



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF FALL DETECTION
SYSTEM FOR DEMENTIA PATIENT USING
WEARABLE SENSOR**

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

by
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MUHAMMAD FAUZI BIN KHASNOR

B071710125

950205015847

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING
TECHNOLOGY

2020

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF FALL DETECTION SYSTEM FOR DEMENTIA
PATIENT USING WEARABLE SENSOR

Sesi Pengajian: 2020



Saya **Muhammad Fauzi bin Khasnor** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

- SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.
- TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.
- TIDAK TERHAD

Yang benar,

Disahkan oleh penyelia:



Muhammad Fauzi bin Khasnor

TS. SALEHA BINTI MOHAMAD

SALEH

Cop Rasmi Penyelia

Alamat Tetap:

Lot 2130, Kampung Air Papan,

86800, Mersing

Johor

Tarikh:17/1/2021

Tarikh:17/1/2021



SALEHA BT. MOHAMAD
PENSYARIAH
Fakulti Teknologi Kejuruteraan
Elektrik & Elektronik
Universiti Teknikal Malaysia Melaka

DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF FALL DETECTION SYSTEM FOR DEMENTIA PATIENT USING WEARABLE SENSOR is the results of my own research except as cited in references.

Signature:



Author: Muhammad Fauzi bin Khasnor

Date: 17/1/2021



اونيورسيتي تيكنيكل مليسيا ملاك

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPROVAL

This report is submitted to the Faculty of Electrical & Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:


Signature: 

Supervisor : TS. SALEHA BINTI MOHAMAD SALEH
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRAK

Kebanyakan orang suka hidup berdikari di rumah. Beberapa aktiviti dalam kehidupan seharian kita terdedah kepada kemalangan, seperti jatuh. Kejatuhan boleh menyebabkan orang mati. Dengan adanya prototaip sistem pengesanan jatuh yang membantu menyelesaikan masalah dengan mengembangkan sistem jatuh, merancang pelacak GPS dan menganalisis pecutan sudut. Kajian sebelumnya mengenai projek ini adalah mengenai jenis sensor yang digunakan dan kelebihan dan kekurangan bagi setiap artikel yang dikaji. Komponen utama yang digunakan adalah Arduino Nano, MPU 6050 dan Modul GSM. Sementara untuk perisian, aplikasi disiapkan dengan menggunakan Thunkable dan Firebase. Kedua-dua Software dan peralatan akan menunjukkan bagaimana penyediaannya. Untuk hasil yang diharapkan, Software ditampilkan sama seperti kedudukan peralatan projek.

ABSTRACT

Most people like to live independently at home. Some of the activities in our daily lives are prone to accidents, such as falls. Falls can cause people to die in fatal conditions. This paper presents a prototype of a fall detection system does help solve the problem by developing the fall system, design a GPS tracker and analyse the angular acceleration. The previous study of this project is on what type of sensor that is used and the advantage and disadvantage for each article that was reviewed. The main component that is being used is Arduino Nano, MPU 6050 and GSM Module. While for the software, the apps being set up by using Thunkable and Firebase. Both software and hardware will be shown how it is set up. For the expected result, the software is displayed as same as the placement of the project.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEDICATION

I devote this project to the Almighty God, my maker, my powerful foundation, my source of strength, insight, grace and comprehension. He has been the source of my strength throughout this program, and on His wings I've only flared up.



ACKNOWLEDGEMENTS

In completing this project, I would like to thank my supervisor TS. SALEHA BINTI MOHAMAD SALEH. It because without her support, comment and praises I would not complete it. And also, to all my fellow friend who help me in time of need.



TABLE OF CONTENTS

	PAGE
TABLE OF CONTENTS	x
LIST OF TABLES	1
LIST OF FIGURES	2
LIST OF APPENDICES	4
LIST OF SYMBOLS	5
LIST OF ABBREVIATIONS	6
CHAPTER 1 INTRODUCTION	7
1.1 Background	7
1.2 Objective	8
1.3 Scope	8
1.4 Problem Statement	8
1.5 Summary	10
CHAPTER 2 LITERATURE REVIEW	11
2.1 Introduction	11
2.2 Type of disease suffers by elders	12
2.2.1 Dementia	12
2.2.2 Alzheimer's Diseases	13

2.2.3	Huntington's Diseases	13
2.3	The problem caused by dementia	13
2.3.1	Wandering	14
2.3.1.1	The connection between GSM to the wanderer	14
2.3.2	Falling	15
2.3.2.1	How the fall detection used to prevent falling	16
2.4	The hardware that was used	18
2.4.1	Arduino Nano	18
2.4.2	GSM Module	19
2.4.3	GPS Module	19
2.4.4	MPU 6050 (acceleration and angle sensor)	20
2.5	The software that was used	21
2.5.1	Arduino IDE	21
2.5.2	Ublox Center	21
2.5.3	Thunkable	22
2.5.4	Firebase	22
2.6	The type of communication	22
2.6.1	Wifi	22
2.6.2	Bluetooth	23
2.6.3	RFID	24

2.6.4	Comparison between Wifi, Bluetooth and RFID	25
2.7	Review Previous Research	26
2.7.1	Camera-based sensing	26
2.7.2	Ambient sensing	27
2.7.3	Wearable sensor	28
2.7.4	Comparison of the previous study	28
CHAPTER 3	METHODOLOGY	32
3.1	Introduction	32
3.2	Flowchart of the project	32
3.3	Data collection	35
3.4	The main components and how to set up	35
3.4.1	Arduino Nano	35
3.4.1.1	Software for Arduino	37
3.4.2	GSM Module	39
3.4.3	MPU 6050	39
3.4.3.1	Software for MPU 6050	40
3.4.4	The online apps set up	42
3.4.4.1	Firebase	42
3.4.4.2	Thunkable	42
3.5	Cost of the project	43

3.6	Changes of the component	44
3.7	Changes in the application	44
3.8	The circuit of the project	45
3.9	Summary	46
CHAPTER 4	RESULT AND DISCUSSION	47
4.1	Introduction	47
4.2	Analysis of the function of the project	47
4.2.1	Software display and reading	47
4.2.2	Analysis of different device's position on patient body	51
4.2.3	Analysis of the GPS tracking of the coordinate	57
4.3	Discussion	58
CHAPTER 5	CONCLUSION AND RECOMMENDATION	59
5.1	Introduction	59
5.2	Conclusion	59
5.3	Future recommendation	60
	REFERENCES	61
	APPENDIX	65

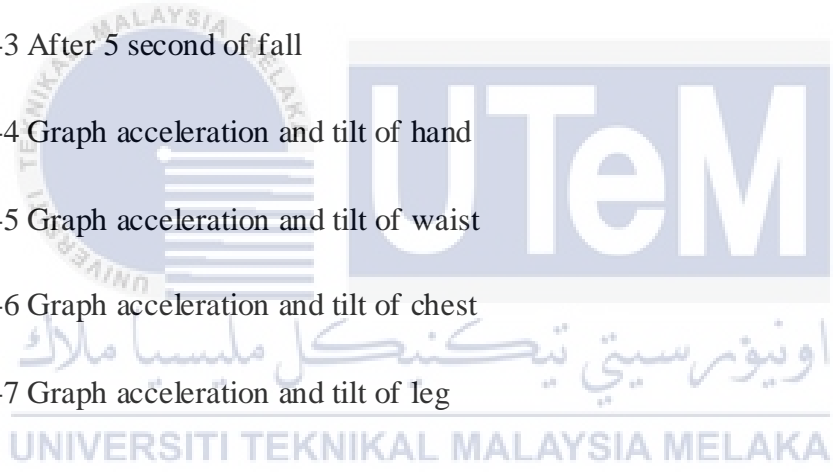
LIST OF TABLES

TABLE	TITLE	PAGE
Table 2-1:	Comparison of Wifi, Bluetooth and RFID table	25
Table 2-2:	Table Comparison.	29
Table 3-1:	Description of the pin.	35
Table 3-2:	MPU 6050 Pin description	40
Table 3-3:	Cost of the project.	43
Table 4-1	The acceleration and tilt of hand	51
Table 4-2	The acceleration and angle of waist	52
Table 4-3	The acceleration and angle of chest	54
Table 4-4	The acceleration and angle of leg	56
Table 4-5	The coordinate of longitude and latitude	58

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2-1:	GSM Module	15
Figure 2-2:	MPU 6050 Orientation and Polarity Rotation.	17
Figure 2-3:	Arduino Nano Module.	18
Figure 2-4:	GSM Module.	19
Figure 2-5:	GPS Module.	20
Figure 2-6:	MPU 6050 Module.	21
Figure 2-7:	Wifi Connection.	23
Figure 2-8:	Bluetooth Connection.	24
Figure 2-9:	RFID Connection.	25
Figure 2-10:	Camera-Based picture	26
Figure 2-11:	Example of Ambient Sensing.	27
Figure 2-12:	Placement of a wearable sensor.	28
Figure 3-1:	Flowchart of the project	34
Figure 3-2:	Arduino model and description.	36
Figure 3-3:	Arduino to PC connection.	37
Figure 3-4:	Tools selecting	38

Figure 3-5: Upload code	38
Figure 3-6: MPU 6050 Module and description.	39
Figure 3-7: MPU 6050 to Arduino connection.	41
Figure 3-8: MPU Teapot	41
Figure 3-9: How API works	42
Figure 3-10: Thinkable view	43
Figure 4-1 Idle or Homepage	48
Figure 4-2 When patient fall	49
Figure 4-3 After 5 second of fall	50
Figure 4-4 Graph acceleration and tilt of hand	51
Figure 4-5 Graph acceleration and tilt of waist	53
Figure 4-6 Graph acceleration and tilt of chest	55
Figure 4-7 Graph acceleration and tilt of leg	56



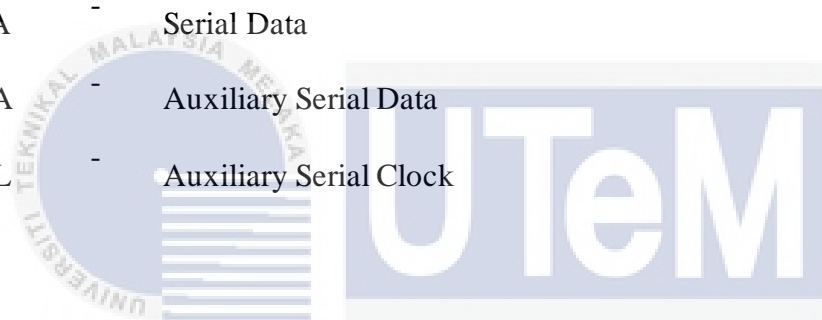
LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix 1	Gant chart of the project	65



LIST OF SYMBOLS

Wifi	-	Wireless Fidelity
GSM	-	Global System for Mobile Communications
GPS	-	Generalized System of Preferences
RFID	-	Radio-frequency identification
LED	-	Light-emitting diode
SCA	-	Serial clock
SDA	-	Serial Data
XDA	-	Auxiliary Serial Data
XCL	-	Auxiliary Serial Clock



اونيورسيتي تيكنيكل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF ABBREVIATIONS

PCA Principal Component Analysis



CHAPTER 1

INTRODUCTION

1.1 Background

Dementia is an overall phrase for a person who did not possess the ability to perform everyday activities, which is characterized by a decrease of memory, language, problem-solving and other thinking skills. Hence, it is essential to have the proper measure in place to stop it from happening.

Even if the caretaker has tried hard to prevent wandering from happening, there is still a risk. The home must always be a safe place for the loved one. To prevent this from occurring the project called "Development Of Fall Detection System For Dementia Patient Using Wearable Sensor" introduced. The idea for this project focusing only on dementia patient.

The main thing about this project is to help the caretaker quickly taking care of the dementia patient or be alerted of their well-being when alone. There were a few data that need to be considered for this project. For example, the initial angle and the angle when the patient fall. Also, the noise that occurs when transferring information via SMS or wifi. Using Arduino Nano as the controller for the design is very crucial as it is smaller and more comfortable with programming. Apart from that, all the equipment were made so it easily wearable for the patient because of the equipment combined, it is minimal and very lights.

1.2 Objective

To overcome the problem, the objectives of this project are as follows:

- To detect and send the condition of the patient either fall or not to the caretaker
- To utilize the tilt, acceleration, and location of the device for monitoring patient
- To analyze the effectiveness of Fall Detection System For Dementia Patient

1.3 Scope

The objectives of the project can be achieved, if several critical criteria are being considered, for example:

- i. Arduino IDE is used to give the command to the Arduino.
- ii. Thinkable is used for creating apps for the mobile phone.
- iii. Firebase is used to store the apps in the cloud.
- iv. The MPU 6050 sensor will be used to detect the angle and acceleration.
- v. The parameters that will be analyzed are angle and acceleration.

1.4 Problem Statement

Fall detection is the best way to help ensure the safety of the dementia patient. It helps a lot to the caretaker to get information about their elders that suffer from dementia. To do this, the information that is needed to gather is which communication that is good for the project. This project uses Wifi and GSM because according to Bharat Ananda Shinde (2014), the most application now depends on Wifi or GSM. It also uses Bluetooth,

but the range is very limited. As for the sensor to detect falls, the sensor that is used is MPU 6050 because it can detect both angle and acceleration, which is perfect for detecting if the person is falling. Another alternative is to use the live feed camera to record the movement. However, the only downfall is that it has a blind spot. While hiring a nurse to care for them also has a disadvantage; that is, the nurse sometimes overlooked the patient.



1.5 Summary

The purpose of this paper is to explore the available strategies for monitoring the patient and the algorithm for fall detection. This article reflects on the introduction of a program that can relieve the caregiver's burden and facilitate day-to-day activities for the patient with dementia. This paper suggests that the customer server model tracks the patient and is based on algorithms based on the threshold.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review or narrative review is one form of a research article. A literature review discusses the latest understanding of a given topic. It contains both theoretical and analytical observations as well as scientific conclusions. Secondary sources are literature reviews, and no new or original experimental papers are published. The academic literature most frequently is.

These reviews are published and should not be confused with the book in scientific journals. Literature reviews form the basis for research in almost all academic fields. As part of a peer-reviewed paper that introduces new work, a narrow-scope literature review may be used. It puts the present work in the context of the literature involved and sets the reader's understanding. This chapter consists of several articles, theses, newspapers, and more, which all have to do with the project.

A lot of research and research needs to be carried out to ensure that this project is successful in understanding the meaning and knowledge of fall detection and how it affects the person or their caregiver and the development of the project from the early stages to now. The main focus of this project is the falling problem. The most significant issue confronting the elders. By understanding what leads the elder falls, we can find a solution for our project to improve the daily basis of the patient. Dementia is a sickness that has been studied to cause the patient more likely to fall. This is why that is important for this project to focuses on this disease.