AUTOMATIC FALL DETECTION AND NOTIFICATION SYSTEM VIA SMARTPHONE

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This Report Is Submitted In Partial Fulfillment of Requirements for the Bachelor Degree of Electronic Engineering (Telecommunication Electronic)

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer

Universiti Teknikal Malaysia Melaka

June 2013

UNIVERSTI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

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Tarikh **: 10/6/2013**

For my beloved family

ACKNOWLEDGEMENT

I would like to express my deepest gratitude and appreciation to the individuals mentioned in the following paragraphs.

I would like to thank my supervisors, PM Muhammad Syahrir bin Johal and Engr Vigneswara Rao a/l Gannapathy for all the advice and guidance that they have offered me throughout the development of the project. Those advices mean very much to me and have helped me to grow into a better person. Thanks to all the other individuals whose names are not mentioned as well.

ABSTRAK

Projek ini bertujuan untuk membina satu system yang boleh mengenalpasti jika seseorang terjatuh dan memaklumkan orang lain secara automatik. Sistem ini terdiri daripada alat pengesan, peranti kawalan, pemancar “Bluetooth” dan telefon pintar. Objektif utama projek ini adalah untuk memaklumkan ahli keluarga terdekat secara automatik sekiranya seseorang itu terjatuh. Kejadian jatuh akan dikenalpasti menggunakan alat pengesan dan peranti kawalan. Satu aplikasi Android yang berkemampuan untuk menerima isyarat cetusan daripada peranti kawalan secara “Bluetooth” akan mendapatkan lokasi semasa GPS dan seterusnya akan menghantar pesanan ringkas SMS kepada nombor telefon yang telah di”program”kan. Jika pertolongan dapat dihulurkan secepat yang mungkin kepada mangsa tersebut, kemungkinan besar mangsa tersebut akan terselamat daripada kecederaan yang mungkin akan mengorbankan nyawa.

ABSTRACT

This project aims to develop automatic fall detection and notification system via smartphone that will notify others of a fall incident. The system will include a sensor, Bluetooth transmitter and smartphone. The main objective is to notify others so that they can provide immediate assistance to any falling victim. Falls will be detected accurately using PIC and data from tri-axial accelerometer sensor. An Android application which can detect the signal sent from the PIC via Bluetooth will be triggered to capture the GPS location of the user and send a fall notification (SMS) to a predefined number. This number may belong to either a family member or personal doctor. If help response can be issued to the falling person as soon as possible, there is a high chance that the person will not suffer serious injury thus saving his or her live.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST OF SYMBOLS / ABBREVIATIONS

SIMBAD	Smart Inactivity Monitor using Array-Based Detectors
PIC	Processor Integrated Circuits
RMS	Root Mean Square

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

1.1 Introduction

A fall is defined as unintentionally going down to ground or even lower level. Events that happen as a result of sustaining violent blow, loss of consciousness, sudden paralysis as in stroke or an epileptic seizure are not considered as falls [1]. In the event of a fall, a strong impact may be inflicted on the elderly causing severe injuries. Studies have shown that falls are one of the major health threats for elderly people and pregnant women. For elderly living independently, the incident of fall is even far more serious and can be fatal as no one would know about it. Hence, it is critical if we can detect the fall as soon as possible. Therefore a fall detection and notification system is developed to notify his or her families and caretakers so that they can respond immediately to the

emergency situation. Immediate treatment to the victim of fall is very critical in saving his or her life. Although fall detection and notification system cannot prevent falls, it will reduce or minimize the risk of fallen victims being left untreated for an extended period.

1.2 Objective and Problem Statement

Falls are one of the major health threats for elderly people and pregnant women [2] & [3]. If the victim could not even seek help after 72 hours, it could be fatal. On the other hand, the elderly is 6 times more likely to survive if help can be attained within 1 hour [1]. For a senior citizen or someone living independently, the accident might not be known to others thus increasing the fatality rate. So, to counter this problem, a fall detection and notification system is developed to provide immediate assistance to the falling victim.

There has been extensive research on fall detection. One existing fall detection system which is from MobileHelp cannot provide notification of fall incident automatically [4]. It would be tragic if the victim is unable to call for help manually if they are unconscious or unable to do so even if the device is around. So, a system that will automatically issue an emergency request that contains the GPS location of the victim upon fall detection is developed.

Existing fall detection systems such as those from iLife Solutions Inc and Tel-Tron are consisted of wearable sensor and a separate central processing device [5] & [6]. Any fall incidents detected by the sensor must first be processed by the central processing and communication device. Moreover, these systems can only be applied in indoor environment. Imagine what will happen if the sensor which is worn by the user goes out of range of the central processing device? Surely the system cannot function

perfectly. Hence, an Android smartphone is suggested to be integrated with the wearable sensor to be used as a mode of communication to get help in outdoor environment. This is because Android smartphones are quite common these days and almost everyone can afford it.

1.3 Scope of Work

The scope of work involved in this project is as following:

(i) Design and assembly of suitable components such as sensor, microcontroller and Bluetooth transmitter module into a single board which contains the functions of data acquisition and processing and fall detection and notification.

(ii) Development of suitable fall detection algorithm using C programming language to cover forward and backward falls.

(iii) Development of Android application which is able to retrieve GPS location of the user and send it as SMS to a predefined number.

(iv) Development of interface between sensor unit and smartphone via Bluetooth.

(v) Testing, troubleshooting, and optimization of system to ensure its functionality.

1.4 Methodology

Firstly, studies will be carried out to identify the components required for a working system. C programming language will be studied to develop the fall detection algorithm. Android programming language will also be studied to develop application for obtaining GPS location and sending SMS. After acquiring all the necessary components, testing and data collection of accelerometer sensor will be performed to ensure its functionality. After the accelerometer has worked successfully, it will be used together with microcontroller to develop the fall detection algorithm before it is interfaced with smartphone via Bluetooth. Next, Android application with the mentioned functions will be developed. Experiments will be conducted to collect data and optimize or improve the system.