



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART ASSISTIVE SHOE FOR DEMENTIA PATIENT BASED ON WEARABLE SENSOR

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

by

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950513-05-5545

FACULTY OF ENGINEERING TECHNOLOGY

2018

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: SMART ASSISTIVE SHOE FOR DEMENTIA PATIENT BASED ON WEARABLE SENSOR

Sesi Pengajian: 2019

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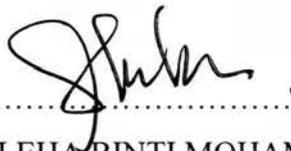
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I hereby, declared this report entitled “Smart Assistive Shoe for Dementia Patient based on Wearable Sensor” is the results of my own research except as cited in references

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APPROVAL

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.....
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ABSTRACT

This study focus on dementia symptoms which was getting serious continuously, even the subsyndrome presentations affecting the health of older adults and meriting intervention [1]. The Smart Assistive Shoe is a device which base on wearable sensor can monitor the dementia patient who have a problem to recognize what location they are and help the patient to contact their family with information such as longitude and latitude of the location through SMS. On this idea we are using fall detection by a suitable sensor that detect the balancing of the patient and predict their motion. Therefore, the design of the Smart Assistive Shoe focuses on helping dementia patient contact to their family in anytime since they are in trouble. The results of fall detection signal for different direction, the origin position for x, y, and z angle rotation is around 135° - 145° , 1.4° - 2.0° and 0.0° - 1.5° respectively. The angle rotation for the component mpu6050 is very sensitive so the origin position for this device does not achieve ideal angle rotation for each axis. Different direction of fall would show different orientation in each axis. Otherwise, we use different provider to observe and record result of GPS signal receive rate which is Maxis Red, U Mobile, Digi, Celcom and Unifi.

ABSTRAK

Fokus kajian ini adalah gejala demensia yang semakin serius secara berterusan, walaupun persembahan subsyndrome menjejaskan kesihatan orang dewasa yang lebih tua [1]. Kasut Smart Assistive adalah alat yang berdasarkan sensor yang boleh memantau pesakit demensia yang mempunyai masalah untuk mengenali apa lokasi mereka dan membantu pesakit untuk menghubungi keluarga mereka dengan maklumat seperti latitud dan longitud melalui SMS sistem. Idea ini menggunakan pengesanan jatuh untuk mengesan keseimbangan pesakit dan meramalkan gerakan mereka. Oleh itu, reka bentuk Kasut Smart Assistive memberi perhatian untuk membantu hubungan antara pesakit dan keluarga mereka pada masa kerana mereka menghadapi kesusahan. Keputusan pengesanan kejatuhan semboyan dalam arah yang berbeza, kedudukan asal x, y, z dan sudut masing-masing adalah antara 135° - 145° , 1.4° - 2.0° dan 0.0° - 1.5° . Sudut pusingan komponen MPU6050 adalah sangat sensitif menyebabkan kedudukan asal peranti ini tidak mencapai sudut pusingan untuk setiap kedudukan. Arah yang berbeza dalam kejatuhan akan menunjukkan orientasi berbeza dalam setiap paksi. Selain itu, kita menggunakan pembekal yang berbeza untuk melihat dan hasil rekod keputusan kadar penerima GPS seperti Maxis Merah, U Mobile, Digi, Celcom dan Unifi.

DEDICATION

To my beloved parents who supported and motivated me that the best kind of knowledge to learn for its own sake. It is also dedicated to my supervisor who gave me suggestion and helped me that even the largest task can be accomplished if it is done one step at a time.

ACKNOWLEDGEMENT

I would like to thank Madam Saleha binti Mohamad Saleh for the endless guidance and helped. She has been the ideal thesis supervisor. Her support was greatly needed and deeply appreciated in this project. Without the help from her, it might not be successful in completing my project and I would like to say thank you once more to everyone who directly or indirectly involved in helping me completing my Finale Year Project report. Thank you.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Dementia symptoms was getting serious continuously, even the subsyndrome presentations affecting the health of older adults and meriting intervention [1]. The Smart Assistive Shoe is a device which base on wearable sensor. This device can monitor the dementia patient who have a problem to recognize what location they are and some problem they face example like falling. The device can help the patient to contact their family and give them some information to the location of the patient. The information is longitude and latitude of the location through SMS. The information will be send since the sensors are triggering simultaneously. On this idea we are using fall detection by a suitable sensor that detect the balancing of the patient and predict it. Furthermore, we are also using GPS/GSM module in tracking system and SMS system. Therefore, the design of the Smart Assistive Shoe focuses on helping dementia patient contact to their family in anytime since they are in trouble.

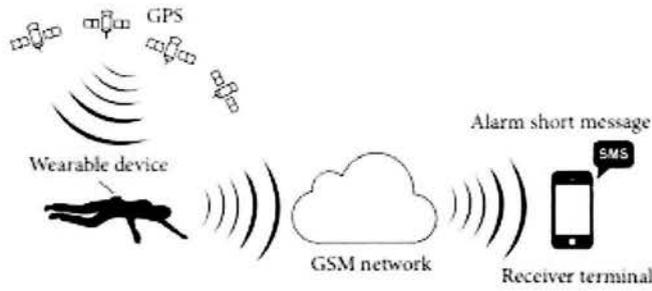


FIGURE 1.1: SAMPLE OF SYSTEM ARCHITECTURE



FIGURE 1.2: SAMPLE OF FALL ALARM SMS WHICH CONTAINS FALL LOCATION URL

1.1 Problem Statement

Dementia in the elderly disturbed memory function is a widespread subjective and/or objective symptom in a variety of medical conditions and some factors of the dementia will cause accident. Dementia symptoms was getting serious continuously, even the subsyndrome presentations affecting the health of older adults and meriting intervention

[1]. In this generation their children or their family were busy in their own work and business which caused lack of time to take care of family member who was dementia patient. Preventing an accident this kind of device such as fall detection which will help lot in their life. To monitor the dementia patient using GPS/GSM system which can contact their family with accurate information and rapidly when fall detection has been triggered.

1.2 Objectives

There are objectives which will be achieved in this project

- i. To design the tracking system and fall detection for dementia patient.
- ii. To develop an alert device through GSM&GPS with SMS system and fall detection base on suitable wearable sensor.
- iii. To test and analyse the performance of the system.

1.3 Scopes of Project

To ensure the objectives are achieved, some of important elements and limitation must be considered. They are:

- i. To focus on dementia patient.
- ii. Free size of shoe and suitable wearable sensor.
- iii. Using Arduino microcontroller for program implementation.
- iv. GSM/GPS module for tracking system.
- v. Suitable sensor such as accelerometer and gyro sensor for fall detection.

- vi. Sensor function as detect the orientation of foot for fall detection.
- vii. Analyzing of study will be done by using Arduino IDE.

1.4 Outlines of Project

The research was consisting 5 chapters. For first chapter is the study starts on introduction of the study accompanied with the problem statement, objective and scope of project.

In chapter 2 discusses about dementia on the literature review, GPS/GSM and methods for fall detection. At the end of chapter will describe the review from the table comparison from the previous journals or researches.

In chapter 3 explains the methodology that will be used for integration of data from the software and hardware development.

In chapter 4 will be present the preliminary results of the research as an evidence in theoretical and formulas. Some observations in result from the project.

In chapter 5 will summarize the outcomes of the study in conclusion part. This project will be achieved its objectives. This chapter has outline some recommendations for the next or future development on the method used.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Chapter 2 has literature review based on previous researches as well as theoretical readings based on dementia, GPS/GSM and fall detection analysis. The literature review done based on the previous researches will help improving the methodology of this project and the result will be recorded successfully.

2.1 Dementia

Dementia is an ailment which depicts a widespread breed of manifestations related with a degeneration in memory and other inference extremely in thinking. Dementia symptoms was getting serious continuously, even the subsyndrome presentations affecting the health of older adults and meriting intervention [1].

These are the symptoms and signs of dementia:

- i. Struggling to remember recent events or dates
- ii. Hard to follow conversations or TV shows
- iii. Forgetting the names of friends or everyday objects
- iv. Repeating words, and forgetting what you were saying

- v. Difficulties thinking and responding
- vi. Feel anxious, angry and notice behavioral changes
- vii. Feel a decline in ability to talk, read and write
- viii. Feel confused, even when in a familiar environment

2.1.1 Alzheimer

Alzheimer defined as one of the problems we need to concentrate since the disease will get serious then the patient will lose the memory or impression as the symptom of Alzheimer's disease. Alzheimer's disease was classified from other forms of dementia by its dangerous and progress of growing, although elevation in level of Alzheimer's disease that will occur [1].

2.2 Wireless Data Communication

Wireless Data Communication is a communication medium which is performed and delivered in wireless. It carries analog or digital signals over LANs or WANs in single- or multiple-way networks. A knowledge which combination with all steps and forms connection between two or multiple devices by using wireless signal through this wireless communication technologies.

2.2.1 GPS and GSM

GPS remains for Worldwide situating framework has wide number of use today prevalently in the field of route and so forth. A GPS receiving wire will get the longitude and scope esteem from satellite about the present area of module alongside the UST time and different parameters [2]. A GSM module is a functioning as modem for transmitting information to the server [2]. Option of A7 GPRS+GSM+GPS Shield which is a Quad Band Module works on various frequency i.e. 850MHz, 900MHz, 1800MHz and 1900MHz. Likewise, it bolsters voice calls, SMS messages, GPRS information administration and GPS work. We can utilize it make a straightforward telephone. The module is controlled by AT command by means of UART and backings 3.3V and 4.2V coherent level. Figure 2.1 shows that the simple GPS and GSM tracking system. Once the signal interrupt the GPS then GPS data will send to the GSM module then GSM module will form a message to a specific contact number which set by the microcontroller. After that, the data of GPS can be use in PC/GPRS tracking system. Figure 2.2 shows the sample of GPS+GPRS+GSM module (A7 thinker).

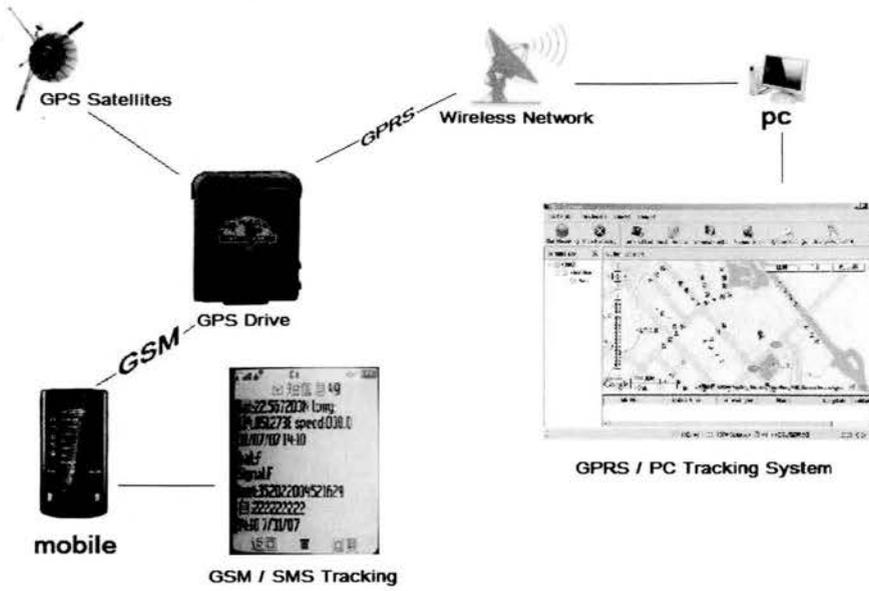


FIGURE 2.1: SAMPLE OF GPS AND GSM TRACKING SYSTEM



FIGURE 2.2: SAMPLE OF GPS+GPRS+GSM MODULE (A7 THINKER)

2.2.2 IR receiver

IR receiver is one of the wireless data communication device which using infrared. For example, as TSOP 1738 in figure 2.3 which is an infrared receiver with active low output. Output signal which is demodulated by TSOP can directly be decoded by a microcontroller. It consumes low power and has high immunity against ambient light. When transmits infrared signals which managed by TSOP and then decoded by microcontroller. Microcontroller sent signals to relay module according to which devices switch ON/OFF once a button pressed. Infrared radiation most used as a part of mechanical, exploratory, and some therapeutic applications. The 4 detection methods in IR sensors:

- i. Thermopile which converts thermal energy into electrical energy.
- ii. Pyroelectric which apply sinusoidal variations of sample temperature at frequencies in the range 0.01-1 Hz.
- iii. Bolometric which is the rectification to the absolute magnitude of an object in order to convert its clear magnitude to its bolometric magnitude.
- iv. Diode methods which used to estimate the actual behavior of real diodes for calculations and circuit analysis.

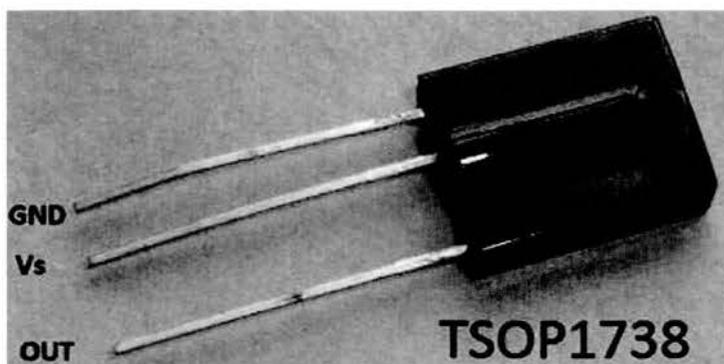


FIGURE 2.3: TSOP 1738 IR RECEIVER