is mainly scoped for the autism children age 4 to 12 years old that have an olfactory dysfunction. This device can have 4 types of fragrances in one time and can be change depends on user desire.

1.6 SIGNIFICANT OF THE STUDY

The significant of this project is to provide an interactive smell therapy device as it is two way communication between the user and caretaker. It can help autism child to improve their sense of smell better than conventional method. Besides, this device also can attract autism child interest to stay focus during the therapy session. By doing this, it can help the improvement of the autism child in term of smell sensory better than conventional method.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Autism is one of heterogeneous neurodevelopmental conditions. Autism can be characterised by unusual or repetitive behaviour, communication and socialisation [18]. Severe deficits Autism can effect on how someone communicates, interprets with the world and socialises. This will lead to wide range of difficulties in daily life including living independently and forming relationships [18].

2.2 AUTISM

Isabelle Rapin [5] was said on her article that the autism is rather known as a symptom of abnormality development of brain and not a disease.[5] Autism child can be detect and diagnose as young as two years old by experienced clinicians. At age of 18 and 24 months are recomended by The American Acedemy Pediatrics for observation of close developmental for autism [11]. For some autism children, it is posible to diagnose the autism from two years old [14].

2.2.1 AUTISM CHARACTERISTICS

a) Difficulties in social interaction [18].
b) Impaired social communication [9].
c) Repetitive or restricted range of interest and behaviours [16].

2.2.2 CAUSE OF AUTISM

The clearly implicated of causation of autism is genetic factors which is copy number of variants, deletions and mutations. Autism is brain development disorder biologically based [14]. Autism spectrum disorder are multifactorial and highly genetic with a lot of risk factors together. Genes are implicated that effects of expression of gene, make neurobiological theories that focus on neural effects and connectivity of gene expression [16].The key of etiology of autism is the genetics, in conjunction with early environment factors developmentally [9]. Isabelle Rapin [5] was said on her article about autism that, autism is not one of the disease but it was a symptom due to immature brain development [5].

2.2.3 OLFACTORY

Olfactory dysfunction is a the disorder of sensory processing that involving an altered smell sensitivity that come from many factor such as viral infections, age, exposure of toxic and neurodevelopmental disorder like autism spectrum disorder [7]. Sensory stimuli unusual response are often present with autism children. Compared with children that have typical development, autism children are reported with

increased on experience of sensory symptoms that have been confirmed by studies and parent report [12]. Individuals with autism spectrum disorder that have experience abnormal reaction of sensory stimuli especially touch, taste and smell have been highlighted by Hans Asperger since 1944. Donna Leanne Williams [11] or known as Temple Grandin is a known person that have autism spectrum disorder have reported vivid own experience of smell with strong unpleasant sensation [11]. Recently, DSM-5 have included in the diagnostic criteria to autism spectrum condition of unusual sensory processing due to the high of prevalence among autism spectrum and its effect in their daily lives [13]. Olfactory disorder can cause many sensory issues on daily life and depending whether it is hyposensitive or hypersensitive [12].

2.2.4 AUTISM OLFACTORY DISORDER

Autism children always present with abnormal responses to sensory stimuli. It have been confirmed by studies and parent report that showing an increasing of sensory symptom [9]. It is known as olfactory disorder that effect the children with autism spectrum disorder. It is considered as sensory processing disorder. It can effect someone daily life, depending on individual whether the person is hyposensitive of hypersensitive [8].

a) Hypersensitive

For most of normal person, autism children that have experience with hypersensitive to smell, may never be aware of. It can be a problem for the person to have a normal daily life [23]. They may avoid to meet people as they do not like the smell of other people. Children with hypersensitive to smell can be detect by notice their smell experience are totally different with us [8]. For example, we found that soap or perfumes are nice to smell. But autism children

with hypersensitive to smell may found that this smell are extremely irritating to them and they try to avoid it.

b) Hyposensitive

Autism children with olfactory hyposensitive have a difficulties to sensing the certain odours. Unfortunately, they will smells something dangerous totally unnoticed such as smoke fumes, noxious chemical or toxic gases [23]. The sense of smell is important to detect danger as it can be a warning alarm. But it was different cases to hyposensitive autism child that have lack of sense of smell. Children with hyposensitive to smell can be detect by notice their lack of smell [8]. For example, they get sick by eating rotten food as they cannot smell the stink of the rotten food.

2.2.5 DIAGNOSIS OF AUTISM CHILD

Early diagnosis of autism spectrum disorder is important but always delayed until the school age. It is critical for many reasons. The most important reasons is to improve the children functioning is more effective on younger children. There are increasing evidence show that clinicians can identify autism children as young as 48 months or 2 years of age. The symptom of autism spectrum disorder can be identified in younger age [9]. American Academy of Pediatrics have recommended observation and screening for autism at 18 and 24 months age. They have also emphasized the need of early identification or detection of autism spectrum disorder [14]. The diagnosis of autism spectrum disorder is perform at age 3 to 6 years. In some children there are increasing evidence that autism spectrum disorder can be detected at age of 2 [14]. Although the instrument for screening autism spectrum disorder for very young children require refinement before it can be used widely [16].

2.2.6 AUTISM CHILD SMELL SENSITIVITY

Response to unusual sensory input often describe in autism spectrum disorder person such as visual, hypersensitivity to auditory and also smell stimuli [21] [10]. Ben-Sasson [1] at 2008 found that autism spectrum disorder toddlers show less sensation of awareness due to sensory avoidance high rates or sensory overload to the environment [1] [10]. Rogers [19] found that autism spectrum disorder toddlers had more deficits in smell sensitivity than other developmental delays toddlers as measured by the short sensory profile [17] [10].

2.3 INTERACTIVE PANEL BY ROMPA

This is the new invention of smell therapy device that developed by company named ROMPA as shown in figure 2.1 [13]. It have improved the conventional therapy method by insert an attractive element such as sounds and colourful LED lighting [13]. It can activate smells, colours, sounds and breezes for aromatic, visual, audible and tactile stimulation. The LED indicate which aroma is being diffused. It is wall mount indoors and uses as a stand-alone product. It is also compatible with others ROMPA product that connected with WI FI such as, sensory magic. Deluxe 8 colour wire free controller and many other ROMPA products. Includes 4 aromas (more available separately). The integral fans have 2 speed settings [13].

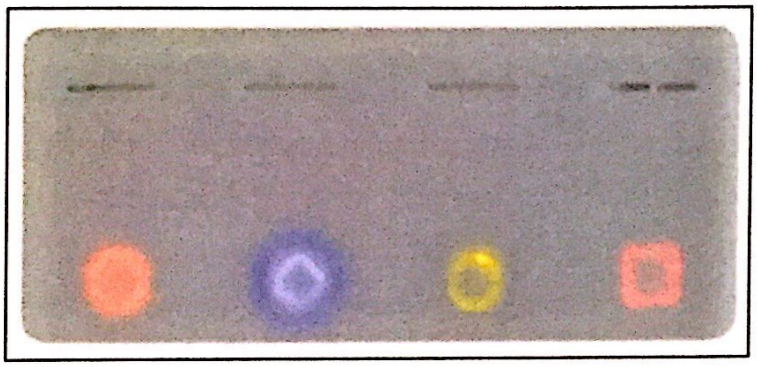

Figure 2.1: Interactive Aroma Panel by ROMPA®

It use fan to blow the aroma from the cartridges that place inside of the device. Cartridges can be filled with the aroma of user choice either use scented beads as shown as figure 2.2, sachets as shown in figure 2.3, or scented oils. It can use 4 types of different scent in one time and can be change by user desire. The cost for this device for sale are 3000 us dolar per unit [13].

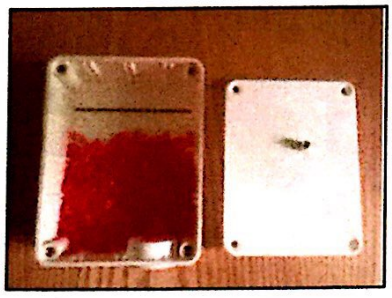

Figure 2.2: Scented beads

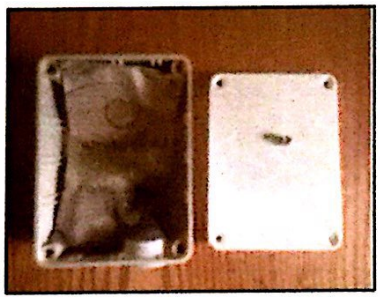

Figure 2.3: Scented sachet

2.4 AROMA DISPENSER

The smell therapy device on this project have 4 aroma dispensers which are used to activate scent that used from this device. Each of the aroma dispenser contain different type of fragrance oil in one time depends on user desire. It use ultrasonic piezoelectric to cause droplet information with scent from the fragrance oil. When disturbances experiences in liquid with sufficient of amplitudes, it can exceeded surface-tension that resulting in droplet. The liquid that agitated will rupture by intense ultrasonic wave and turn into droplet at its interface with another liquid or gas. When a water is vibrated to its surface in a normal direction, capillary wave or ripple having a period that is double the initiating vibration on its surface are formed. A standing wave pattern of capillary wave intersecting is produced, shaded rectangles or a mesh

of light are appeared. If the liquid surface perturbations caused by these capillary wave large, it can be assumed that bounded ligaments by lines of nodal of the capillary wave are produced. If the depth of liquid is great and the perturbation is enough to result unstable ligaments, it is possible that the ligaments rupture into droplets.

2.5 LEMON IN AROMATHERAPY

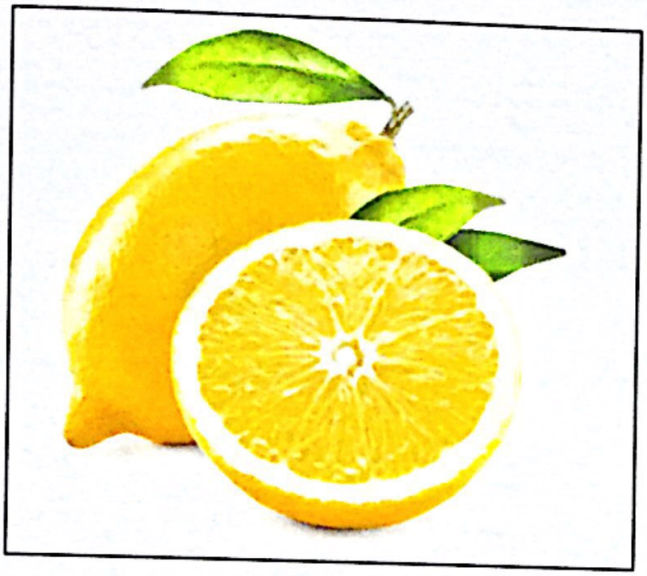

Figure 2.4: Genus Citrus

Figure 2.4 shows Genus Citrus. Essential oil lemon are derived from Genus Citrus it provides aromatherapy benefits and array of health. It is come from lemon's Latin name Linnaeus (citrus lemon) and it is derived from the tall lemon trees. The earliest found of lemon were from India, China, Italy, Mediterranean and Arabia. Historians agree that lemon was introduced to Europe during Crusades, and gaining popularity by 16th century. They believe that lemon was not introduced until 1493 in Americas. Lemon use has been known throughout the history, lemon's benefits and enticing aromas as even have written by famous authors and poets. In 1931 Maude Grieve [11] has reported on her book that the most powerful fruit is lemon in term of used to preserve health. Oil from lemon essential used to treat various health concerns [11]. It is in fact are used as antidote for some poisons. Antiseptics properties inside of the lemon, can be used for healing agent and also cleansing. In 1747 James Lind [7] using lemon as an experiment subject to study the patient which are seamen with scurvy [7]. Lind discovered seamen more able to sustain curvy when lemon juice are added in the sailor's diet as it contain rich of vitamin C [7]. Lemon also can stimulate health and wellness benefits. Essential oil from lemon are popular used for its benefit to aromatherapy.

It has uplifting effect to the body. In aromatherapy experts use the lemon oil to improve concentration, promote wellbeing enhancements, helps refresh the mind, improved mood and also remove negative feelings. In autism aspect, it can reducing behavioural aspects and emotional of autism. Daily used can help keep everything calm, balanced and happy.

2.6 COFFEE

Figure 2.5: Coffee beans

Figure 2.5 shows coffee beans. Coffee scent help to neutralise the scent in our nose to distinguish the latest scent. It is called olfactory fatigue, which when nose unable to distinguish odours after exposure to certain odours. Annie Tomlin [2] the scientist in lab of UC Berkeley from Noem Sobel in experiment of " Influence of smelling Coffee on Olfactory habituation" found that smelling coffee aroma between samples are actually work compare to unscented air [2]. The odour of the perfume stayed the same from sample to sample after smelling coffee while it decreased when smelling air between samples. However, the pleasant of perfume are still the same after smelling coffee or air.

CHAPTER 3

METHODOLOGY

3.1 PROJECT INTRODUCTION

For completing this project, there are several task need to be done. The task can be divided in three phase which are research phase, device development phase and last one is testing and data analysis phase. The first phase is actually the most important phase, it is because on this phase almost all of the knowledge that needed for this project are collected from this phase. The second phase begin after all of the info and data was enough collected. Second phase is the whole process of development of the device. Starting from programming, circuit design, and device design until the product is finish and can be test. Third phase, which is last phase is important for the result of the product. On this phase the product will be tested until the objective of the project are achieved. Figure 3.1 shows the flowchart of the project.

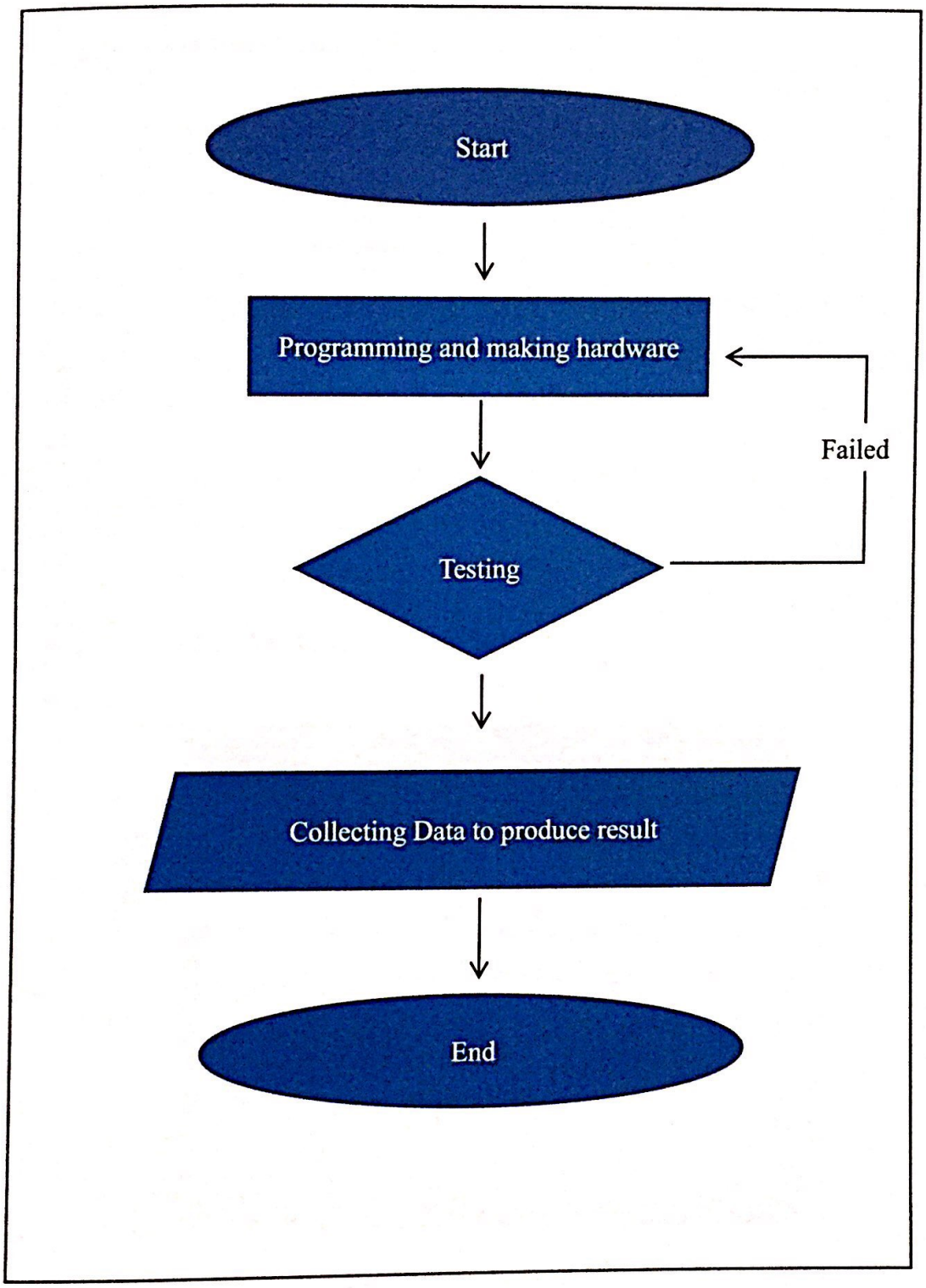

Figure 3.1: Flow chart of the project

3.2 COMPONENT LIST

This are component used in this project:

- Arduino UNO
- HC-05 module
- Smartphone with custom application installed (can be use any android base smartphone but need to share the application by owner through Share-it application)
- Arduino compatible SD card module slot socket reader
- RGB LED.

3.3 ARDUINO UNO

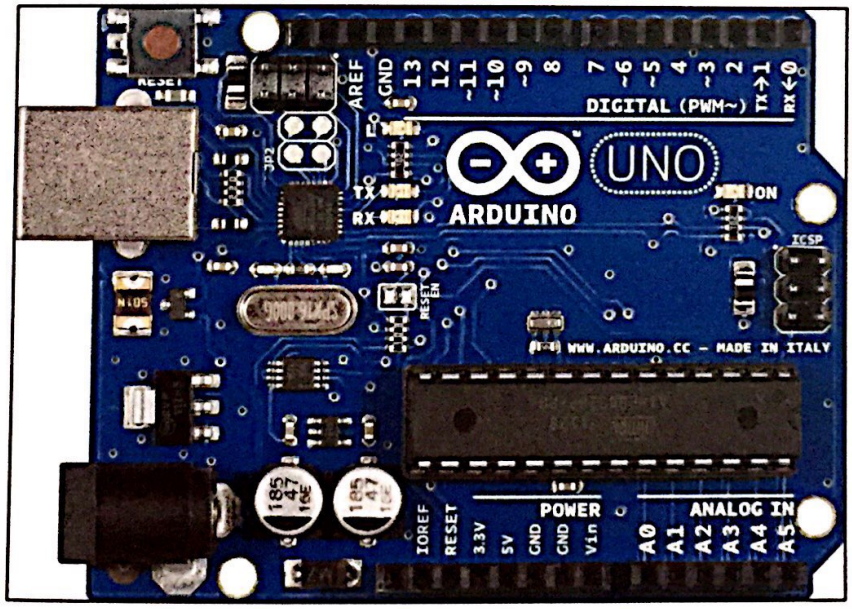

Figure 3.2: Arduino UNO

Figure 3.2 shows arduino UNO. Arduino Uno is a microcontroller board based on the Atmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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. Others can tinker with UNO without worring too much about doing something wrong, worst case scenario the chip need to be replace for a few dollars and start over again."Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

3.4 HC-05 BLUETOOTH MODULE

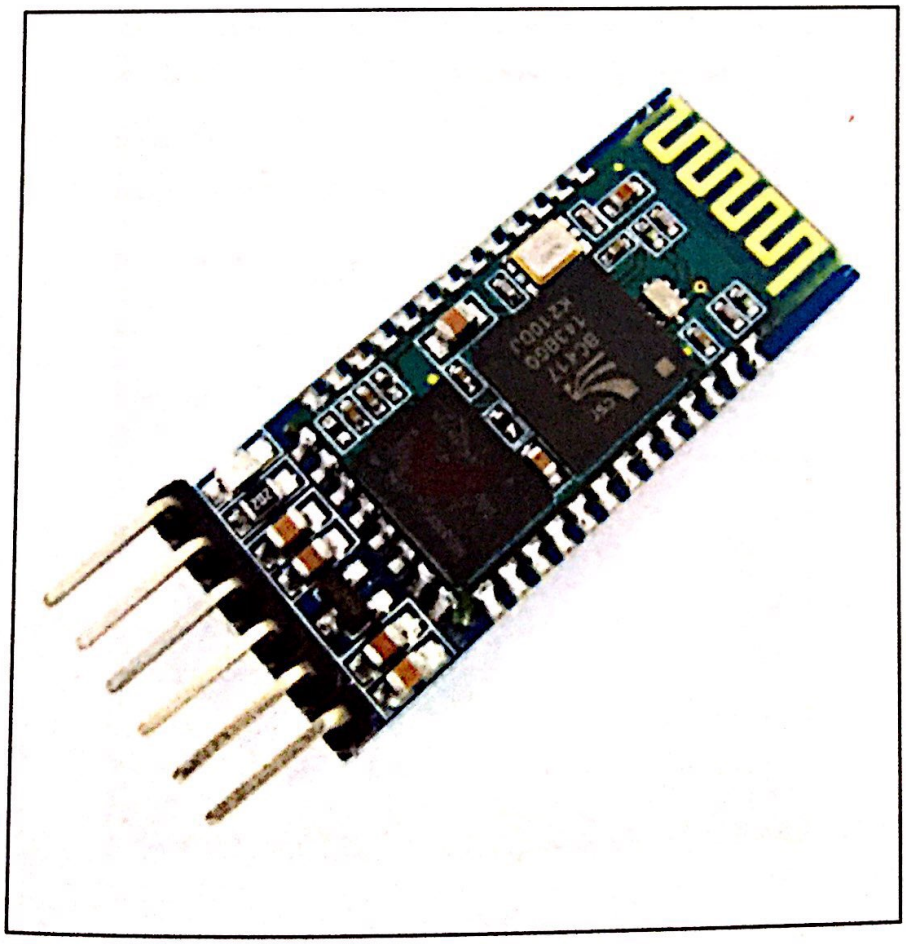

Figure 3.3: HC-05 bluetooth module

Figure 3.3 shows HC-05 Bluetooth module. Comparing it to the HC-06 module, which can only be set as a Slave, the HC-05 can be set as Master as well which enables making a communication between two separate Arduino Boards. There are several different versions of this this module but I recommend the one that comes on a breakout board because in that way it's much easier to be connected. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via the Serial Communication.

3.5 CUSTOM APPLICATION (ANDROID)

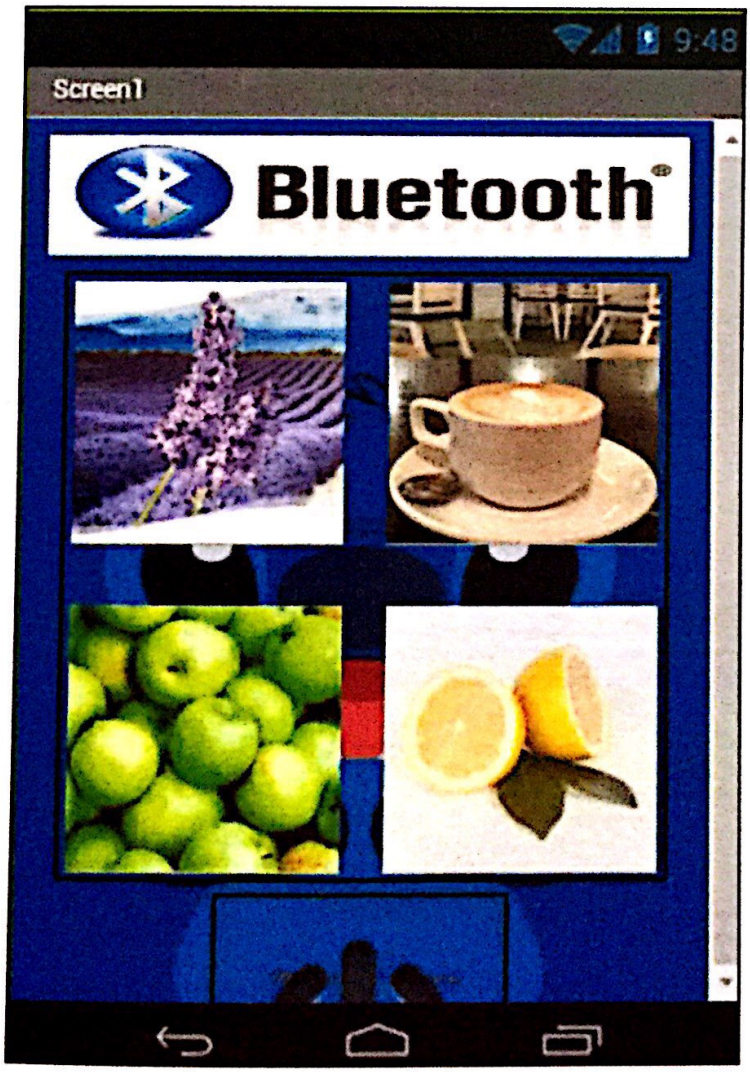

Figure 3.4: Application design

Figure 3.4 show the application of smell therapy device that can be access by all of android base smartphone user. It was developed by using MIT APPINVENTOR 2 from website ai2.appinventor.mit.edu/.The application will be conduct by the care-taker. This is the procedure of the application:

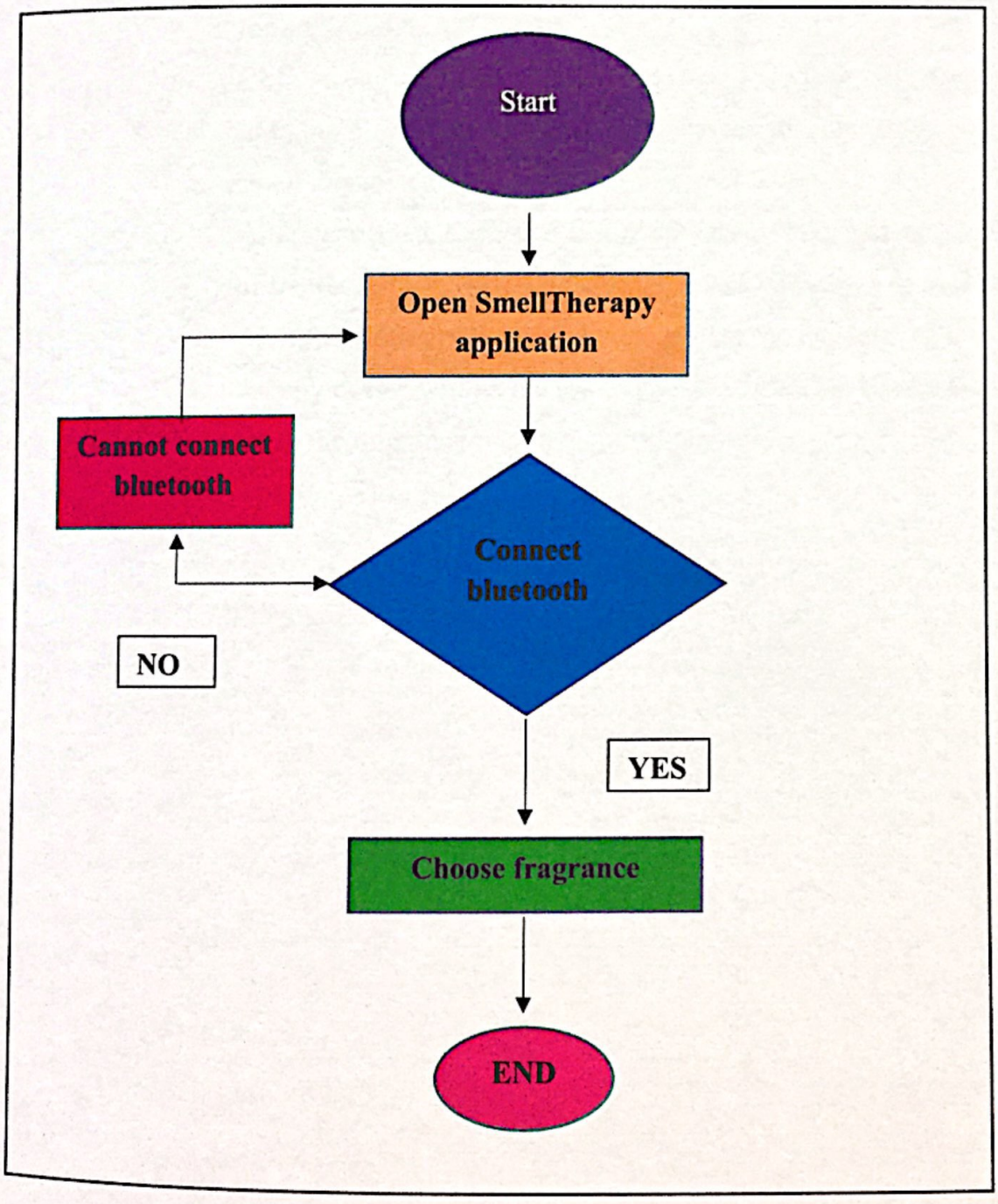

Figure 3.5: Flow chart of the application procedure

Figure 3.5 shows the flow chart of the project. It is the procedure of the project. This procedure show step on how the device work:

i. The smartphone is android base and Bluetooth have to be turned on.
ii. Open the application from smartphone named "SmellTherapy". This application need to be shared first by the owner through "Shareit" application or Bluetooth transfer before the other user can download the application.
iii. Click to the "Bluetooth" icon on the top of the application as shown in figure 3.3 and select device name "Autism" to be paired with the smell therapy device.
iv. After connected, Caretaker can simply choose one out of four types of fragrance from the application as shown in figure 3.4.
v. After the fragrance have been chosen from the application, the smell therapy device will let out the fragrance and autism children need to guess the fragrance.

3.6 ARDUINO COMPATIBLE SD CARD READER

Figure 3.6: Arduino compatible SD card reader

Figure 3.6 shows Arduino compatible SD card reader. It need use SD library in order to operate. The SD library allows for reading from and writing to SD cards on the Arduino Ethernet Shield. It is built on sdfatlib. The library supports FAT16 and FAT32 file systems on standard SD cards and SDHC cards. It uses short names for files. The file names passed to the SD library functions can include paths separated by forward-slashes, /, eexaple, "directory/filename.txt". Because the working directory is always the root of the SD card, a name refers to the same file whether or not it includes a leading slash. As of version 1.0, the library supports opening multiple files. The communication between the microcontroller and the SD card uses SPI, which takes place on

digital pins 11, 12, and 13. Additionally, another pin must be used to select the SD card. This can be the hardware SS pin, pin 10 or another pin specified in the call to SD.begin(). Even if someone do not use the hardware SS pin, it must be left as an output or the SD library won't work.

3.7 RGB LED

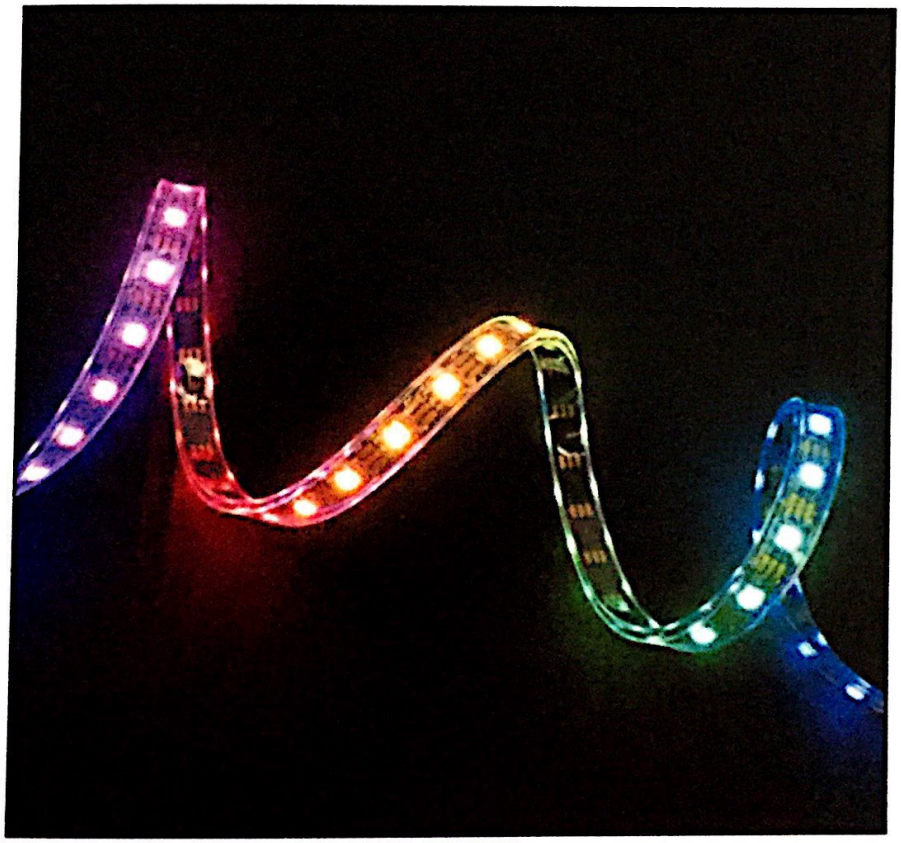

Figure 3.7: RGB LED

Figure 3.7 show RGB LED. RGB LED means red, blue and green LEDs. RGB LED products combine these three colours to produce over 16 million hues of light. Note that not all colours are possible. Some colours are "outside" the triangle formed by the RGB LEDs. Also, pigment colours such as brown or pink are difficult, or impossible, to achieve.

3.8 SMELL THERAPY DEVICE

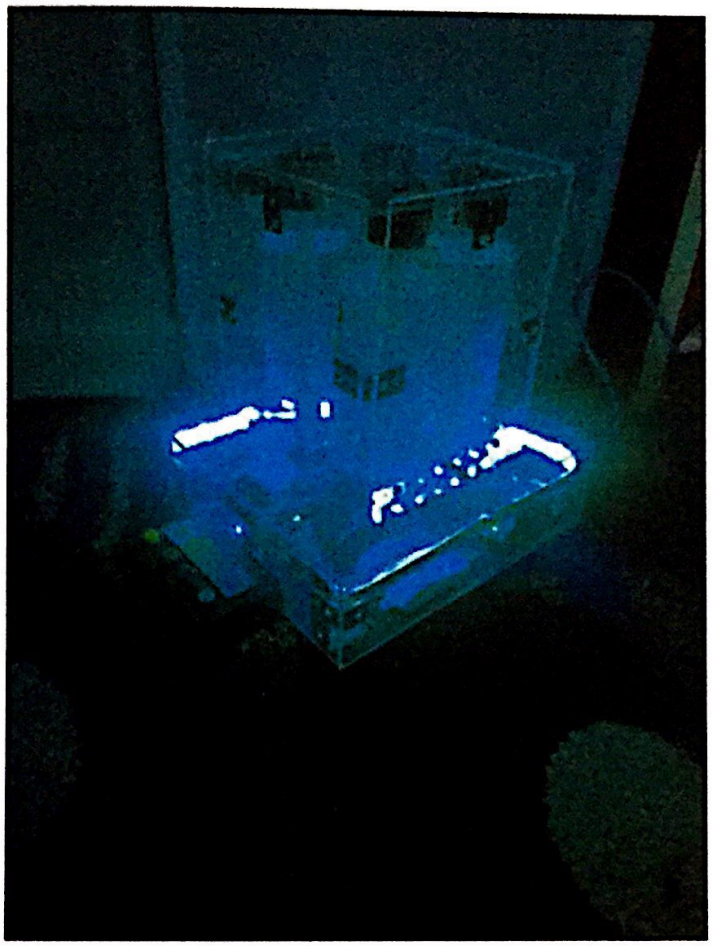

Figure 3.8: Smell therapy device

Figure 3.8 show the developed smell therapy device. This device only work with custom application on android phone to operate. This device will spread out the fragrance that used to test the smell sensitivity of the autism child. It have the procedure to operate:

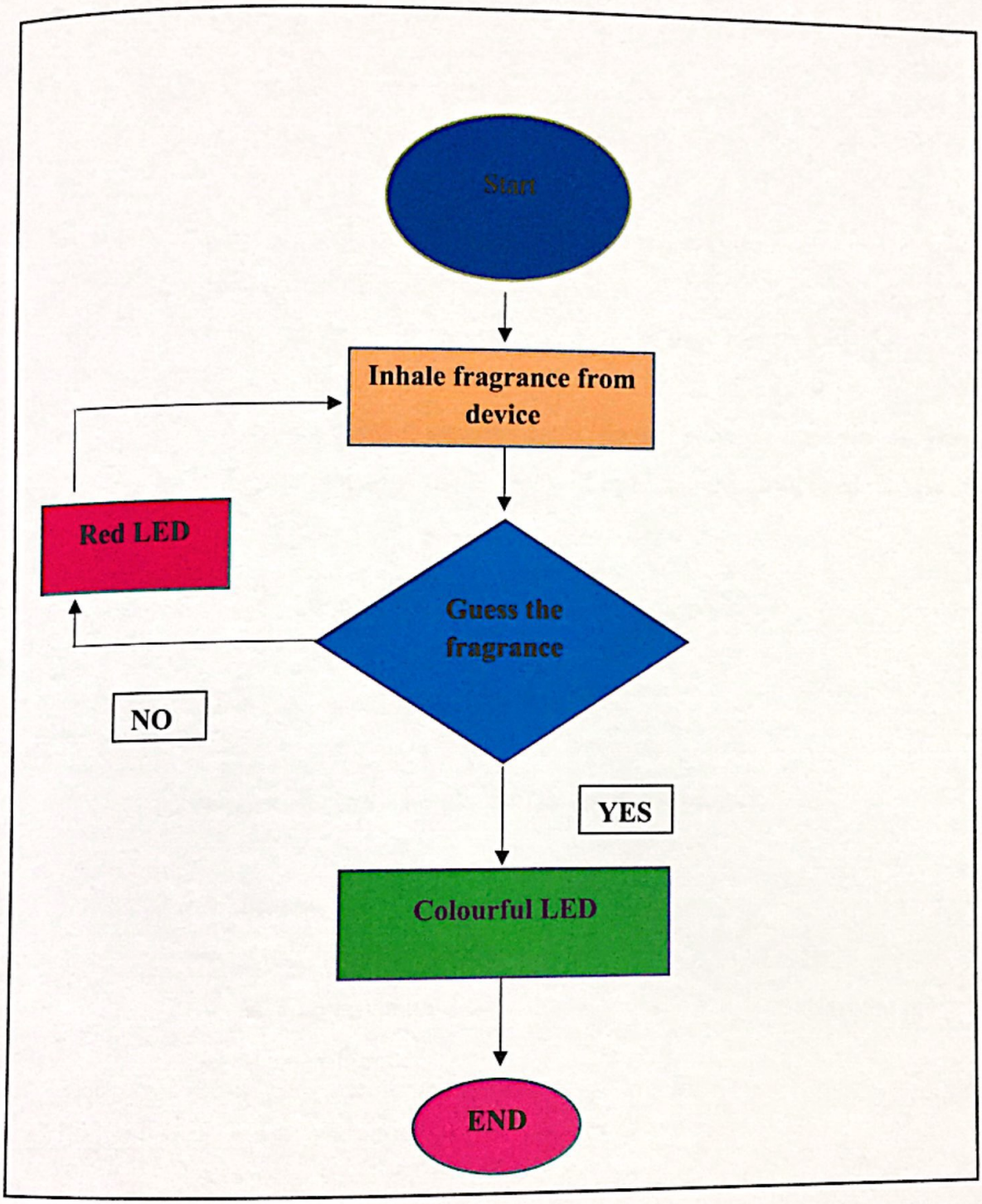

Figure 3.9: Flowchart for device's standard operation procedure

Figure 3.9 shows the flowchart for device's standard operation procedure:

i. After caretaker choose the fragrance from the application, the device will release fragrance from the top of the device.

ii. Autism child will need to inhale the fragrance and guess what kind of smell that release from the device.

iii. After the autism child recognise the smell, they can answer the type of fragrance by push 1 out of 4 button at the bottom of the device.

iv. If the answer is correct, the colourful LED will blinking with cheerful song.

v. If the answer is wrong, the buzzer will buzz and the child need to redo the test.

vi. Repeat all of the steps from step 1.

3.9 SOFTWARE

These are the software planned to use in the project:-

- Proteus 7.4
- Arduino IDE
- MIT appinventor 2
- Microsoft excel

3.10 PROTEUS 7.4

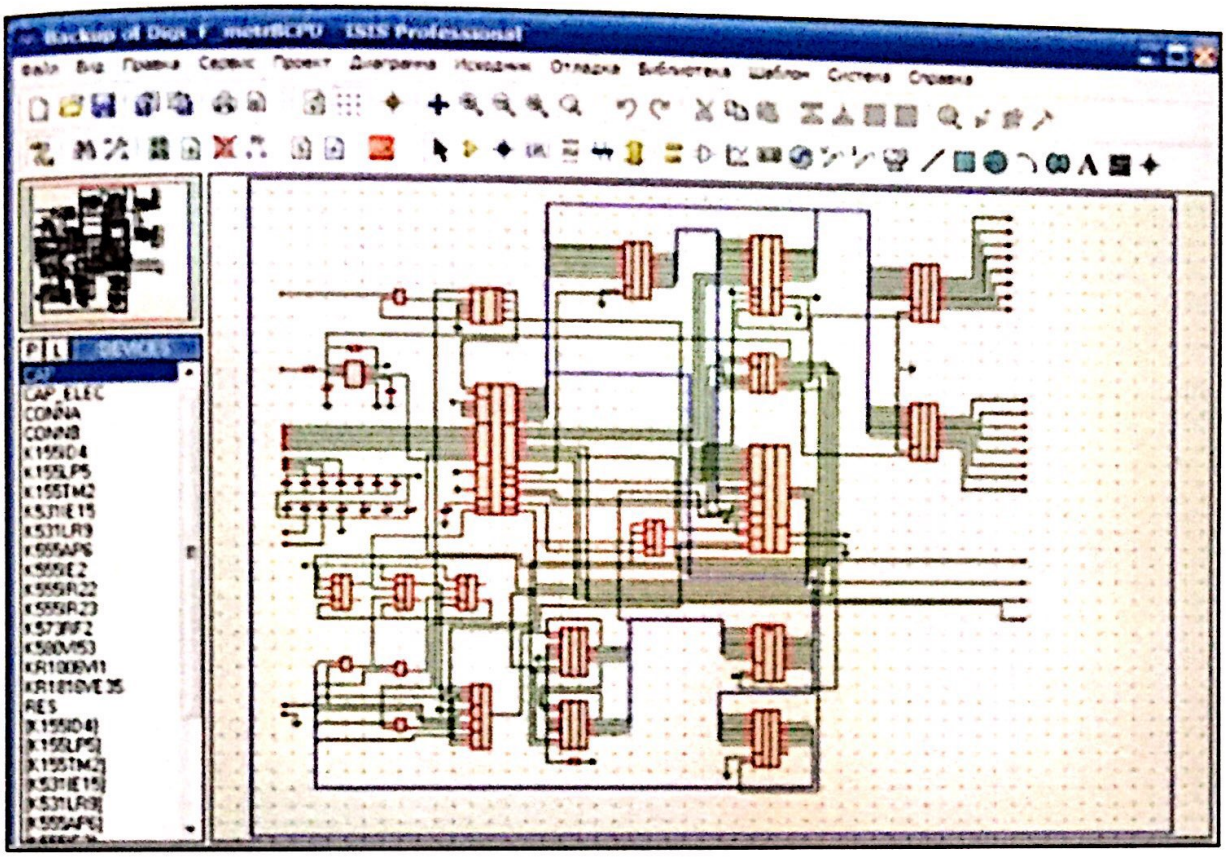

Figure 3.10: Proteus 7.4

Figure 3.10 show Proteus 7.4. In this project, Proteus 7.4 are used to design the circuit and doing the simulation process before proceed to the actual circuit. It will help to detect the failure or short circuit in the circuit during simulation. So the damage of the actual circuit can be avoid.

3.11 ARDUINO IDE

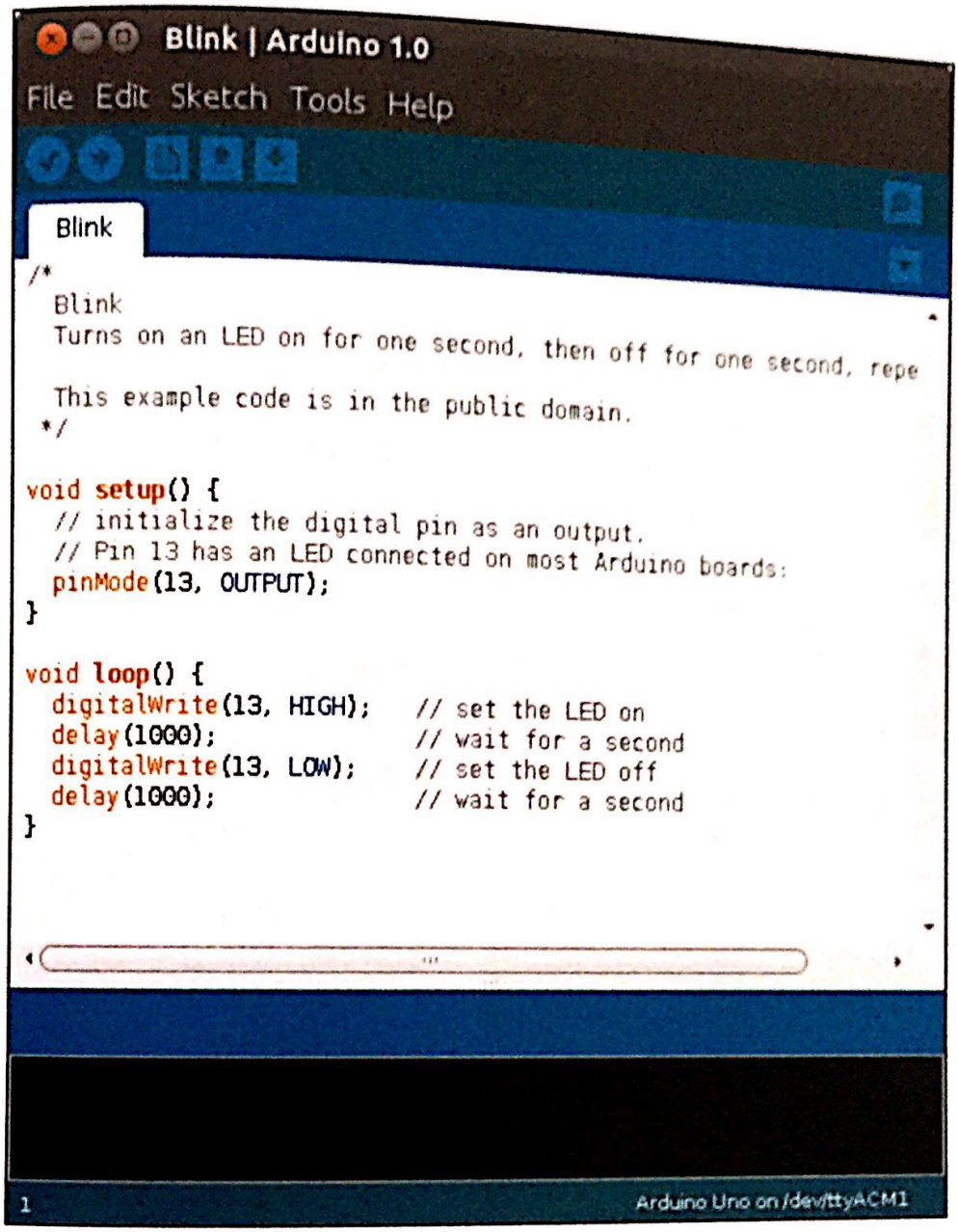

Figure 3.11: Arduino IDE

Figure 3.11 shows Arduino IDE. The open source Arduino software makes it easy to write code and upload it to the board. It runs on Windows,Mac OS X, and Linux. The environment is written in java based on Processing and other open source software.

3.12 MIT APPINVENTOR 2

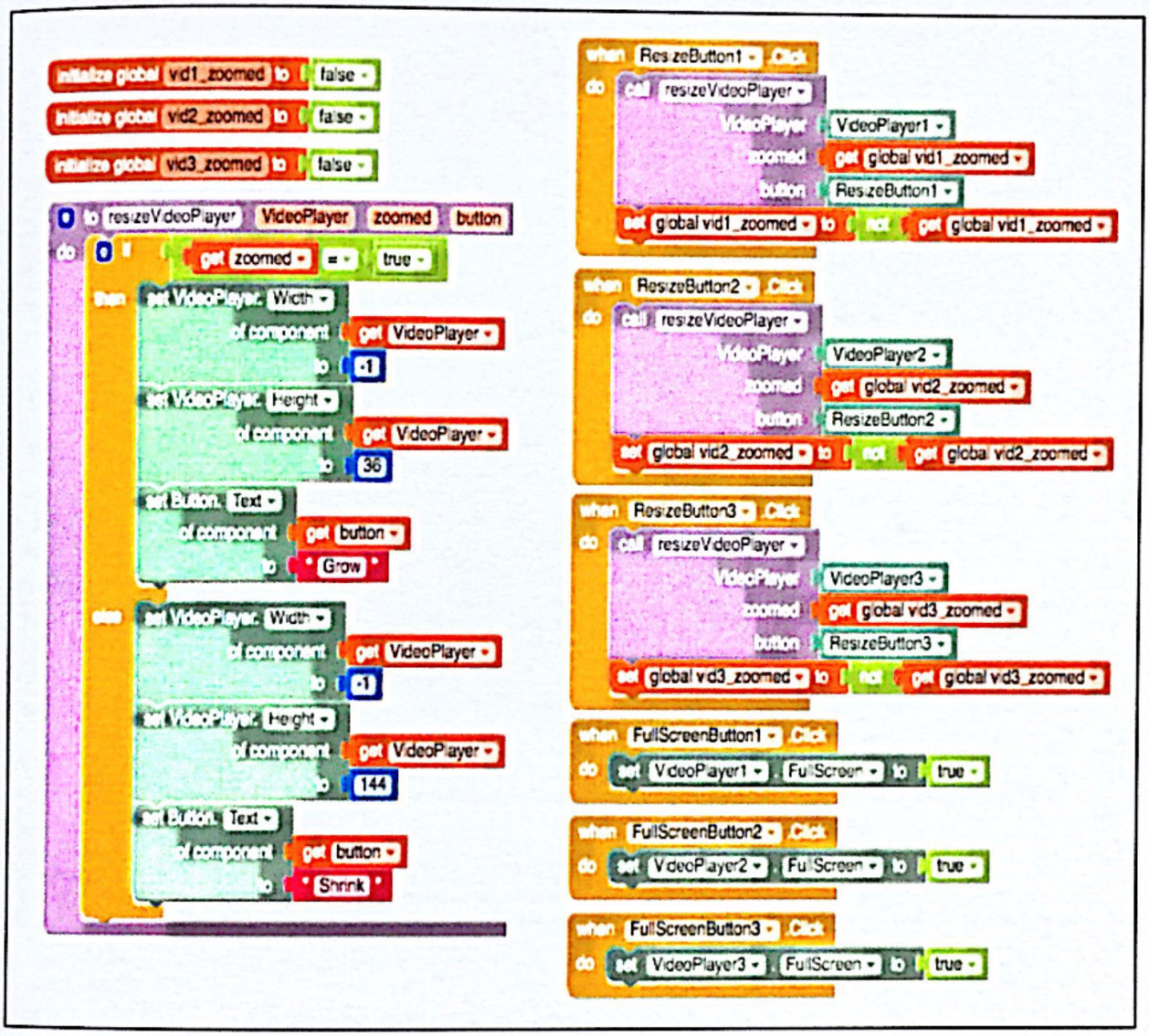

Figure 3.12: MIT Appinventor 2

Figure 3.12 show MIT Appinventor 2. It is a platform used to develop application that can be used by android user only. As this project use application on smartphone, this is one of the important platform to use in order to develop the device.

3.13 MICROSOFT EXCEL

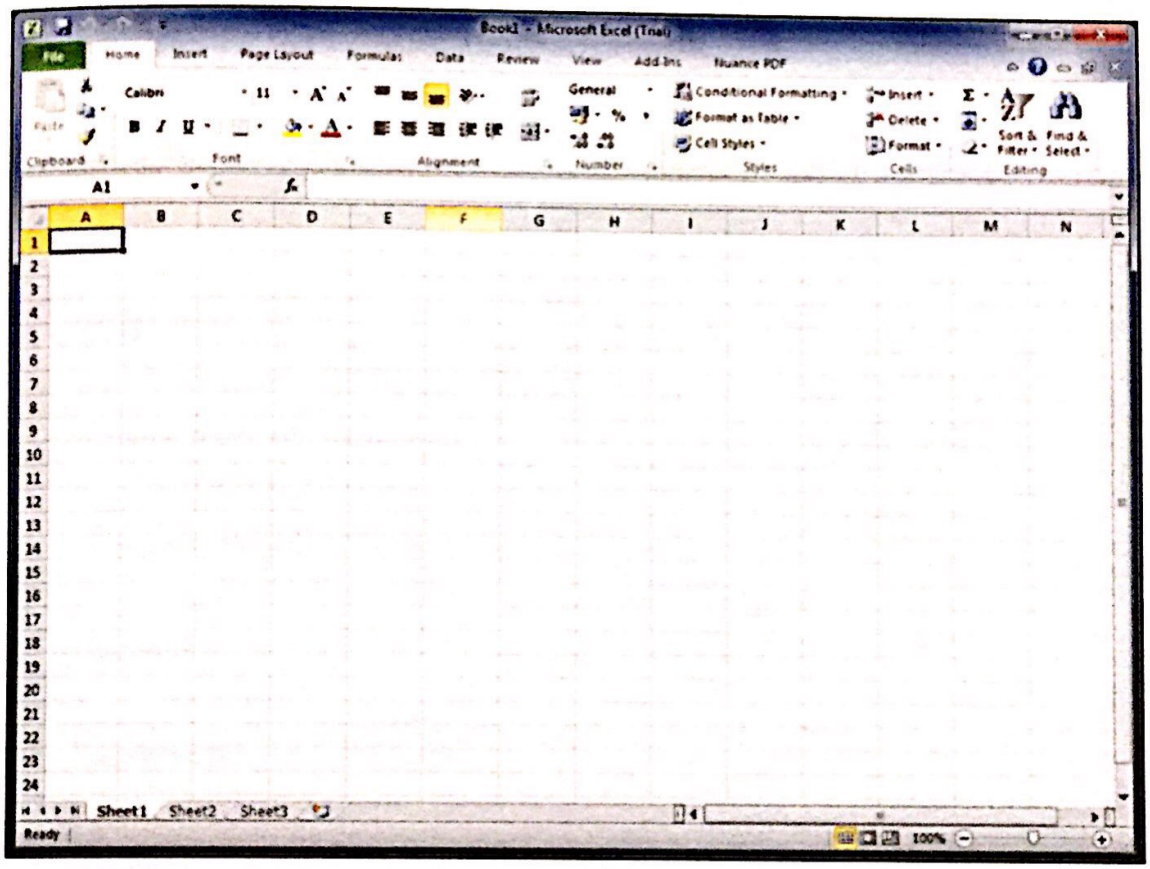

Figure 3.13: Microsoft excel

Figure 3.13 show Microsoft excel. It is used in this project to key in the data and convert into graph. This software are helping a lot in analysis phase. It create the graph automatically using the data collected.

3.14 COST FOR THE PROJECT

Table 3.1: Cost of the Project

Component	Quantity	Cost (RM)
Arduino UNO	1	50.00
RGB LED	1	25.00
Arduino bluetooth module HC-05	1	45.00
Arduino compatible SD card slot	1	20.00
Humidifier	4	120.00
Fragrance oil	4	100.00
Casing	1	100.00
Small component		40.00
	TOTAL	**RM 500.00**

3.15 BLOCK DIAGRAM OF THE PROJECT

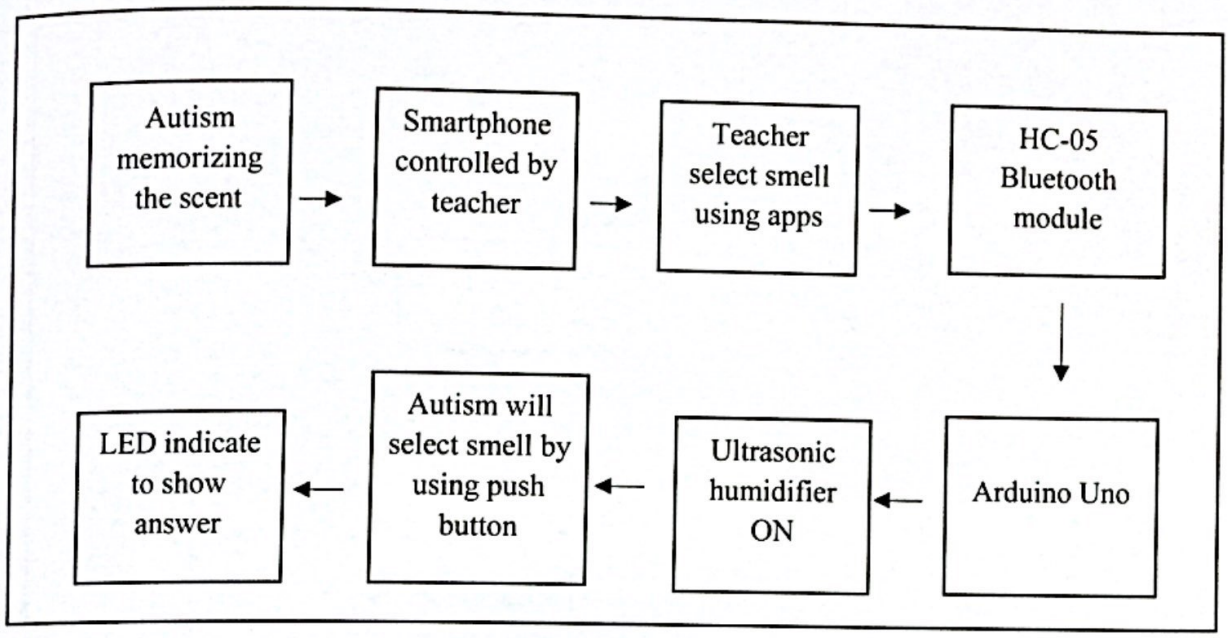

Figure 3.14: Block diagram of the project

Figure 3.14 shows the block diagram of the project. It is the procedure of the project. This procedure show step on how the device work:

i. Autism child will try to memorize the scent first by holding the fragrance bottle for them to smell.

ii. Smartphone was controlled by the teacher/caretaker.

iii. Teacher/caretaker will select the smell by using application on the smartphone.

iv. The smartphone will send data to HC-05 Bluetooth module

v. HC-05 Bluetooth module will send the data to Arduino UNO.

vi. Arduino UNO that have been programed will triggered on the ultrasonic humidifier as selected by the teacher/caretaker.

vii. The autism child will select the answer by choose 1 of 4 from the pictured push button.

viii. The green LED will indicate to show the answer is correct and red LED will indicate to show the answer is wrong

3.16 FLOW CHART OF THE DEVICE

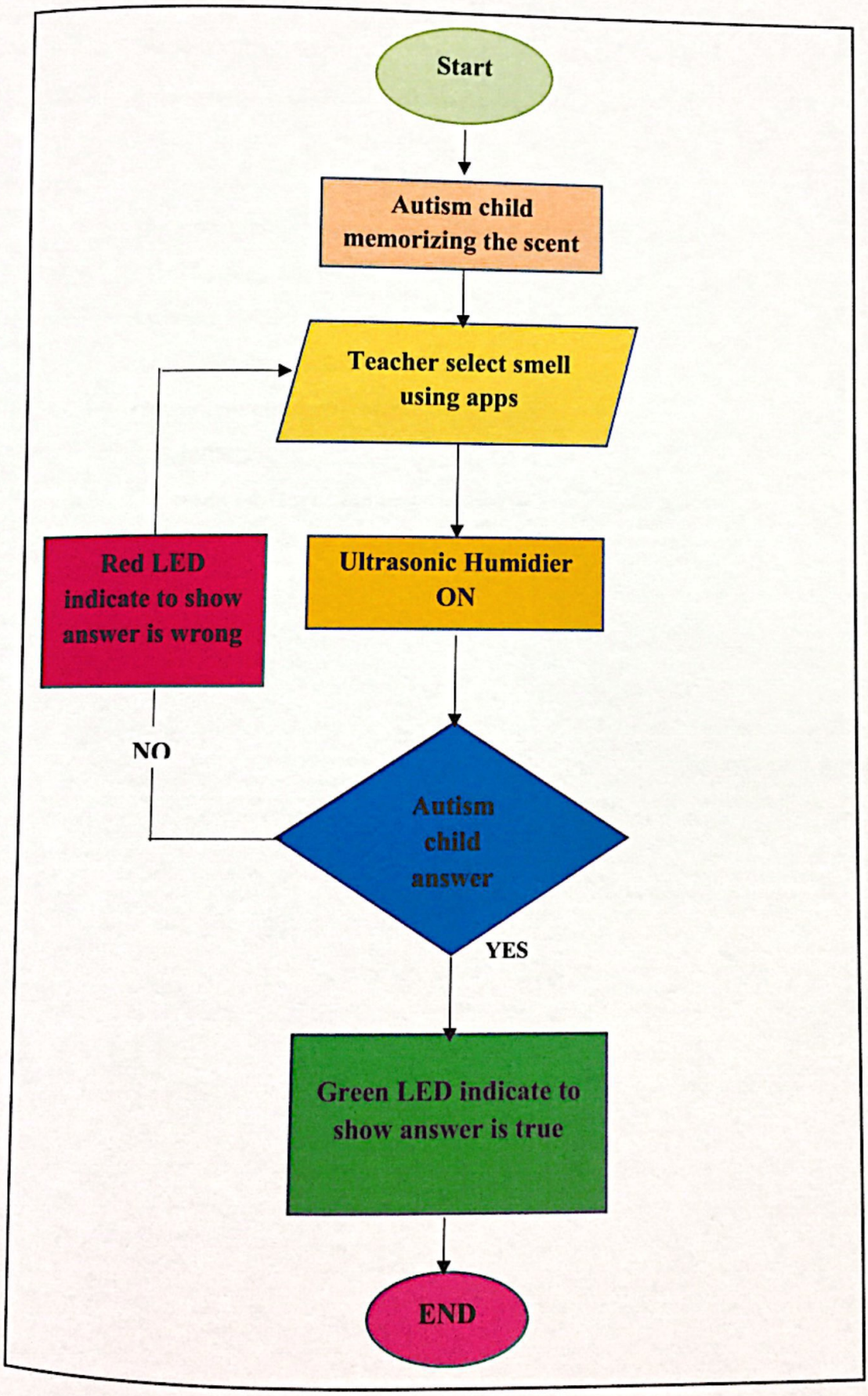

Figure 3.15: Flow chart of the device

Figure 3.15 shows the flow chart of the project. It is the procedure of the project. This procedure show step on how the device work:

i. Autism child will try to memorize the scent first by holding the fragrance bottle for them to smell.

ii. Smartphone was controlled by the teacher/caretaker.

iii. Teacher/caretaker will select the smell by using application on the smartphone.

iv. The smartphone will send data to HC-05 Bluetooth module

v. HC-05 Bluetooth module will send the data to Arduino UNO.

vi. Arduino UNO that have been programed will triggered on the ultrasonic humidifier as selected by the teacher/caretaker.

vii. The autism child will select the answer by choose 1 of 4 from the pictured push button.

viii. The green LED will indicate to show the answer id correct and red LED will indicate to show the answer is wrong.

3.17 GANTT CHART OF THE PROJECT FIRST SEMESTER

Table 3.2: Gantt chart of the project for first semester

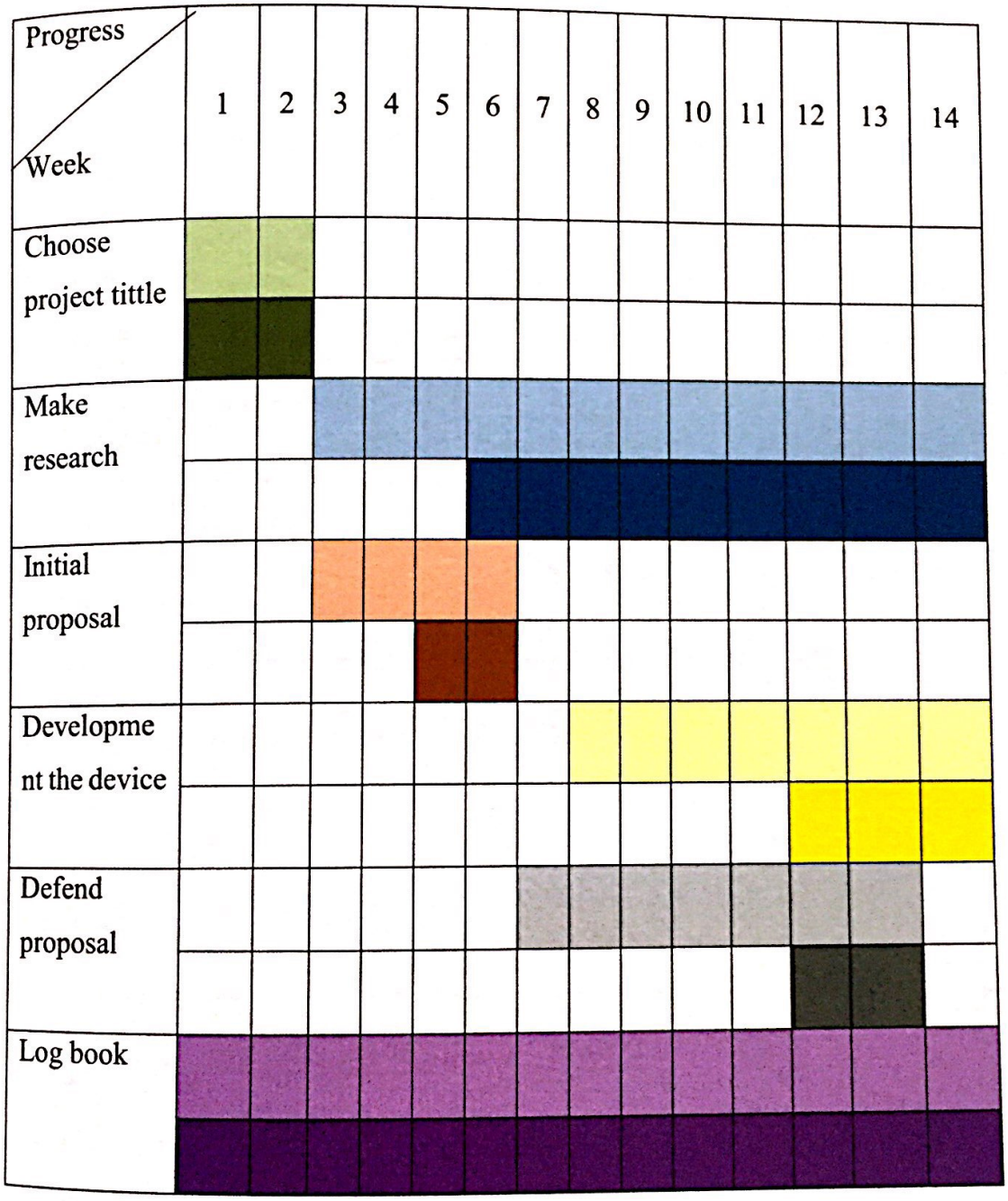

Table 3.2 shows the Gantt chart of the project for semester 1. It is a plan to conduct on this project. On week 1 and 2 the project progress was choosing the tittle of project and write the report in log book. On week 3 until 4 is the time to make a preparation for initial proposal also make a research about this tittle and write the report on logbook. On week 7 until 13 was planned for a defend proposal.

3.18 GANTT CHART OF THE PROJECT SECOND SEMESTER

Table 3.3: Gantt chart of the project for second semester

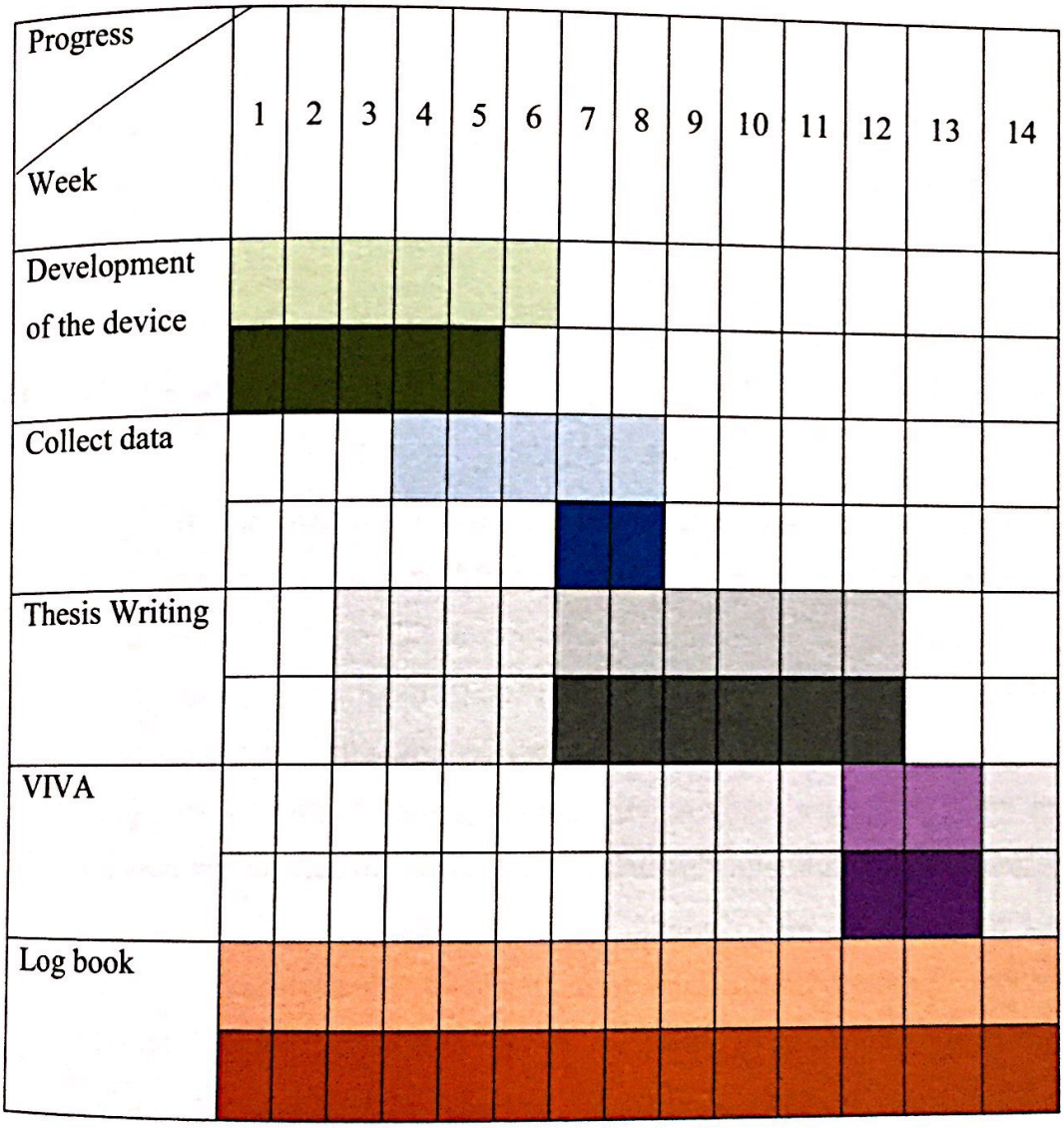

Table 3.3 shows the Gantt chart of the project for semester 2. It is a plan to conduct on this project. On week 1 until 6 the project progress is development of device and write the report in log book. On week 4 until 8 is the time to collect some data from survey questions and also write the report on logbook. On week 7 until 12 was planned for a thesis writing. On week 12 and 13 is a VIVA presentation.

CHAPTER 4

RESULT AND DISCUSSION

4.1 INTRODUCTION

In this chapter it discuss about the results and findings of the analysis conducted on this project. After the development of smell therapy device for autism were complete, this device was brought to the 'Pusat Pendididikan Khas Minda' at seksyen 7 Shah Alam. This device were tested for the effectiveness, comfortableness, attraction of the device and also the design. Each of the categories consist of 4 set of question. Also, this device was tested by 3 different children which were the severe level of autism child, mild level of autism child and also a normal boy. The testing was conducted for 6 days in two weeks to observe and analysis the development of smell sensitivity of the autism child. Normal child are used to differentiate the ability of smell from normal children and also the autism child. The test can be used as prove, that this device are working just fine for autism child.

4.2 ANALYSIS OF DEVELOPMENT OF SMELL SENSITIVITY OF THE SEVERE AUTISM CHILD.

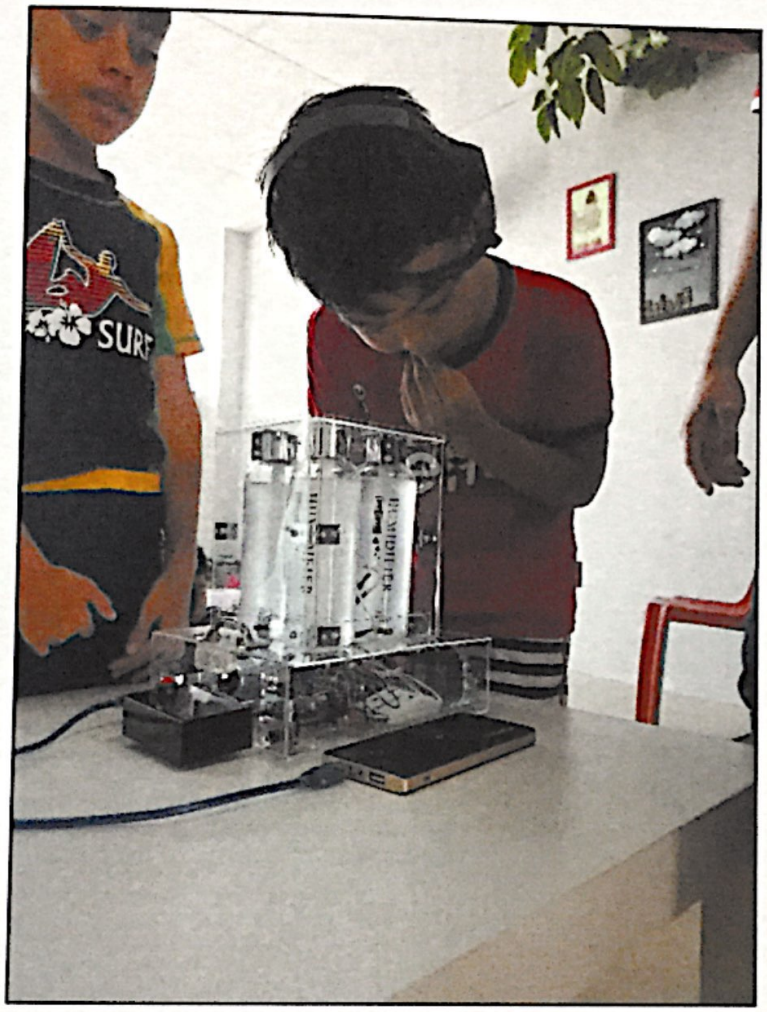

Figure 4.1: Severe autism child

Figure 4.1 shows that severe autism child testing the product. Subject is 5 years old children that have been diagnosed as severe autism child by the 'Pusat Pendidikan Khas Minda' at seksyen 7. Subject was testing the product and the development of subject smell sensitivity was analysed for 2 weeks in 6 days in total. Each day of the testing, subject will be tested 9 times per day 3 times each session. During the testing conducted, subject score was taken for the total correct answer day by day to see the development of the subject smell sensitivity.

Table 4.1: Analysis of smell sensitivity for severe autism child for 1st week

Autism Level	Mon(Day1)	Tue(Day2)	Wed(Day3)
Severe	0%	33.30%	83.30%

As shown in the result, subject got all wrong answer for the first day which lead to 0%. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{1st\ attempt + 2nd\ attempt + 3rd\ attempt}{300} \times 100$$

For severe autism child, subject is starting with 2 different fragrance as he got most lack of sensitivity. As shown in table 4.1, for the 1st day subject got 0% of correct answer after 3 attempts. On 2nd day subject got an improvement which he got 33.30% of correct answer for 3 attempts. For third day, subject got 83.30% score of correct answer. As shown in result, subject's smell sensitivity are improved day by day. It give a positive result of the smell therapy device.

Table 4.2: Analysis of smell sensitivity for severe autism child for 1st week

Autism Level	**Mon(Day4)**	**Tue(Day5)**	**Wed(Day6)**
Severe	55.55%	55.55%	77.78%

For a second week. The testing moving to another higher level. Which are the amount of bottle are increasing. For severe autism child, subject is starting with two fragrance. On the 2nd week subject was testing by using three different fragrance. As shown in the table 4.2, there are the increasing of the number which are represent the total score of the autism child day by day. For the 4th day subject got 55.5% of correct answer after 3 attempts. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{1st\ attempt + 2nd\ attempt + 3rd\ attempt}{300} \times 100$$

On 5th day subject got the same score which are 55.5% of correct answer for 3 attempts. This is because subject is still confused with the new fragrance. For third day, subject got 77.78% score of correct answer which is a high score. As shown in the result, subject's smell sensitivity are improved day by day. It give a positive result of the smell therapy device.

4.3 ANALYSIS OF DEVELOPMENT OF SMELL SENSITIVITY OF THE MILD AUTISM CHILD.

Figure 4.2: Mild autism child

Figure 4.2 shows that mild autism child testing the product. Subject is 7 years old children that have been diagnosed as mild autism child by the 'Pusat Pendidikan Khas Minda' at seksyen 7. Subject was testing the product and the development of subject's smell sensitivity was analysed for 2 weeks in 6 days in total. Each day of the testing, subject will be tested 9 times per day 3 times each session. During the testing conducted, subject's score is taken for the total correct answer day by day to see the development of subject's smell sensitivity.

Table 4.3: Analysis of smell sensitivity for mild autism child for 1st week

Autism level	Mon(Day1)	Tue(Day2)	Wed(Day3)
Mild	22.22%	55.56%	77.78%

For mild autism child, subject is starting with 3 different fragrance as subject got better sensitivity than severe autism child. As shown in table 4.3, for the 1st day subject got 22.2% of correct answer after 3 attempts. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{1st\ attempt + 2nd\ attempt + 3rd\ attempt}{300} \times 100$$

On 2nd day subject got an improvement which subject got 55.56% of correct answer for 3 attempts. For third day, subject got 77.78% score of correct answer. As Shown in the result, subject's smell sensitivity are improved day by day. It give a positive result of the smell therapy device. But by observation, the score of subject is lower than severe autism child. It is because the differences of fragrance used for each student. In general mild autism children have better sensitivity than severe autism child.

Table 4.4: Analysis of smell sensitivity for mild autism child for 2nd week

Autism Level	Mon(Day4)	Tue(Day5)	Wed(Day6)
Mild	41.67%	58.33%	83.33%

For a second week. The testing moving to another higher level. Which are the amount of bottle are increasing. For mild autism child, subject is starting with three fragrance. On the 2nd week subject was testing by using the whole four types of different fragrance. As shown in the table 4.4, it shows that the increasing of the number which are represent the total score of the autism child day by day. For the 4th day subject got 41.67% of correct answer after 3 attempts. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{\text{1st attempt} + \text{2nd attempt} + \text{3rd attempt}}{300} \times 100$$

On 5th day subject got the same score which are 58.33% of correct answer for 3 attempts. For third day, subject got 83.33% score of correct answer which is a high score. As shown in the result, subject's smell sensitivity are improved day by day. It give a positive result of the smell therapy device.

4.4 ANALYSIS OF DEVELOPMENT OF SMELL SENSITIVITY OF THE NORMAL CHILD.

Figure 4.3: Normal child

Figure 4.2 shows that normal child testing the product. Subject is 9 years old children that have no problem with the smell sensitivity. Subject testing the product in order to differentiate the ability of normal child and autism child smell sensitivity. Subject also testing the product for 2 weeks in 6 days in total. Each day of the testing, subject will be tested 9 times per day 3 times each session. During the testing conducted, subject score was taken for the total correct answer day by day for record.

Table 4.5: Analysis of smell sensitivity for normal child for 1st week

Autism Level	Mon(Day1)	Tue(Day2)	Wed(Day3)
Normal	66.66%	91.67%	100%

For normal child, subject is starting with the whole 4 different fragrance as subject got the best sensitivity among them. As shown in table 4.5, for the 1st day subject got 66.6% of correct answer after 3 attempts. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{1st\ attempt + 2nd\ attempt + 3rd\ attempt}{300} \times 100$$

On 2nd day subject got an improvement which subject got 91.67% of correct answer for 3 attempts. For third day, subject got 100% score of correct answer. As shown in the result, subject got an excellence score because subject got no problem with smell sensitivities.

Table 4.6: Analysis of smell sensitivity for normal child for 2nd week

Autism Level	Mon(Day4)	Tue(Day5)	Wed(Day6)
Normal	100%	100%	100%

For a second week. Normal child was tested by using the same amount of fragrances which is 4 in total as this device are created to have 4 max fragrances at one time only. As shown in the table 4.6, subject got a perfect 100% score for the whole week. It is because subject is normal child and got no problem smell sensitivity. This percentage is calculated by using below formula:

- Percent of Correct Answer 1st attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 2nd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer 3rd attempt:

$$\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$$

- Percent of Correct Answer total:

$$\frac{1st\ attempt + 2nd\ attempt + 3rd\ attempt}{300} \times 100$$

4.5 OVERALL ANALYSIS OF DEVELOPMENT OF SMELL SENSITIVITY

As shown from the data above that have been discuss, there are the increasing of development of smell sensitivity of autism child. Either the subject is a severe or mild autism child, both of them show excellence positive result. On this sub chapter, we discuss on the overall performance of this device ability to improve the autism child smell sensitivity.

Table 4.7: Overall analysis smell sensitivity development for 1st week

Autism level	Mon(Day1)	Tue(Day2)	Wed(Day3)
Severe	0%	33.30%	83.30%
Normal	66.66%	91.67%	100%
Mild	22.22%	55.56%	77.78%

Table 4.7 shows the overall analysis smell sensitivity development for 1st week. As shown in the table, all of the candidate have increasing their smell sensitivity day by day. This shows that this device can improve the smell sensitivity of the autism child.

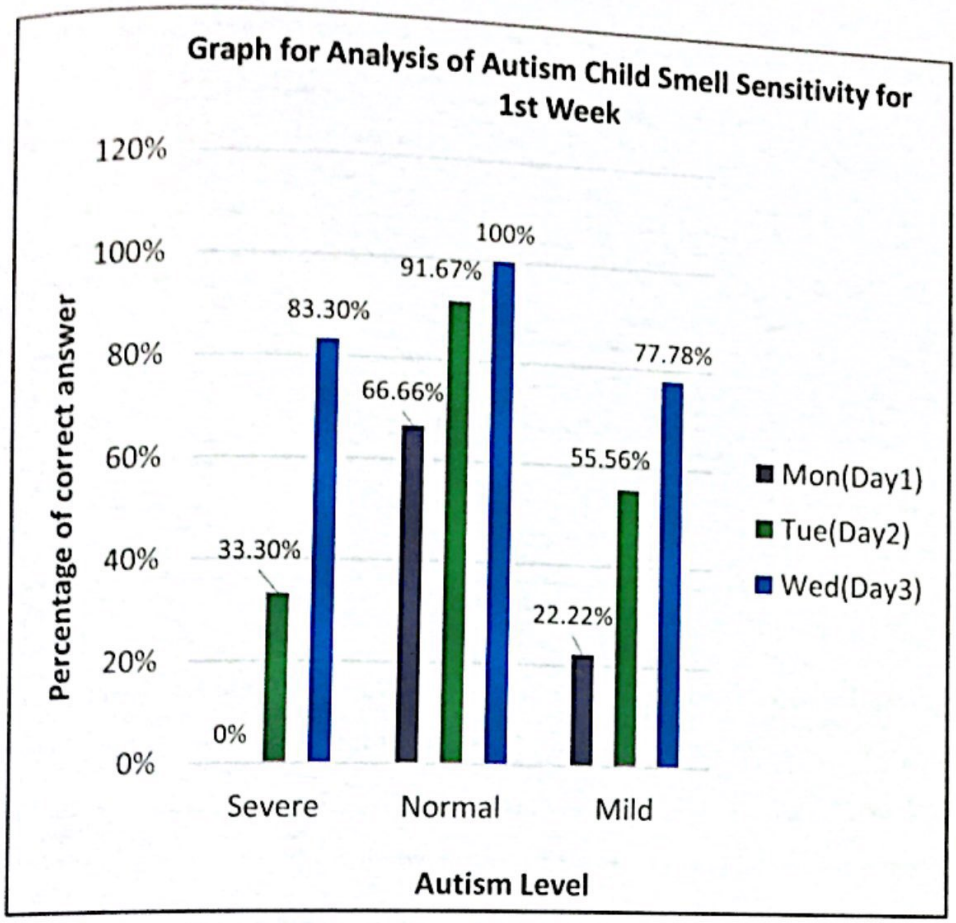

Figure 4.4: Graph for analysis of autism child smell sensitivity for 1st week.

Figure 4.4 shows the graph for analysis of autism child smell sensitivity development for 1st week. As shown in the graph, all of the candidate have increasing their smell sensitivity day by day. This shows that this device can improve the smell sensitivity of the autism child.

Table 4.8: Overall analysis smell sensitivity development for 2nd week

Autism Level	Mon(Day4)	Tue(Day5)	Wed(Day6)
Severe	55.55%	55.55%	77.78%
Normal	100%	100%	100%
Mild	41.67%	58.33%	83.33%

Table 4 shows the overall analysis smell sensitivity development for 2nd week. As shown in the table, all of the candidate have increasing their smell sensitivity day by day. The 4th day which is the 1st day of the 2nd week show the decreasing of the score compare to the 1st week. This is because on the 2nd week. There was an addition of the fragrance more than the 1st week. That is why there is small decreasing of score compare to the 1st week. But it show the increasing of the score day by day. This shows that this device can improve the smell sensitivity of the autism child.

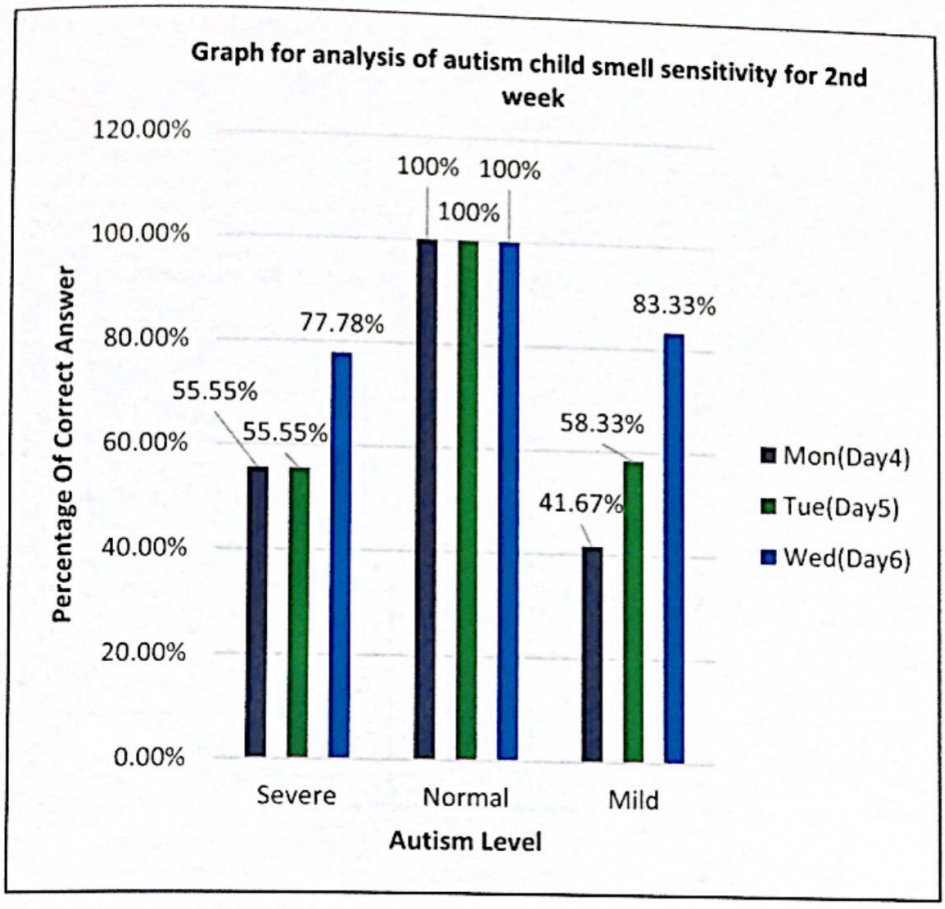

Figure 4.5: Graph for analysis of autism child smell sensitivity for 2nd week.

Figure 4.5 shows the graph for analysis of autism child smell sensitivity development for 2nd week. The 4th day which is the 1st day of the 2nd week show the decreasing of the score compare to the 1st week. This is because on the 2nd week. There was an addition of the fragrance more than the 1st week. That is why there is small decreasing of score compare to the 1st week. But it show the increasing of the score day by day. This shows that this device can improve the smell sensitivity of the autism child. This data and analysis shown that the 3rd objective which are to analyse the development of autism child smell sensitivity are successfully achieved.

4.6 ANALYSIS OF EFFECTIVENESS OF THE PRODUCT

On this subtopic we discuss about the analysis of effectiveness of the product. Data was collected by distribute the questionnaire to the 6 caretaker of the 'Pusat Pendidikan Khas Minda' at seksyen 7 Shah alam. After questionnaire are answered, we can see the data collected on the table 4.9 below.

Table 4.9: Table of data collected of effectiveness of the product.

Strongly agree	Agree	Don't have answer	Disagree	Strongly disagree
2	4	0	0	0

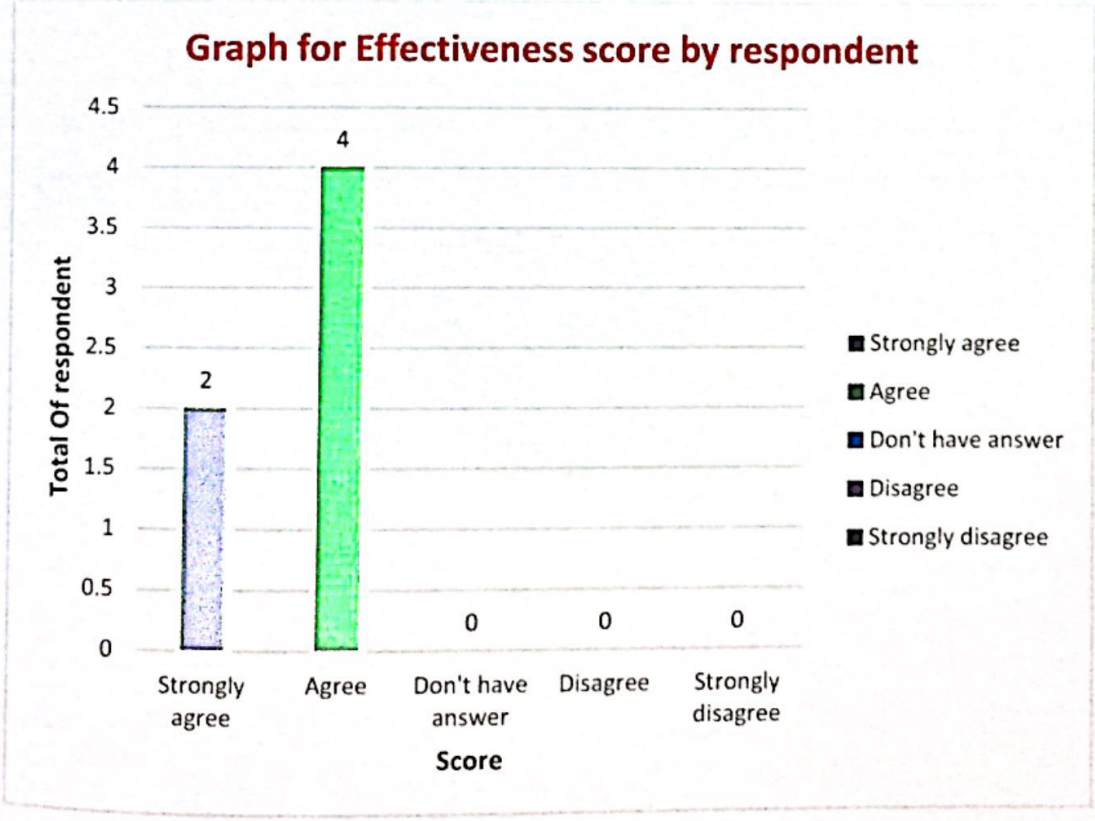

Figure 4.6: The graph for effectiveness score by respondent

Table 4.9 and figure 4.6 shows the data of effectiveness of the product. 2 persons are totally agree that this product are effective. 4 persons are agree that this product are effective. The questionnaire is scored by 1until 5 which are 5 is totally agree, 4 is agree, 3 is don't have the answer, 2 is disagree and 1 is totally disagree. This data is calculated by formula

$$\frac{Total\ of\ score}{25} \times 100$$

This data is calculated based on 4 questions given to the respondent which are:

1. Do you love this product?
2. Do you think this product can help autism child to recognise smell?
3. Autism child can learn to use this product quickly?
4. Can this product improve the autism child smell sensory better in time than conventional method?

This data also are used in order to archive objective number 2 which is to improve the conventional method of smell therapy by make the session become more interesting and modern such as the used of smartphone and also the attraction element such as lighting with sounds.

4.7 ANALYSIS OF THE COMFORTABLENESS OF THE PRODUCT

On this subtopic we discuss about the analysis of comfortableness of the product. Data was collected by distribute the questionnaire to the 6 caretaker of the 'Pusat Pendidikan Khas Minda' at seksyen 7 Shah alam. After questionnaire are answered, we can see the data collected on the table 4.10 below.

Table 4.10: Comfortableness of the product

Strongly agree	Agree	Don't have answer	Disagree	Strongly disagree
2	4	0	0	0

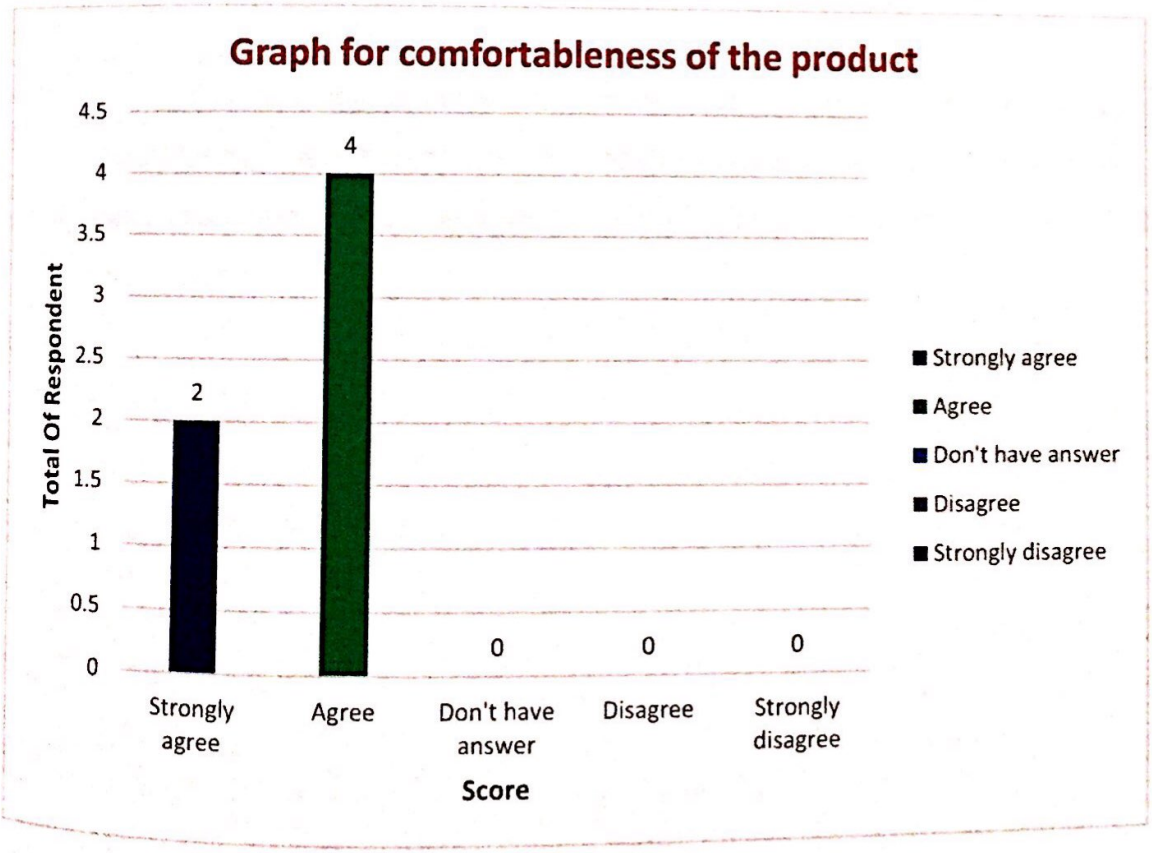

Figure 4.7: Graph of the comfortableness of the product

Table 4.10 and figure 4.7 shows the data of comfortableness of the product. 2 persons are totally agree that this product are effective. 4 persons are agree that this product are effective. The questionnaire is scored by 1until 5 which are 5 is totally agree, 4 is agree, 3 is don't have the answer, 2 is disagree and 1 is totally disagree. This data is calculated by formula:

$$\frac{Total\ of\ score}{25} \times 100$$

This data is calculated based on 4 questions given to the respondent which are:

1. Do you think the smell used in this device are appropriate for the user?
2. Are you feel comfort while using this product?
3. Does the product easy to use and user friendly?
4. Is this product are safe to use?

This data also are used in order to archive objective number 1 which is to innovate a smell therapy device in order to make it more practical such as by using application on the smartphone and also have attraction element such as sounds and lighting.

4.8 ATTRACTION OF THE DEVICE

On this subtopic we discuss about the analysis of attraction of the product. Data was collected by distribute the questionnaire to the 6 caretaker of 'the 'Pusat Pendidikan Khas Minda' at seksyen 7 Shah alam. After questionnaire are answered, we can see the data collected on the table 4.11 below.

Table 4.11: Attraction of the product

Strongly agree	Agree	Don't have answer	Disagree	Strongly disagree
5	1	0	0	0

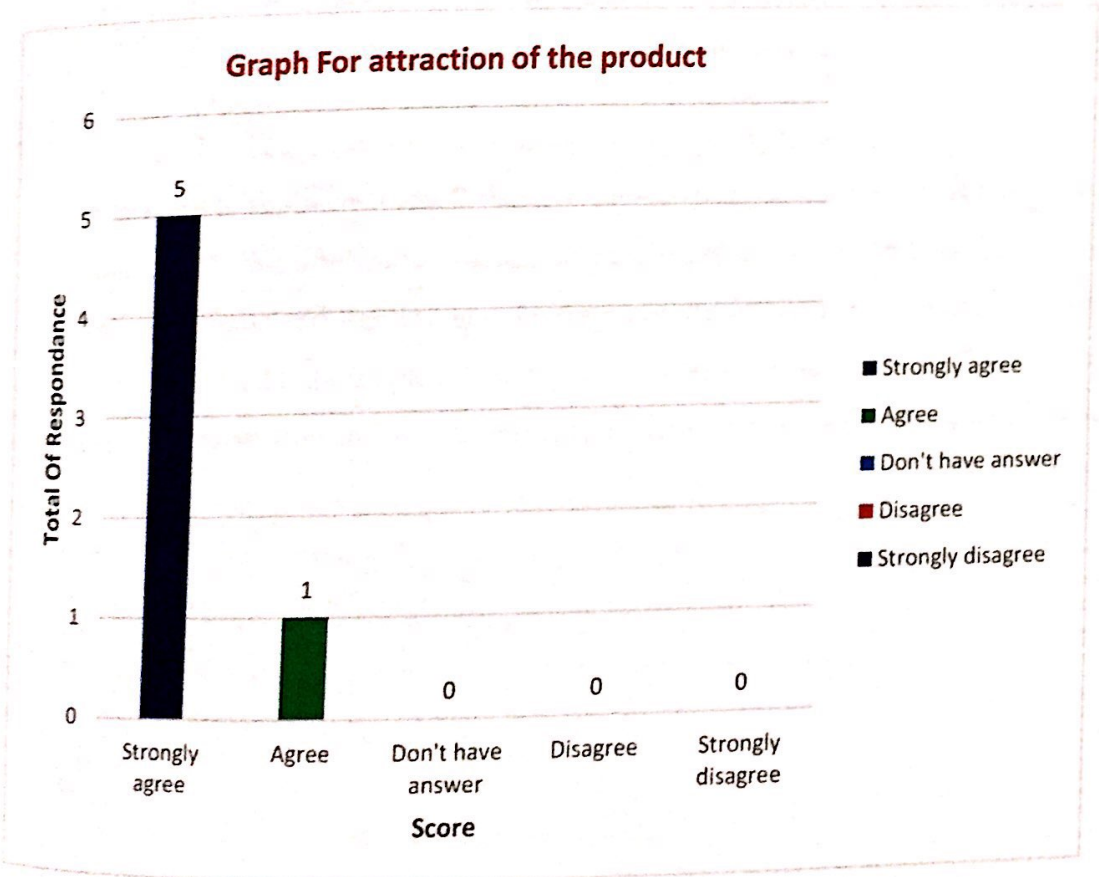

Figure 4.8: Graph for the attraction of the product

Table 4.11 and figure 4.8 shows the data of attraction of the product. 5 persons are totally agree that this product are effective. 1 persons are agree that this product are effective. The questionnaire is scored by 1until 5 which are 5 is totally agree, 4 is agree, 3 is don't have the answer, 2 is disagree and 1 is totally disagree. This data is calculated by formula:

$$\frac{Total\ of\ score}{25} \times 100$$

This data is calculated based on 4 questions given to the respondent which are:

1. Do you think this device give more attraction than traditional therapy?
2. Do you think this product can help autism child to stay focus during the therapy session?
3. The attraction did not give any uncomfortable feelings?
4. Can this product improve the traditional method?

This data also are used in order to archive objective number 1 and 2 which are to innovate a smell therapy device in order to make it more practical such as by using application on the smartphone and also have attraction element such as sounds and lighting and To improve the conventional method of smell therapy by make the session become more interesting and modern such as the used of smartphone and also the attraction element such as lighting with sounds.

4.9 DESIGN OF THE PRODUCT

On this subtopic we discuss about the analysis of design of the product. Data was collected by distribute the questionnaire to the 6 caretaker of `the 'Pusat Pendidikan Khas Minda' at seksyen 7 Shah alam. After questionnaire are answered, we can see the data collected on the table 4.12 below.

Table 4.1: Design of the product

Strongly agree	Agree	Don't have answer	Disagree	Strongly disagree
3	3	0	0	0

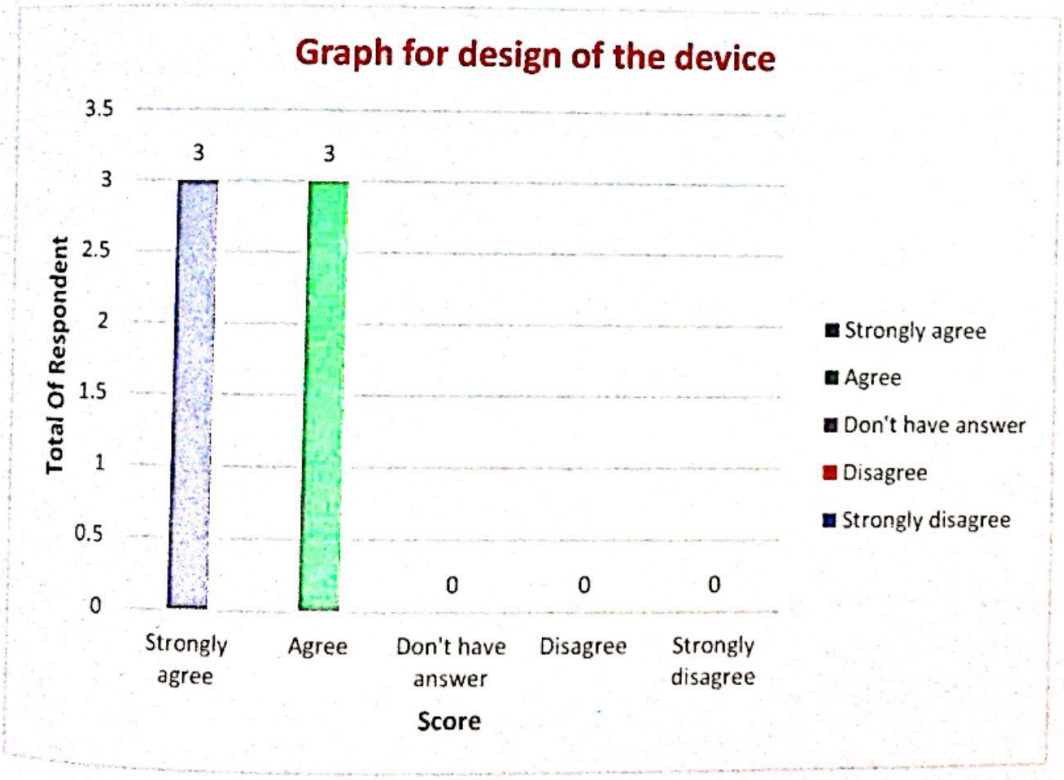

Figure 4.8: Graph for the attraction of the product

Table 4.11 and figure 4.8 shows the data of attraction of the product. 5 persons are totally agree that this product are effective. 1 persons are agree that this product are effective. The questionnaire is scored by 1until 5 which are 5 is totally agree, 4 is agree, 3 is don't have the answer, 2 is disagree and 1 is totally disagree. This data is calculated by formula:

$$\frac{Total\ of\ score}{25} \times 100$$

This data is calculated based on 4 questions given to the respondent which are:

1. Does this design are suitable to use for autism child?
2. Does this product are suitable to use at home?
3. Are this product are easy to carry anywhere (portable)?
4. Is this device design are attractive?

This data also are used in order to archive objective number 1 and 2 which are to innovate a smell therapy device in order to make it more practical such as by using application on the smartphone and also have attraction element such as sounds and lighting and to improve the conventional method of smell therapy by make the session become more interesting and modern such as the used of smartphone and also the attraction element such as lighting with sounds.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This project implements to do some innovation to smell therapy for autism. The project is success to improve current smell therapy by add some technology with interesting and fun features in order to improve the smell sensory of autism child. This project also succeed to help with analyse of development of the smell sensitivity of autism child. Thanks to the 'Pusat Pendidikan Khas Minda' at seksyen 7 for contribute with this study.

For a conclusion, as shown in the result of analysis, we can conclude that this project objective are successfully archived. This device are more practical than conventional method. It was succeed to improve the smell therapy compared to conventional method as the result are much faster to archive. We also have successfully to analyse the development of smell sensitivity of the autism child with a positive result. Overall the objective of the study are succeed to archive.

5.2 RECOMMENDATION

After doing survey, there are several recommendation has been listed. Which are:

1. To innovate the single inhale valve so that the odour of fragrance will not scatter to the surroundings.
2. Use small bottle of fragrance to make the device more lightweight
3. Add some more interactive element such as touch screen panel with animation video inside in form of video games.

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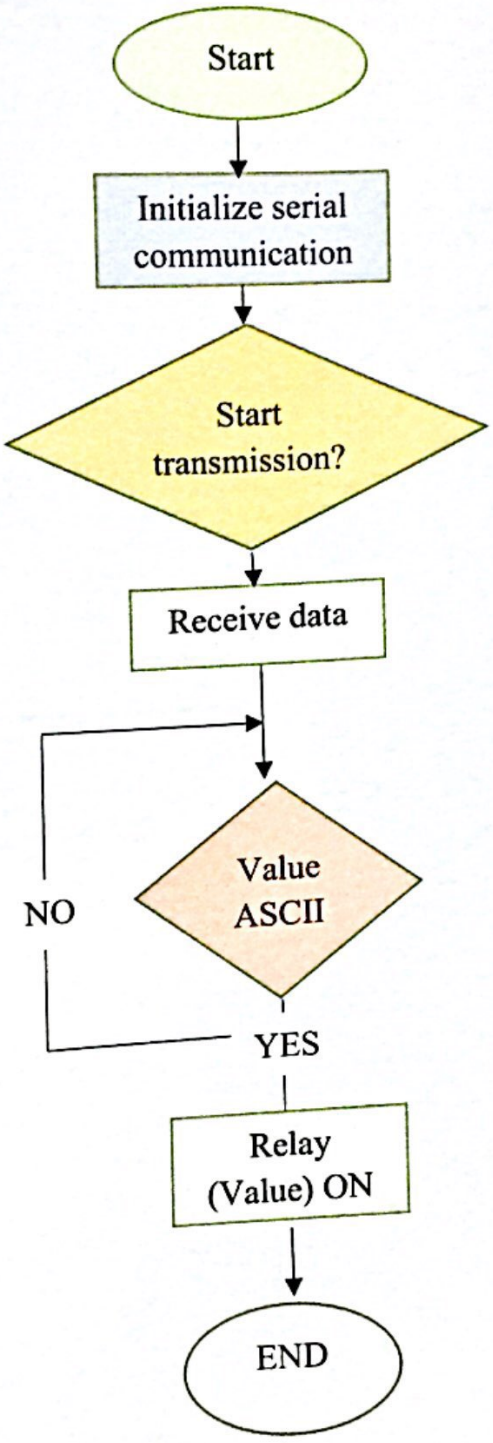
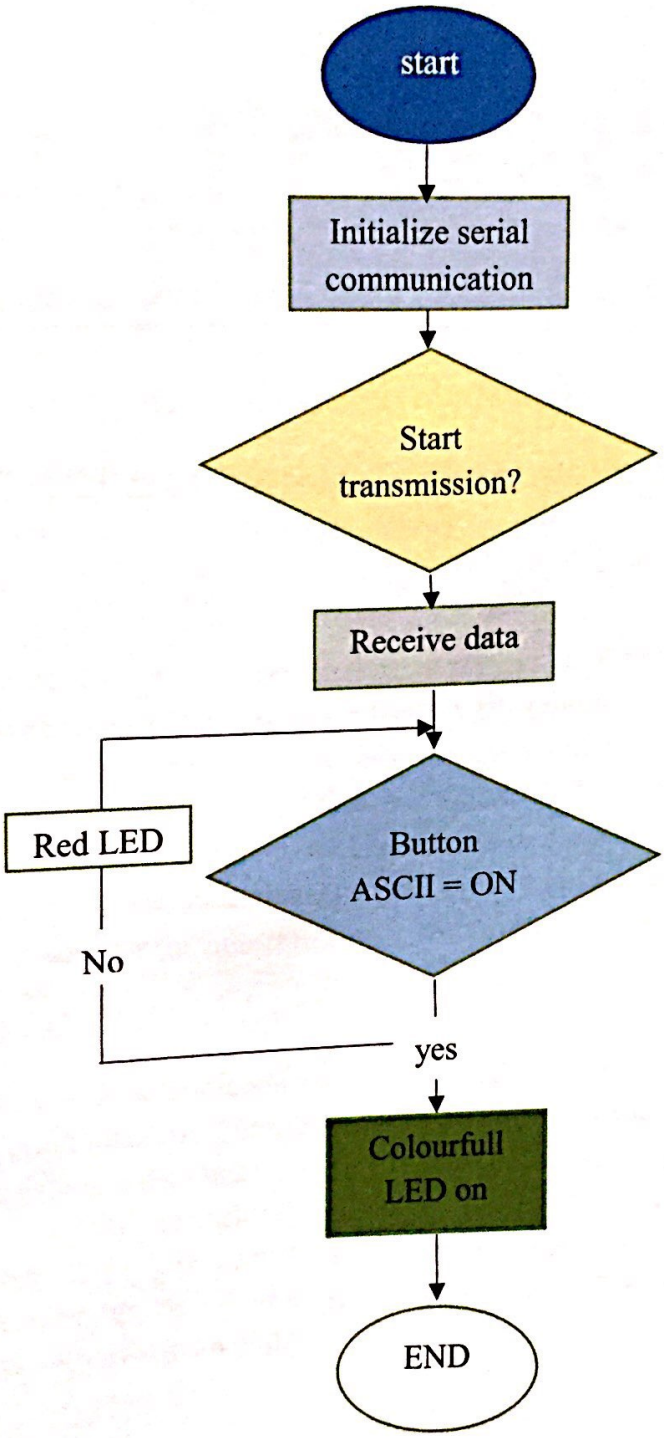
APPENDIX A

ARDUINO CODING FLOWCHART CARETAKER



APPENDIX B

ARDUINO CODING FLOWCHART SUBJECT



APPENDIX C

SAMPLE OF QUESTIONAIRE

For subject

POLITEKNIK
Sultan Salahuddin Abdul Aziz Shah
Jabatan Pengajian Politeknik

SURVEY QUESTIONNAIRE

THE DEVELOPMENT OF SMELL THERAPY DEVICE FOR AUTISM CHILDREN

DISCLAIMER

The survey is created based on the final year project in **Barchelor of Electronic Engineering Technology (Medical Electronic) with honours.** The main purpose of the questionnaire is to acquire opinion or information about **THE DEVELOPMENT OF SMELL THERAPY DEVICE FOR AUTISM CHILDREN** and evaluate the application of the device. This survey will be helpful in order to improve and enhance the device in the future. The participants of this survey are completely voluntary and anonymous. Please answer the question below with cycle in the appropriate statement.

ABOUT THIS PROJECT

Autism is an abnormal developmental disability that come from disorder of neurological which effect the brain function. There are a few characteristics that show the difficulties of the autism. As example they have trouble to have a conversation with others. Besides, they cannot focus as they are easily distracted by. Moreover, they have difficulties for their smell sensory. For my project, I will focus on to the autism that have the smell sensory difficulties or can be called olfactory dysfunction. This device are believe to improve smell sensory of autism child.

CONSENT

I have read and understand all the information that mentioned above. My participants in this survey is voluntary and I am willing to share any necessary information for this survey.

Autism child subject no 1

Age	**4-6**	**7-9**	**10-12**
Gender	**Male**	**Female**	
Level of autism	**Severe**	**Mild**	**Normal**

Analysis of autism child smell sensitivity focusing.

WEEK/DAY _____

No	Item				
a)	Amount of fragrance used	1	2	3	4
b)	Correct answer for 1st attempt	1	2	3	4
c)	Correct answer for 2nd attempt	1	2	3	4
d)	Correct answer for 3rd attempt	1	2	3	4

Percent of Correct Answer 1st attempt: $\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$

$= \_\_\_\_\_ \times 100$

$= \_\_\_\_\_ \%$

Percent of Correct Answer 2nd attempt: $\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$

$= \_\_\_\_\_ \times 100$

$= \_\_\_\_\_ \%$

Percent of Correct Answer 3rd attempt: $\frac{Correct\ answer}{Amount\ of\ fragrance\ used} \times 100$

$= \_\_\_\_\_ \times 100$

$= \_\_\_\_\_ \%$

Percent of Correct Answer total:

$$\frac{\text{Percent of Correct Answer 1st attempt+"2nd attempt+"3rd attempt}}{300} \times 100$$

$= \_\_\_\_\_ \times 100$

$= \_\_\_\_\_ \%$

Recommendation/Comments

_____

_____

_____

For caretaker

POLITEKNIK
Sultan Salahuddin Abdul Aziz Shah
Jabatan Pengajian Politeknik

SURVEY QUESTIONNAIRE

THE DEVELOPMENT OF SMELL THERAPY DEVICE FOR AUTISM CHILDREN

DISCLAIMER

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ABOUT THIS PROJECT

Autism is an abnormal developmental disability that come from disorder of neurological which effect the brain function. There are a few characteristics that show the difficulties of the autism. As example they have trouble to have a conversation with others. Besides, they cannot focus as they are easily distracted by. Moreover, they have difficulties for their smell sensory. For my project, I will focus on to the autism that have the smell sensory difficulties or can be called olfactory dysfunction. This device are believe to improve smell sensory of autism child.

CONSENT

I have read and understand all the information that mentioned above. My participants in this survey is voluntary and I am willing to share any necessary information for this survey. This section are divided in three section which is section A, B and C.

Age	**<18**	**18-30**	**30-50**	**50>**
Gender	**Male**	**Female**		

SECTION A: Effectiveness of the product

No	Item	Strongly Disagree	Disagree	Don't have the answer	Agree	Strongly agree
a)	Do you love this product?	1	2	3	4	5
b)	Do you think this product can help autism child to recognise smell?	1	2	3	4	5
c)	Most autism child can learn to use this product quickly?	1	2	3	4	5
d)	Can this product improve the autism child smell sensory better in time than traditional method?	1	2	3	4	5

SECTION B: Comfortableness

No	Item	Strongly Disagree	Disagree	Don't have the answer	Agree	Strongly agree
a)	Do you think the smell used in this device are appropriate for the user?	1	2	3	4	5
b)	Are you feel comfort while using this product?	1	2	3	4	5
c)	Does the product easy to use and user friendly?	1	2	3	4	5
d)	Is this product are safe to use?	1	2	3	4	5

Section C: Attraction of the device

No	Item	Strongly Disagree	Disagree	Don't have the answer	Agree	Strongly agree
a)	Do you think this device give more attraction than traditional therapy?	1	2	3	4	5
b)	Do you think this product can help autism child to stay focus during the therapy session?	1	2	3	4	5
c)	Does the attraction in the device make you uncomfortable?	1	2	3	4	5
d)	Can this product improve the traditional method?	1	2	3	4	5

Section D: Design

No	Item	Strongly Disagree	Disagree	Don't have the answer	Agree	Strongly agree
a)	Does this design are suitable to use for autism child?	1	2	3	4	5
b)	Does this product are suitable to use at home?	1	2	3	4	5
c)	Are this product are easy to carry anywhere (portable)?	1	2	3	4	5
d)	Is this device design are attractive?	1	2	3	4	5

Recommendation/Comments

APPENDIX D

ENDORSEMENT PAPER

Pusat Pendidikan Khas Minda,
No 5-2 Tingkat 2 Jalan Keluli Am7/Am,
Taman Perindustrian Bukit Raja Selatan,
40000 Shah Alam,
Selangor Darul Ehsan.

2 May 2017

Sir/Madam
Subject: Letter of Acknowledgement for " The Development of smell therapy device for autism child (STDA)"

Hereby with a sense of gratitude and appreciation for the innovation that has been made on the smell therapy device for autism child. The innovator detail as below:

Name of innovator	: Muhammad Luqman Bin Nizamuddin
NRIC	: 921218-08-5331
Innovation's name	**: The Development of smell therapy device for autism child (STDA)**

2. This innovation also demonstrated the ability to provide the consumer and society. Furthermore, the innovation is suitable to market for the use by blind people.

3. We hope for more innovation to improve the quality of therapy in rehabilitation field.

Thank You

Sincerely,

....
Name: KHAIRUL [illegible] BIN CHE OMAR
Date: 11/5/17

PUSAT PENDIDIKAN KHAS MINDA 1171800-W

Darul Ehsan Medical Center,
Jalan Ikhtisas,
Seksyen 14,
40000 Shah Alam,
Selangor Darul Ehsan.

9th May 2017

Sir/Madam,

Subject: Letter of Acknowledgement for "Development of Smell Therapy Device for Autism Child (STDA)"

Hereby, with a sense of gratitude and appreciation for the innovations that has been made on the smell therapy device for autism child. The innovator detail as below:

Name of Innovator	**: MUHAMMAD LUQMAN B NIZAMUDDIN**
NRIC	**: 921218-08-5331**
Innovation's name	**: Development of Smell Therapy Device for Autism Child (STDA)"**

2. This innovation also demonstrated the ability to provide benefit to the consumer and society. Furthermore, this innovation is suitable to market for the use by autism child age 4 to 11 years old.

3. We hope for more innovation to improve the quality of therapy in rehabilitation field.

Thank you

Sincerely,

Name: MOHD RAZALI ZULKIPLY
Senior Technical Executive (Biomedical)
Engineering & Facility Maintenance Department
DEMC Specialist Hospital Shah Alam