UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ELDERLY SMART SYSTEM FOR FALL DETECTION WITH GPS TRACKER AND MEDICINE REMINDER ALARM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours

by

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DECLARATION

I hereby, declared this report entitled “Elderly Smart System for Fall Detection with GPS Tracker and Medicine Reminder Alarm” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Masalah berkaitan kejatuhan amat sinonim dengan golongan warga emas. Selain daripada itu, golongan warga emas juga sinonim dengan masalah kesihatan yang memerlukan mereka mengambil ubat mengikut masa yang ditetapkan. Dalam kalangan orang tua, terdapat sesetengah daripada mereka yang mempunyai masalah mudah lupa dan tidak pandai membaca jam untuk makan ubat mereka pada masa yang telah ditetapkan oleh doctor. Projek ini adalah penyelesaian inovatif yang bertujuan untuk mengesan dan mencari orang terutama untuk orang tua dengan masalah kesihatan. Ia direka sebagai sistem pengesanan kejatuhan, mengesan lokasi semasa dan tetapan peringatan ubat untuk mengingatkan pengambilan ubat mengikut masa yang telah ditetapkan oleh doctor. Mikrokontroler yang digunakan dalam projek ini ialah NodeMCU (ESP8266) dan Arduino Mega 2560 Pro Mini. Modul MPU6050 pula digunakan untuk sistem pengesan jatuh dan modul GPS NEO-6M digunakan untuk mengesan lokasi semasa pengguna untuk projek ini. Jam Masa Nyata (RTC) DS3231 pada asasnya berjalan pada bateri seperti jam tangan dan masa terus berjalan walaupun terdapat gangguan kuasa. Modul RTC digunakan untuk sistem penggera ubat dalam projek ini. Projek ini juga menggunakan platform internet iaitu aplikasi Blynk untuk menghantar pemberitahuan apabila mengesan jatuh dan untuk menjejaki lokasi semasa pengguna.

ABSTRACT

Problems related to the fall are synonymous with the elderly. In addition, the elderly is also synonymous with health problems that require them to take the medication on time. Among the elderly, there are some who have memory problem and are not know how to read the time to take their medication at the time that their doctor suggests. This project for people is a revolutionary solution aimed at identifying and finding people with a health problem, particularly for the elderly. It is designed as a fall detection system, tracking current location and system of medication reminders alarm to remind the elderly to take medication according to a doctor's prescribed time. The microcontroller that been used in this project are NodeMCU (ESP8266) and Arduino Mega 2560 Pro Mini. MPU6050 accelerometer module is use for fall detector system and NEO-6M GPS module is used to track the current location of the user for this project. Real Time Clock (RTC) DS3231 is basically runs on a battery like a watch and keeps time for user even when there is a power outage. The RTC module is use for the medicine alarm system in this project. The project also uses the internet of things (IoT) platform, the Blynk application to send notifications when detecting falls and to track user's current location.

DEDICATION

To my beloved parent Jendia Anak Anyid and Nongie Anak Gatey also my supervisor Puan Norlezah Binti Hashim and co-supervisor Puan Dayanasari Binti Abdul Hadi who sacrificed and work hard as I did to make this work possible.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION, SYMBOLS AND NOMENCLATURE

Arduino IDE	Arduino Integrated Development Environment
BW	Bandwidth
CPU	Central Processing Unit
EPROM	Erasable Programmable Read-Only Memory
GPS	Global Positioning System
GSM	Global System Mobile Communication
RTC	Real Time Clock
IoT	Internet of Things
PCB	Printed Circuit Board
USB	Universal Serial Bus
V	Voltage
G	Gravity
LED	Light Emitting Diode
LCD	Liquid Crystal Display
PCB	Printed Circuit Board
DC	Direct Current
FYP	Final Year Project
g	Gravity

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this study, it all about the elderly smart fall detector and medicine reminder alarm. This project focused primarily on detecting falling and automatically locating people especially for elderly people with a health problem. This project is an innovative solution to meet quickly evolving the technologies nowadays. However, there are a lot of fall detector sensor and medicine alarm technologies that exist, but the requirement is still not fulfilled as it needs improvisation. Therefore, this elderly smart fall detector and medicine reminder alarm system developed to make the user more comfortable while saving in terms of cost and power consumption. The smart system provides a fall detection system, a GPS tracker to track the current location, and a medicine reminder setting to remember pill intake on time.

This section basically provides an overall overview of this study. The problem statement, objectives, scope of work, cost involve in this project and also the expected result will be discussed and explained briefly.

1.2 Background

Every country in the world has focused on developing its nation, including increasing the country's population. The global population is expected to grow by more than 1 billion people in 15 years, which could accumulate to 8.5 billion by 2030,

according to the UN's 2015 findings on world population. People aged 60 or older are the fastest growing population, currently accounting for 12 percent of the world's population. This population is growing by 3.26 percent annually and is expected to reach 1.4 billion by 2030.

As the number of older people is increasing, there is a rapid increase in demand for healthcare services. Most people 60 years of age or older are hospitalized due to falls. A global report by the World Health Organization (WHO) states that 28-35% of older people aged 65 years and older fall each year, rising to 32-42% for those 70 years and older.

Elderly people are at higher risk of falling when they are alone. In addition, falling frequently can result in psychological and physiological damage leading to severe injury and even death if there is no immediate medical attention.

It is necessary to provide immediate medical care to reduce the risk of falling harm to the elderly. Therefore, a reliable fall detection system can help detect falling in the elderly and contact the nearest health service for support and assistance.

It must be user friendly to the fall detection system, making it easier for older people to use it. The system must also not interfere with and interfere with the elderly's daily living (ADL) activities. The system needs to be cost-effective and sustainable.

1.3 Problem Statement

Many elderly people staying alone at home because their child lives elsewhere. Their child can always avoid worrying feeling with the help of smart technology because they can monitor the condition of their parent anywhere and anytime. The smart technology will detect when their parent falls down the system will

automatically send a notification. The size of the smart technology for fall detector are not suitable for the user to use it as a bracelet as it is big and heavy.

Besides that, elderly people who live alone at home when their children are not at home will have a risk to forget to eat their medicine on time. This may cause the any dangerous risk when they have a very bad health condition at the moment.

Therefore, this project is conducted to overcome problem that stated earlier. This system will let their child know that there is something might happen to their parents. It also works as reminder to let the person to eat their medicine. This device is also complete for parents who live alone at home because there is sensor that can track their location at the current time. This can also help their children track their parent's locations immediately in case of anxiety like falling. In addition, the device is not bulky and easier for the elder person to carry along everywhere.

1.4 Objectives

There are few goals to achieve by the end of this project. The aims of this project are as below:

i. To develop a NodeMCU (ESP8266)-based smart fall detection system that is selected as the microcontroller and connected to the accelerometer sensor.

ii. To develop a location monitoring using GPS module.

iii. To develop a Real Time Clock (RTC) module for medicine reminder.

1.5 Scope of Work

The scope of this research work is determined in accordance with the objectives mentioned. This elderly smart fall detector system is built using accelerometer with Arduino. Accelerometer is an electromechanical device that measures the force of acceleration due to gravity in unit g. It can be used in tilt sensing applications. The MPU6050 accelerometer measures acceleration along X, Y and Z axes and provides proportional analogue voltage output to the acceleration along these three axes.

Besides, GPS module is built for location tracking and a medicine reminder Real Time Clock module (RTC) use for medicine reminder alarm. Both of this system also built with Arduino Mega 2560 Pro and NodeMCU (ESP8266). Additionally, Arduino Mega 2560 Pro and NodeMCU (ESP8266) used as a microcontroller will set as the core controller for controlling the input and output for this project. The data of the system will display on serial monitor of Arduino IDE as an output of the system. This study is emphasising on detecting fallen and tracking location of the elderly. Also, alarm sound when it is time to take the medicine by using the Real Time Clock (RTC) module.

1.6 Rational of Study

This smart fall detector and medicine reminder alarm is the automatic device that used by the elderly. This device will help their children to detect any emergency fallen happen of their parents at any time and place. This device can automatically send the information via notification on Blynk application to their children when it detects the fallen of the elderly. The position of the elderly is detected by the

accelerometer which it has the acceleration of gravity that show the gravity of the elderly.

Besides, this device also has the location tracking. This device uses the GPS module to locate the location of the elderly. The GPS module connect with the NodeMCU (ESP8266) which function as the microcontroller for the device.

The elderly also will be reminding when it time to take their medicine. The time has set by using the RTC module. This RTC module is function like watch. The time of the elderly to eat time has been set in the RTC module by using the Arduino Mega 2560 Pro which is the microcontroller of the device. The system has a buzzer which will make a sound as the medicine alarm.

From the implementation, this project helps the elderly to remind them of time to consume their medicines. In addition, this project is very helpful in such an emergency as fallen and can be tracking the location of their parents. This can help ease their children to check on their parent's condition if they need to work away or not at home at the moment.

1.7 Cost Involved in Project

The cost involved in this project explained in detail adding with the features of hardware used based on the requirement of elderly smart fall detector and medicine reminder alarm by using accelerometer sensor, Real Time Clock (RTC) module and GPS module that built with Arduino Mega 2560 Pro and NodeMCU(ESP8266) as a microcontroller.

Table 1. 1: Cost Involved in Project

Hardware	Unit	Description	Price (RM)
Arduino Mega 2560 Pro	1	Embed version of Mega 2560 CH340G/ATmega2560 - compatible with Arduino Mega 2560 board. Built on the Atmel ATmega2560 microcontroller and USB-UART interface chip CH340G.	44.90
NodeMCU (ESP8266)	1	NodeMCU provide the best platform for IOT application development at the lowest cost. Development Kit based on ESP8266, integrates GPIO, PWM, IIC, 1-Wire and ADC all in one board.	22.90
OLED Module	1	The visible portion of the OLED measures 0.96" diagonal and contains 96x64 RGB pixels, each one made of red, green and blue OLEDs.	42.40
Real Time Clock Module	1	The module can work on either 3.3 or 5 V that make it suitable for	6.10

		many platforms or microcontrollers for development.	
MPU 6050 Accelerometer	1	The MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip. It is very accurate, since it contains 16-bits analog to digital conversion hardware for each channel.	13.10
GPS Module	1	A complete GPS module with an integrated active antenna and an integrated EEPROM to save data on configuration parameters	21.60
			Total = 151.00

1.8 Expected Result

By the end of this research, it is expected to develop the elderly smart fall detector and medicine reminder alarm. For the fall detector part, the system should be able to detect the condition of the elderly. The movement or position of the elderly will be determined by the accelerometer. This module will calculate the position of the elderly and can detect either they are sitting or fall down. If there any fallen happen, the system will send an emergency notification to their children to notice them about it. This function to get an emergency rescue when there is any fallen happen.

Besides that, for the elderly location tracking. It will help their children to detect and locate the location of the elderly at the moment. The GPS module has been used in this system. Their children can monitor the location of their parent at any time and any place.

In addition, for the medicine reminder alarm it help the elderly to eat their medicine on time. This system is used the RTC module. This module is work as a watch which already set by using the microcontroller. The buzzer will make a sound as an alarm of this system. The time for the elderly to take their time has set in the RTC follow the time suggest by the doctor.

1.9 Thesis Organization

There are five chapters in this report. First, the introduction to the problem, objective and scope to give an overview of this project was explained in Chapter 1. In addition, it also gives an overview of the project's expected outcome.

Followed by Chapter 2, literature on existing methods adopted and various technologies implementation previous project on smart fall detector and reminder alarm for medicine. Also, a detailed comparison with this study was discussed in the previous study of this project.

Subsequently, the description of the components and methods to be used will be explained in Chapter 3. Moreover, this chapter will also briefly describe the project's overview flow of how it operates.

Chapter 4 consist of result and discussion. It covers the discussion of the data analysis of this project.

For chapter 5, this part covered the conclusion and future work of the project. This chapter conclude the thesis and suggestion on future work for this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter is part of the literature review which will discuss about the previous research that already done by previous researchers related to the title of the project. This chapter will be divided into three part. Firstly, in this chapter will explained and described about the previous research related to fall detection and location tracker. Next, this section will also describe about Internet of Things (IoT) which is related to the title of the project. In addition, the microcontroller hardware that used in this project will be described in detailed.

2.2 Previous Related Research

Several research to develop fall detector, location tracking and medicine timer for the elderly system has been conducted around the world. For instance, body or wrist motion was used to detect falls. Previous studies may also be referred from the various author and also a variety of sources such as newspapers, articles, journals, books and websites.

As stated (Alicia Y.C. Tang, Chin-Hoa Ong, & Azhana Ahmad, 2015), the older people's fall detection sensor system is a system that use to detect fallen of the elderly. Nowadays many parents are left alone at home as most of their children have to work. Therefore, if an incident like an elderly fall down alone, it may be difficult