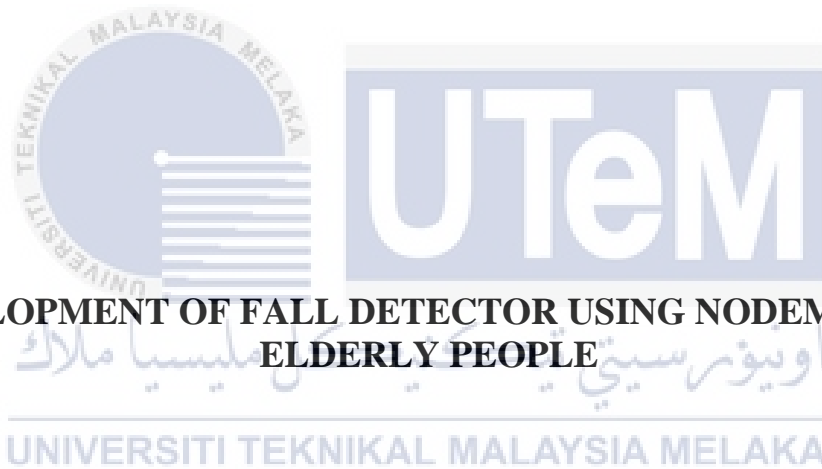**Faculty of Electrical and Electronic Engineering Technology**

DEVELOPMENT OF FALL DETECTOR USING NODEMCU FOR ELDERLY PEOPLE

MUHAMMAD AMIR ZAHID BIN ABD RAZAK

Bachelor of Electronics Engineering Technology with Honours

2022

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**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours**

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Development of Fall Detector Using NodeMCU for Elderly People.

Sesi Pengajian : 2019/2020

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DECLARATION

I declare that this project report entitled "Development of Fall Detector Using NodeMCU for Elderly People" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature   :

Student Name   :   MUHAMMAD AMIR ZAHID BIN ABD RAZAK

Date   :   16/1/2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature :

Supervisor Name : Dr. Haslinah Binti Mohd Nasir

Date : 16/1/2023

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Co-Supervisor :
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DEDICATION

To my beloved father, Abd Razak Bin Osman
and my beloved mother, Zurina Binti Adini

ABSTRACT

The increase of lonely senior citizen living by themselves may cause mental and physical health issues as well as the chances of accidents happen most likely to be high. Thus, this project entitled "Development of Fall Detector Using NodeMCU for elderly people" aims to develop fall detector for elderly people. This project were equipped with NodeMCU and global positioning system (GPS) which integrated with gyroscope and accelerometer sensors that able to sense sudden falls. It will notify their children or close contact if there are emergency aided needed with the current location provided. The project needs to be connected to the internet so that the use of its advantages is comprehensive. This project implement threshold approach on detecting sudden movement and the detection in sensing acceleration, orientation and angular condition is excellent. The development in making this project is to improvise surveillance, community and individual safety.

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ABSTRAK

Peningkatan bilangan warga emas yang tinggal bersendirian pada masa kini boleh menyebabkan masalah kesihatan mental dan fizikal serta besar kemungkinan kemalangan boleh berlaku adalah tinggi. Oleh itu, projek yang bertajuk "Pembangunan Pengesan Kejatuhan Menggunakan NodeMCU untuk warga emas" ini dibangunkan, ia bertujuan untuk mengesan kemalangan jatuh pada warga emas. Projek ini dilengkapi dengan NodeMCU dan sistem penentududukan global (GPS) yang disepadukan dengan sensor giroskop dan pecutan supaya dapat mengesan kejatuhan secara tiba-tiba. Peralatan ini akan menghantar pesanan untuk memberitahu anak-anak mereka atau mereka yang mempunyai hubungan rapat jika terdapat bantuan kecemasan yang diperlukan pada lokasi semasa yang disediakan. Projek ini perlu disambungkan ke internet supaya penggunaan kelebihannya adalah menyeluruh. Projek ini melaksanakan pendekatan ambang untuk mengesan pergerakan mengejut dan pengesanan dalam mengesan pecutan, orientasi dan keadaan sudut adalah sangat baik.. Pembangunan dalam membuat projek ini adalah untuk menambah baik pengawasan, keselamatan, komuniti dan individu.

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ADL   -   Activities of Daily Living
GPS   -   Global Positioning System
KKM   -   Kementerian Kesihatan Malaysia
PCA   -   Principal Component Analysis Algorithm
TN   -   Number of ADL correctly classified
FP   -   Number of False Falls
TP   -   Falls correctly identified
I/O   -   Input Output

LIST OF ABBREVIATIONS

V -   Voltage
mAh   -   Ampere Hour
m   -   Meter
Hz   -   Hertz

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CHAPTER 1

INTRODUCTION

1.1   Background

Due to increase population of senior citizen here in Malaysia and added with lower fertility rate, demand for nursing home has also increased and children may feel sorry to place their parents far from them under someone else care [1]. Based on the report of Kementerian Kesihatan Malaysia (KKM), one over three of senior citizen that aged sixty and above population in Malaysia had experienced fall accidents, this can lead to injury or worst-case scenario are death. This tragic tragedy may have negative effects for the victims, closed families, the healthcare system, and society at whole.

The responsibility of the child is to preserve the health and safety of the parents, but today, with a low number of children and birth rates, the attention that a child can give to a parent becomes limited by the constraints of job and affairs of daily life, it is from this problem that the cause of the elderly accident at home without supervision occurs, one of many popular caused of accidents are falls accident, accidents like this if it happen to young people it will not cause a big problem but if it happen to elderly people it can result in brain injury, bone fractures, lack of ability to do something on their own and even depression in a psychological context.

To make sure help comes quickly, the idea of this fall detector using Node MCU for elderly people was worked out. Even though many fall detector function can now be found in smartwatches, fitness trackers, and other types of wearables but consumers must buy the other packages offered and this makes it much more expensive to own a fall detection

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function. The goals are to build a system that can detect fall activities which then the report will be sent to the phone through Telegram app to the people who were in charge to supervise the user who wear it.

1.2   Problem Statement

Falls increase exponentially with age-related biological changes, resulting in a high incidence of falls and fall-related injuries in ageing societies. Because falls are a major public health concern among the elderly, the number of systems designed to detect them has grown dramatically in recent years [2]. From this string of problems arose the idea of the development of fall detector using node MCU for elderly people are being created and develop to improve safety and preventing this kind of accident to happen. It is expected to solve majority of the problems and concerns in nursing parents at home.

1.3   Project Objective

The main aim of this project is to propose an alternative way of using the fall detector device to assist the elderly people to help prompt assistance when needed. Specifically, the objectives are as follows:

a)   To develop a low-cost fall detector using gyroscope and accelerometer to detect the falls.

b)   To integrate the device with the notification system through Telegram app.

1.4 Scope of Project

The scope of this project are as follows:

a) To develop fall detector using node MCU integrates with gyroscope and accelerometer Sensor to detect any accidents from fall of elderly people.

b) By integrating with Telegram app, the system will be able to notify the close contact to expedite the arrival

c) To propose a low-cost system that meets all requirements by leveraging existing mainstream, dependable technologies.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In today's modern society, in twenty years prediction, the estimation of younger people that will move out from their parent house will be increase and resulting in more seniors going to live alone. Even though this youngster were living in the same city as their parents, there is currently about 70 percent of them prefer to rent or buy their own home. This trend is also due to job demands especially outside the accommodation area or after setting up a household. There are some senior citizens living alone face some difficulties especially related to movement even though they are mentally healthy. These people do not necessarily live in care centers because they can still be independent. To make it easier for young people to ensure the safety of their parents, a safety technology needs to be developed to detect any form of movement that is alarming or dangerous so that prompt help can be delivered.

2.2 Fall Detection Approaches.

To make things clear on how the development of fall detector, this chapter will compile regularly about progress that other research had made throughout the year. The discussion of this topic includes an approach that had been taken to develop a fall detector according to the wishes of the designer. Among the approaches introduced are cell phone-based approaches, sensor-based approaches, camera-based approaches and lastly threshold and machine learning based approaches.

2.2.1 Cell Phone-Based Approaches.

In distribution feeder, electrical energy flows through multiple feeder sections to serve all connected loads. Sometimes, one or more line branches (or laterals) branch emanates from the main feeders. Each MV feeder and/or feeder section can be fairly short, on the order of a few or less than 1 km, or it can be as long as several tens of km, depending on the distance from the substation to the load point.

To create a system that be able to predict fall risk, cell phone based approached were develop using three-dimensional accelerometer sensor. By monitoring the behavior of human walking pose using accelerometer sensor is much cheaper to build. In addition to the proposed work, the authors [3] defined gait symmetry and stability under acceleration data conditions. The proposed gait assessment model was capable of analyzing and evaluating an individual's gait's stability and symmetry. The proposed gait assessment model accurately predicted the fall risk of a walking object. Improved performance and efficiency results were obtained, proving the effectiveness of the work

Fortina and Gravina [4] created a system that uses a smartphone and a wearable accelerometer to send an alert when a fall is detected in real time. The system was capable of triggering fall incidents using various alerting modalities, quickly notifying emergency services. The method was tested on 20 people, and the results showed that it had an 83 percent specificity, 97 percent sensitivity, and 90 percent precision. Because of this work, the fall detection system will be improved in terms of design and evaluation in the future.

The problem of fall prediction is complex, requiring the coordinated coordination of behavioural, physiological, and environmental parameters.
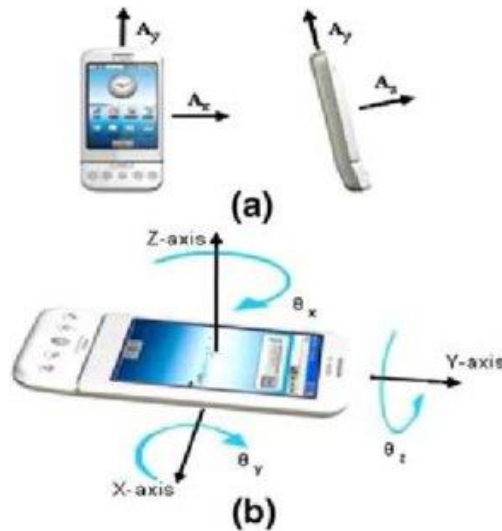
Figure 2.1 Cell phone-based approaches gyroscope [3].

2.2.2 Sensor-Based Approaches.

Many developers and inventors suggested to use the gyroscope and accelerometer sensors, these sensors usually in pair or just one or another. Other related sensor such as barometer and magnetometer also were recorded being use in the study of development of fall detector, but the percentage is small compared to the gyroscope and accelerometer sensor. Based on the figure 2.3 [2] the used of accelerometer alone is 80.2%, 7% the use of gyroscope in fall detector, of a combination of accelerometer and gyroscope there is 6.8% used recorded and the rest is barometer and electrometer which only 5% of usage from all sensors was ever recorded to detect fall.

In Malaysia, the dangerous of fall among elder people are well known as there are many old people sitting in a house or village alone usually. If there is something bad happen to these type of group, immediate assist and help need to be engaged as a delay on this matter can lead to serious injury and even death. The article by Ed Hardy [5] proposed a new system, which involves IoT, cloud computing and smart devices as this type of system is energy efficient and reliable as there are efficient and reliable. By using IoT, real time movement of

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elderly people can be observed from time to time. One of the ideas on realizing this idea is to connect the sensor to 6LoWPAN which can allow connection directly with the internet using open standards.
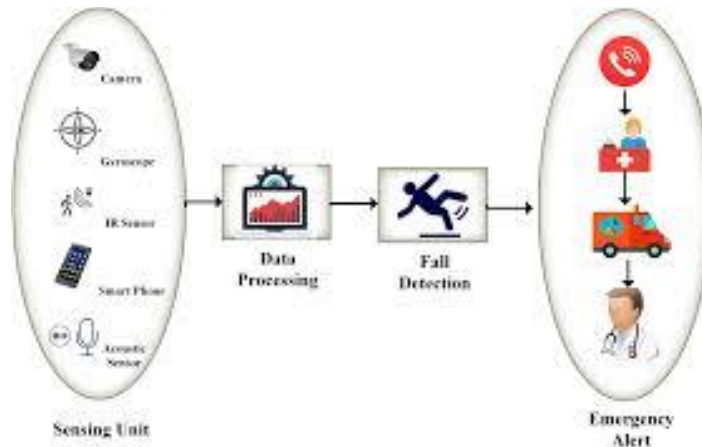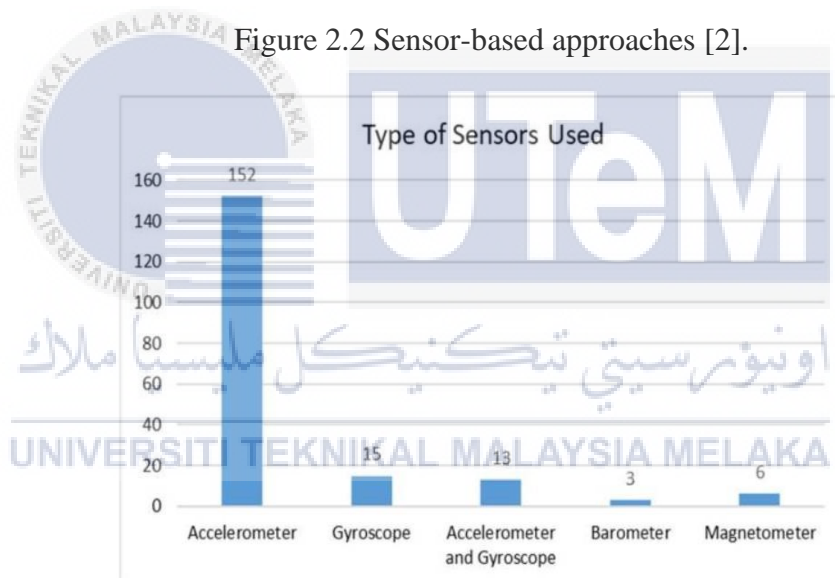

Figure 2.2 Sensor-based approaches [2].

Figure 2.3 numbers on various type of sensor [2].

2.2.3   Camera-Based Approaches.

Other than two mention approaches above, camera-based approaches is one of the approaches that has the most positive impact in detecting and predicting fall activities and individual routing activities [6]. This type of approach combine with ambient sensor will allow the camera to operate in any amount of ambient light present as the module will