

**OBJECT LOCATOR FOR PEOPLE WITH DEMENTIA
(DEMICATOR)**

JOYE TER JI-XI

**This Report Is Submitted In Partial Fulfillment Of Requirements For The
Bachelor Degree of Electronic Engineering (Industrial Electronics) with
Honours**

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

June 2013



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : OBJECT LOCATOR FOR PEOPLE WITH DEMENTIA

Sesi Pengajian :

1	2	/	1	3
---	---	---	---	---

Saya **JOYE TER JI-XI**

(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

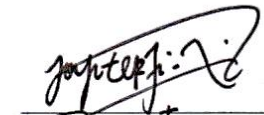
*(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD**

** (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:


 (TANDATANGAN PENULIS)


 (COP DAN TANDATANGAN PENYELIA)
Prof. Madya Tan Kim See

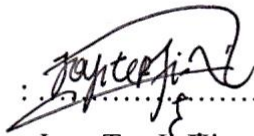
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
 Universiti Teknikal Malaysia Melaka (UTeM)
 Karung Berkunci No 1752
 Pejabat Pos Durian Tunggal
 76109 Durian Tunggal, Melaka.

Tarikh: **5/6/2013**

Tarikh: **10/6/2013**

“I hereby declare that this report is the result of my own work except for quotes as cited in the references.”

Signature

: 

Name of Author

: Joye Ter Ji-Xi

Date

: June 5, 2013

“I hereby declare that I have read this project report and in my opinion this project report is sufficient terms of scope and quality for the award of the degree of Bachelor of Electronic Engineering (Industrial Electronics) With Honours.”

Signature

: 

Name of Supervisor

: Assoc. Prof. Tan Kim See

Date

: June 5, 2013

In the loving memory of my grandmother, Lim Seok Yah (1925-2013).

ACKNOWLEDGEMENT

I would like to take the opportunity to express my heartfelt gratitude to the people who helped me in making this project a success.

First and foremost, I would like to thank my supervisor, Associate Professor Tan Kim See for his invaluable guidance and advice. His support and encouragement brought me on the right path especially in times of need, motivating me to carry on with the project even when things look unsure at times, Also, my heartfelt appreciation to my co-supervisor, Dr Kok Swee Leong, for without his help, I would not have been able to make tremendous progress in this project.

In addition, I would like to say a big thank you to my housemates and my parents for all their wonderful support. They had given me a lot of feedback and suggestions, some of which became the inspiration of the features of my product. Without their unceasing words of encouragement, the project could not have been what it is today.

Lastly, I would like to thank my course-mates, Sau Seong and Ee Leng for their time in helping and showing me how to solve some difficult circuit problems. Their patience in answering my never-ending questions and their selfless ways in helping me throughout this semester is one of the many the factors that help me to complete my project successfully.

ABSTRACT

Misplacing small but essential items, such as keys, wallets and medicine container is not uncommon among people who are at a certain age or state of health. Senior citizens with poor short term memory and those who are affected by memory impairment are the main concern, such as those suffering from Dementia syndrome. Sometimes, during emergency, it can be a matter of life or death if the keys to the main door cannot be found in time. This project purpose is to come up with an efficient electronic locator to provide a solution to the stated problem above. The design of the locator system, named DemiCator, comprise of a base station, remote control and five receiver tags which are attached to the missing items. So if a person wishes to find the item which has been misplaced, they can simply carry the remote control around to locate the keys, or fix it on the at the wall to locate the medicine. The corresponding tags will indicate the position to the users. If the remote control gets misplaced, user can use the base station to locate the remote control. The base station is fixed at a strategic place where it can be easily seen by users.

ABSTRAK

Tersalah letak barang-barang yang kecil dan penting seperti kunci rumah, dompet dan peti ubat adalah sesuatu yang selalu berlaku bagi individu di dalam lingkungan umur yang tertentu atau di dalam sesuatu tahap kesihatan. Warga emas dengan daya ingatan yang kurang dan golongan orang yang terjejas oleh kemerosotan ingatan amatlah membimbangkan, sebagai contoh orang yang mengalami sindrom Dementia. Ketika waktu kecemasan, perkara seperti dapat mencari kunci rumah dengan segera boleh menentukan hidup mati seseorang. Tujuan projek ini adalah untuk membuat sebuah sistem pencarian yang boleh menyelesaikan masalah tersebut. Sistem pencarian ini, atau dinamakan DemiCator, terdiri daripada stesen pangkalan, alat kawalan jauh dan lima tag yang digantungkan pada barangan yang mudah tercicir. Oleh itu, jika seseorang yang hendak mencari barang mereka yang telah tercicir, mereka hanya perlu menekan butang pada alat kawalan jauh yang terdapat pada dinding atau pintu. Alat kawalan jauh ini juga boleh dibawa ke mana-mana untuk kemudahan pengguna. Alat penerima dalam tag akan berbunyi untuk memberitahu pengguna lokasi benda tersebut. Jika alat kawalan jauh hilang, stesen pangkalan akan digunakan untuk mencari alat tersebut. Stesen kawalan diletakkan pada lokasi yang strategik bagi memudahkan pengguna untuk melihatnya.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	VERIFICATION FORM	ii
	DECLARATION	iii
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENT	ix
	LIST OF TABLE	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS AND SYMBOLS	xv
I	INTRODUCTION	
	1.1 What is Dementia?	1
	1.2 Project Background	2
	1.3 Objectives	4
	1.4 Problem Statement	4
	1.5 Scope of Work	5
	1.5.1 Base Station	5
	1.5.2 Remote Control	6
	1.5.3 Tags Receiver	6
	1.6 Project Methodology	7
	1.6.1 Flow Chart Process Detail	7
	1.6.1.1 Project Planning	7

1.6.1.2 Literature Review	8
1.6.1.3 Construction of Prototype	8
1.6.1.4 Finalization	8
1.6.2 Report Structure	10
1.6.2.1 Chapter 1 - Introduction	10
1.6.2.2 Chapter 2 - Literature Review	10
1.6.2.3 Chapter 3 - Project Methodology	10
1.6.2.4 Chapter 4 - Results and Discussions	10
1.6.2.5 Chapter 5 - Conclusion and Recommendation	11

II LITERATURE REVIEW

2.1 Survey Concerning Misplaced Item	12
2.1.1 Conclusion	14
2.2 Prompting People with Dementia to Carry Out Tasks.	14
2.2.1 Method	14
2.2.2 Early Findings	15
2.2.3 Conclusion and Project Implementation	16
2.3 Available System in the Market	17
2.3.1 Sound-Based Key Finder	17
2.3.1.1 Limitation	18
2.3.1.2 Conclusion	19
2.3.2 Paired Lost Item Finding System	19
2.3.2.1 Invention Background	20
2.3.2.2 Limitation	21
2.3.2.3 Conclusion	22
2.3.3 Brookstone's <i>SmartFinder</i> Remote Control Key Finder	22
2.3.3.1 Invention Background	22
2.3.3.2 Limitation	23
2.3.3.3 Conclusion	24
2.4 ZigBee	25

III	METHODOLOGY	
	3.1 Introduction	27
	3.2 Project Planning	27
	3.3 System Design	31
	3.3.1 Base Station Design	31
	3.3.2 Remote Control Design	32
	3.3.3 Tags	33
	3.4 Design Process	33
IV	RESULTS AND DISCUSSION	
	4.1 Introduction	38
	4.2 Circuit Design	38
	4.2.1 Base Station	39
	4.2.2 Remote Control	40
	4.2.3 RF Transmitter and RF Receiver Module	43
	4.3 Hardware Section	44
	4.4 Project Operation	46
	4.4.1 Range Test of Remote Control and Tags	47
	4.4.2 Range Test of Base Station and Remote Control	49
V	CONCLUSION AND SUGGESTION	
	5.1 Future Recommendation	52
	REFERENCES	53
	APPENDIX A	56
	APPENDIX B	57

LIST OF TABLES

NO	DESCRIPTION	PAGE
2.1	List of items most likely misplaced by people every day.	13
2.2	Comparison between ZigBee and ZigBee PRO Series 1 specification.	25
2.3	ZigBee module pins.	26
4.1	Range test inside the house between remote control with tag D and tag E.	48
4.2	Range test outside of the house within compound between remote control with tag D and tag E.	48
4.3	Range test inside of the house and outside of house between base station and remote control.	49

LIST OF FIGURES

NO	DESCRIPTION	PAGE
1.1	Schematic diagram of DemiCator system.	3
1.2	Flow chart of the general workflow process of PSM 1 and PSM 2.	9
2.1	An advertisement of Whistle Key Finder via Area Plus website.	18
2.2	Schematic representation of the operation of the paired locator to find the other locator.	20
2.3	Brookstone's SmartFinder remote control key finder with two key fobs.	23
2.4	ZigBee's Data Flow Diagram in a UART-interfaced environment.	26
3.1	K-Chart of the project working scope for base station and remote control.	29
3.2	K-Chart of the project working scope for remote control and tags.	30
3.3	Block diagram of the base station.	31
3.4	Block diagram of the remote control.	32
3.5	Block diagram of the tags.	33
3.6	Flowchart of the base station process.	35
3.7	Flowchart of the remote control process.	36
3.8	Flowchart of the tag receiver process.	37
4.1	Schematic diagram of base station circuit using ISIS Proteus.	39

4.2	Completed circuit board of base station unit with transmitter ZigBee.	39
4.3	Schematic diagram of remote control circuit.	40
4.4	Completed circuit board of remote control unit.	41
4.5	Energizer 522 9v alkaline battery discharge curve using standard industrial test at 21oC f for high drain devices.	42
4.6	Block diagram of KTS418 and KRS418.	43
4.7	The complete design of base station, remote control and tags.	44
4.8	A description of the features on the remote control.	45
4.9	Working operation between base station and remote control.	46
4.10	Testing ground of the range test for the DemiCator system.	47

LIST OF ABBREVIATION AND SYMBOLS

DemiCator	–	Object Locator for People with Dementia
FTLD	–	Fronto Temporal Lobar Degeneration
LCD	–	Liquid Crystal Display
LED	–	Light Emitting Diode
PIC	–	Programmable Integrated Circuit
PSM 1	–	Projek Sarjana Muda 1
PSM 2	–	Projek Sarjana Muda 2
RF	–	Radio Frequency
RX	–	Receiver
s	–	second
SS	–	Search Signal
TX	–	Transmitter
UTeM	–	Universiti Teknikal Malaysia Melaka
V	–	Volt
Wi-Fi	–	Wireless Fidelity

CHAPTER 1

INTRODUCTION

1.1 What is Dementia?

Dementia is commonly associated with age related disease. On contrary to popular belief, it is not a normal part of aging. Dementia is not a specific disease; rather it is an overall term to describe a range of symptoms involving memory loss or other thinking skill. It is a term used to describe the symptom of illnesses that cause the progressive declination of a person's cognition and ability to function, resulting in loss of memory, intellectual, rationality and social skill [1]. These changes can affect the physical, social and emotional life of the patient, their family, carers and friends negatively [1].

Researches have shown that there are many forms of Dementia, and each has their own causes. Among the most common form of Dementia includes Alzheimer's disease, vascular dementia, Fronto Temporal Lobar Degeneration (FTLD) and dementia with Lewy bodies [1]. The most common cause of dementia is caused by Alzheimer, which accounts of 50% to 70% of all dementia cases [1]. But whatever form of illness that causes the patient to have Dementia, the result is relatively similar: the death and damage of nerve cells in the brain [2]. Shrinking of brain cells means that information cannot be recalled or assimilated.

There are some reversible dementia conditions, for example thyroid problem and memory problem due to lack of essential vitamins [3]. But most of the time, treatments for dementia will not stop or reverse the disease, as such in the case of Alzheimer's disease. This is an example of a progressive and degenerative disease, meaning that symptoms start out slowly and get worse gradually [3]. There are medications to slow the progress, but currently there are no cures for Alzheimer's disease.

1.2 Project Background

Dementia patients have the habit of misplacing small but essential items, such as keys, mobile phones and medicine. Many frustrating minutes or even hours are wasted searching for the items. Even mobile phone has its predicament moments of locating it, such as in silent mood or the battery is drained. On a normal day, searching for the misplaced items would just be bothersome and irritating event. One could find the item at one's own pace, or alternatively, use a spare unit until the lost item is found. But during the state of emergency, it is a different story. It could be a matter between life and death. For example, if it happened that the dementia patient has fallen down and need to go to the hospital immediately, not being able to locate the house keys or car keys could be life threatening. Many other instances such as asthma attack and heart attack, time is a prime factor to save the victim. Losing invaluable time to search for misplaced inhaler or medicine could be perilous if the item is not found immediately. And being a dementia patient, it is very likely they would forget where they had placed these items.

The project purpose is to come out with an electronic locator to provide a solution to the problem as stated above. It is designed especially for people with dementia to help them regain some amount of independence as well as to ease the stress of their caregivers. This project relates to the system for finding lost objects specifically for people with dementia problem. There are three parts in this system, which are the base station, remote control and the tags receiver. Figure 1.1 shows the schematic of the project that is designed.

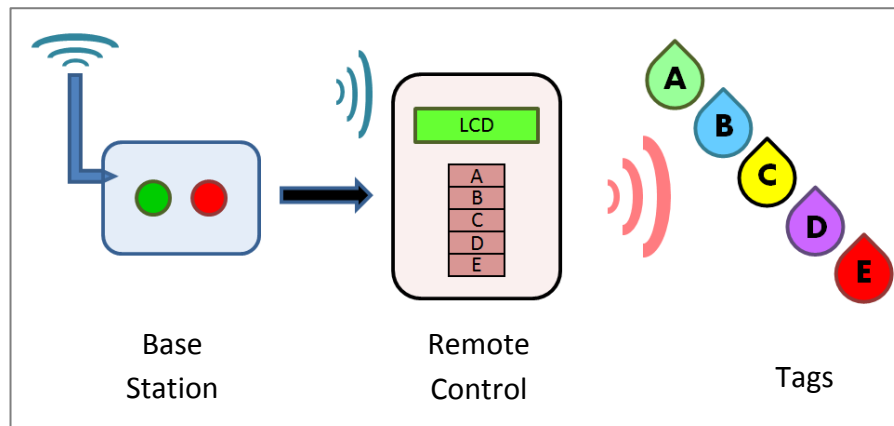


Figure 1.1: Schematic diagram of the designed product.

The design of the locator system comprised of a base station, remote control and five tag receivers. Base station will send out a search signal to the remote control, and the remote control is used to find the tags which are attached to the missing items. The transmission between the base station and remote control uses ZigBee, while the transmission between remote control and tags uses RF (radio frequency) module. The project is designed in this way because RF module is much cheaper to use for multiple receivers compared to ZigBee. ZigBee features match its price by having further, more reliable sensing range.

The reason this system consists of three sections is because this structure offers flexibility for the users to choose whether to fix the remote control in a specific location, or to make it mobile. This feature will be useful if it happened that user house is too big for the RF module in the remote controller to sense the tags, user can then take the remote down from the wall and walk around to search for the missing item.

How this system works is when a person wishes to find an item which has been misplaced, they can simply press the button A, B, C, D or E on the remote control to locate the keys, medicine, wallet or anything that are likely to be misplaced. A LCD (liquid crystal display) will indicate which button had been pressed, along with an LED (light emitting diode) which will light up to show that the search signal has been transmitted. The transmitter will send out the correct signals to communicate with the corresponding items. The tag on the lost item will

indicate its position by beeping so that it can easily be found. The same concept is used between the base station and the remote control. If the remote control is being misplaced, user can press the green button on the base station to locate the remote control. With an assistive technology like this, it will certainly help in decreasing the frustrations of Dementia patients and their caregivers.

1.3 Objectives

The objectives of this project are firstly, to design an item locator consisting of a transmitter and a receiver to locate a misplaced item. The idea is to place the transmitter in a fixed position where it is easily seen, for example on the wall or on the door. Then it is used to detect the receiver that might be misplaced within the range of a house. After this phase of the project is completed, the next objective is to construct the design by integrating software together with all the required hardware components. The last objective is to test the functionality of the completed project within an indoor environment.

1.4 Problem Statement

There are several challenges in this project. Firstly, in terms technical aspect, the medium of transmission connection between the transmitter and receiver could be a problem. As the transmitter is going to be fixed on the wall or the door, the search signal may be out of range from the receiver if the house is too big.

Secondly, the physical size of the remote control and tags post a big challenge as they have to be of appropriate size to be carried around comfortably. If the designs are too large, they will not be convenient to carry around, hence lowering their market value.

Finding a sustainable power source could be a problem. As the remote controller, which is also the receiver part, has been integrate with many functions, 9V alkaline battery like GP Supercell Super Heavy Duty might not have enough

power to sustain the circuit's power consumption. And as the remote control is also portable, it is not practical to use heavy bulky battery like lead acid battery.

Lastly, the environment might be a setback if there are a lot of interference signal in the surrounding, or if the surrounding is too noisy. If the system is placed near to objects with magnetic field, it might interfere with the communication between the transmitter and receiver. On the other hand, if surrounding is too noisy, it might prevent the buzzer from being heard. Also, in terms of physical obstruction, if any objects are placed on top of the receiver such as pillows or clothes, it could prevent the buzzer or LED from being heard and seen.

1.5 Scope of Work

This project focuses on assisting people with forgetfulness problem to locate their frequently misplaced items in the most effective way. The implementation also includes making it as user friendly as possible, so that Dementia patients will not have to struggle to remember instructions. It is built to be installed in the house within the perimeter range of the signal strength between the transmitter and receiver: the base station and the remote control, or remote control and the tags. Also, the house must be a place where it is not too noisy until that the buzzer cannot be heard. The working scope of this project involves three elements, which are explained in detail in the following subtopic.

1.5.1 Base Station

Base station function is used to find the remote control if ever remote control gets misplaced. To transmit a search signal from the base station, user has to press the green button or red button on the keypad. The green button will cause the remote control to start beeping, while the red button will make the beeping stop. Each time user presses a button, a LED will light up to acknowledge that the ZigBee transmitter has send out a search signal. The base station will be fixed onto a wall or door or places that can be easily seen for user's conveniences.

1.5.2 Remote Controller

The remote controller is designed to be flexible. User can fix the remote controller on the wall, or take it around while searching for lost items. On the remote control, there is a Zigbee receiver that corresponds with the search signal send from the base station. The remote will emit a beacon signal, which is audible beeping and flashing of light. Once the remote is found, user can stop the indicators either from the base station or the remote control itself.

Also, on the remote control there is a RF transmitter that can detect five different missing objects whenever user presses an input button on the remote. Each of the five buttons corresponds to five different tags receiver. And every time the input button is pressed, a red LED light will indicate the transmitter signal has been send. At the same time, a LCD will display out which the missing items that have been attached to the tag.

Other than that, the remote controller can indicate to user when the battery is weak. It will inform user the amount of percentage left in the battery before it cannot be used. This is so to warn users to change the battery before it goes completely empty. This feature is useful as the remote is mobile. If the battery is drained, user will not be able to use the base station to search for the remote if the remote goes missing.

1.5.3 Tags Receiver

There are a total of five tags altogether that can be attached to five potential misplaced items. To find these items, user has to press the button on the remote control to transmit a search signal. The corresponding tags will ‘tell’ users the item’s location by beeping for eight seconds, thus enabling users to locate the lost locator and the attached item. When the receiver’s battery supply is going to running out, the buzzer will give out a different tone of continuous buzzing which will not stop until the tag is turned off and the battery is changed.

1.6 Project Methodology

Flow chart in Figure 1.2 is a graphical representation of the project flow to make the project process clearer. The flow chart is a combination of PSM 1 (*Projek Sarjana Muda 1*) and PSM 2 (*Projek Sarjana Muda 2*). For PSM 1, the requirement is that students have to suggest their proposal title and do literature reviews, whereby related work done by others in the past are read and reviewed. At the end of PSM 1, students supposed to know what their project design is, what components they are going to use and how they are going to integrate it with software.

For PSM 2, students are required to use their research done in PSM 1 to design their product out using hardware and software, integrating it together and testing it whether it is working or not. If it did not work as planned, students have to go back to designing the project to see what had gone wrong. This process is usually repeated numerous times as the integration of hardware and software rarely works out perfectly for the first time. That is why it is advisable to complete the process of the designing part as quickly as possible because if ever the product does not worked as intended, there is still time to modify the circuit.

1.6.1 Flow Chart Process Detail

The detail of the flow chart process for is divided into four main sections: Project Planning, Literature Review, Construction of Prototype and Finalization. Explanations for each section are described in detail for better understanding.

1.6.1.1 Project Planning

First, there must be a problem that have occurred that brought on to the idea of the proposed project. This is when students know the concept and then look up at the theories to support the implementation of the project. Then, a flow chart is drawn out to show the process of the project.

1.6.1.2 Literature Review

Literature review on the past works done by other researchers is considered the critical points of current knowledge. Typically, the findings are in line with the particular proposed project, and it helps in contributing theoretical and methodological facts. It also been used to help students look up for suitable components to use and what improvement can be made from the existing product. Other than that, it serves as a background reading to build a stronger base for the students' ideas. Literature review is considered as secondary source and can be seen as an abstract accomplishment.

1.6.1.3 Construction of Prototype

After researching and knowing which components are available in component shops, the prototype of project is constructed by integrating both software simulation and hardware. Once the software simulation is completed, it is integrated into the hardware. Then the integrated circuit is tested to see whether it is working properly or not. If it is not, students have to detect the problem, solve it and improve it if possible, and then test the circuit again to make sure it is working.

1.6.1.4 Finalization

Finalization is done after making sure all the components are in working order, the circuit is working as desired and the system fulfils all the stated objectives. Once the project has been finalize, it is best not to make any major modification onto it. Presentation of PSM 2 demonstrates the outcome of the project. After that, students have to hand in the complete report of their project as stated in the requirement.

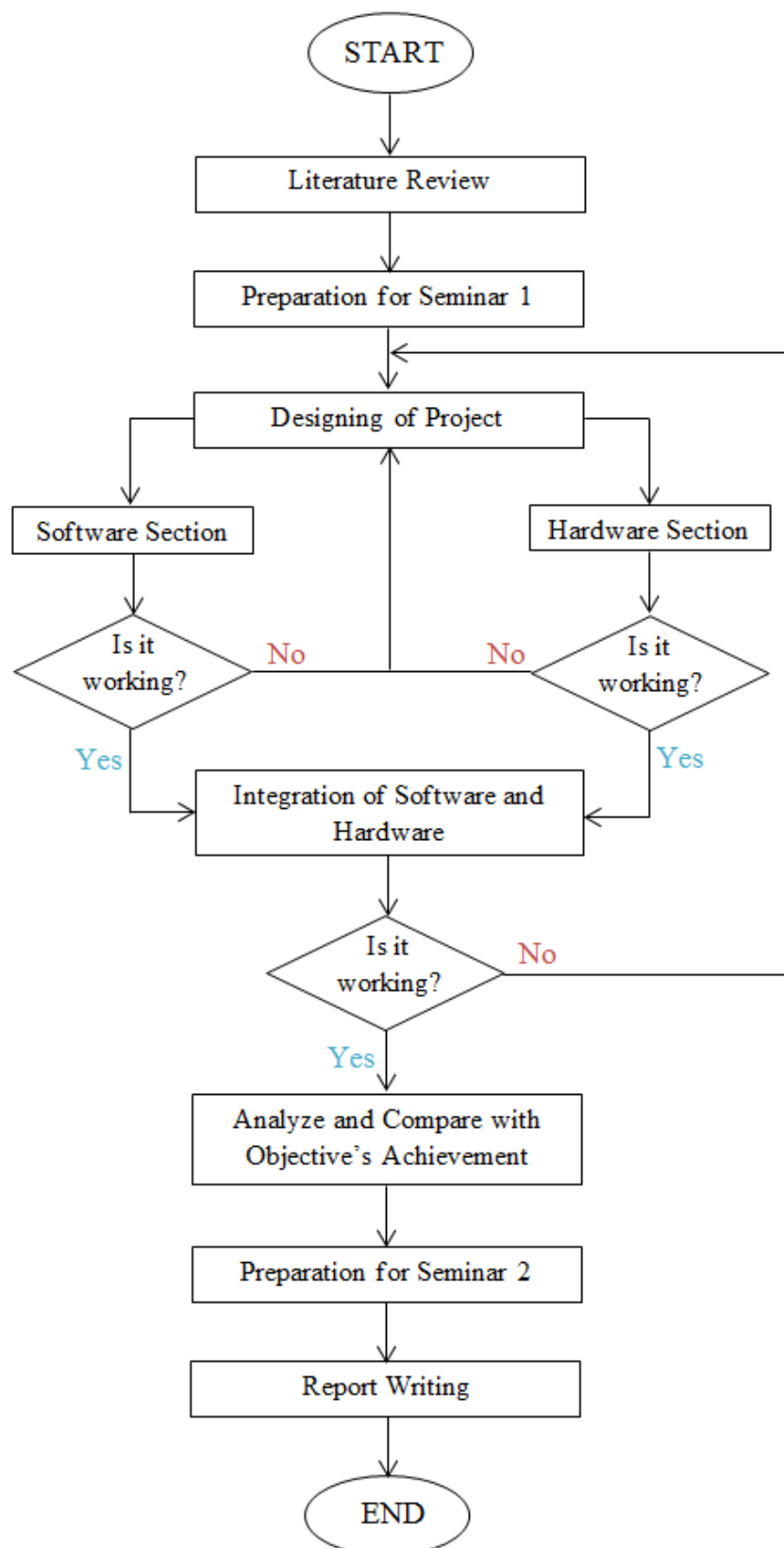


Figure 1.2: Flow chart of the general workflow process of PSM 1 and PSM 2.