UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WIRELESS ANDROID-BASED WHEELCHAIR CONTROL AND SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Industrial Electronics) (Hons.)

by

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TAJUK: **WIRELESS ANDROID-BASED WHEELCHAIR CONTROL AND SYSTEM**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) (Hons.). The member of the supervisory is as follow:

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(AHMAD FAUZAN BIN KADMIN)

ABSTRAK

Pada masa kini, bilangan warga tua telah meningkat. Ada di antara mereka tinggal bersama anak mereka, ada juga yang tinggal di rumah orang-orang tua dan ada juga yang tinggal bersendirian. Masalah akan timbul apabila warga tua kehilangan kebolehan untuk bergerak. Tidak semua orang boleh berada di samping mereka pada sepanjang masa untuk menolong mereka. Projek ini dibuat untuk menolong mereka yang mempunyai masalah menggunakan kaki untuk berjalan seperti warga tua yang tidak berdaya atau orang yang lumpuh disebabkan oleh kemalangan. Tujuan projek ini adalah untuk membangunkan Sistem dan Kawalan Kerusi roda menggunakan Android tanpa wayar yang terdiri daripada telefon pintar Android dan kotak pengawalan yang boleh mengawal pergerakan kerusi roda dengan mengunakan motor. Kod punca ditulis dalam perisian Basic 4 Android. IOIO adalah pengawal utama yang mengawal motor, menghantar isyarat ke penerima isyarat RF dan menerima data bersiri dari telefon pintar android. Protokol perhubungan Bluetooth digunakan untuk berkomunikasi di antara telefon pintar android dan kotak pengawal. Arah dan kelajuan motor dikawal menggunakan pemacu motor MD30C. Tiga cara untuk mengawal pergerakan kerusi roda iaitu D-pad, kayu ria dan suara telah digunakan. Empat pilihan pergerakan adalah pergerakan ke hadapan, ke belakang, ke kiri dan ke kanan. Sistem ini juga mempunyai kebolehan untuk mengawal peralatan elektrik dengan menggunakan frekuensi radio sebagai komunikasi tanpa wayar. Peralatan elektrik boleh dihidupkan dan dimatikan secara tanpa wayar dengan menggunakan pemancar frekuensi radio yang meghantar isyarat ke penerima frekuensi radio. Sebagai kesimpulan, produk ini tidak hanya membenarkan, orang kurang upaya untuk mengawal kerusi roda sendiri tanpa bantuan orang lain, tetapi juga membenarkan orang lain untuk menggunakan telefon pintar android untuk mengawal kerusi roda dan peralatan elektrik di samping boleh menunjukkan arah kiblat bagi umat Islam untuk bersolat.

ABSTRACT

Nowadays, the number or elderly people has increased. Some live with their children, some live in the adult foster home and some even live by themselves. The problem arises when the elderly people lose their ability to walk. Not everyone can be present to help them at all time. This project is built to help those who have trouble using their feet to walk around due to some difficulties such as helpless elderly people or people who met with accidents and end up with paralyzed legs. The aim of this project is to develop Wireless Android-Based Wheelchair Control and System that consists of an android device and a control box that controls the movement of wheelchair by using DC motor. The source code is written in (Basic-4-Android) software. IOIO is the main controller that controls motor, sends signal to RF receiver and receives serial data from android phone. Bluetooth communication protocol is used for communicating between the android device and the control box. The motor direction and speed are controlled by motor driver MD30C through IOIO. Three control interfaces which are D-pad, joystick and voice are used to control for the wheelchair movement. The four conditions can be described as forward, backward, right and left. This system also has the ability to control electrical appliances by using radio frequency as the wireless communication. Electrical appliances can be switched on and off wireless by using radio frequency transmitter to send a signal to radio frequency receiver. As a conclusion, this product not only allows, the handicapped people to control the wheelchair by themselves without help from others but also allows other people to use the android phone to control the wheelchair and the electrical appliance, as well as providing Qibla' direction for the Muslims to pray.

DEDICATION

Alhamdulillah, praise to the Almighty Allah S.W.T

This thesis is dedicated to:

My beloved family,

My Parents,

My Supervisor,

My lecturers

And all my friends

Thanks for their encouragement and support

ACKNOWLEDGEMENT

Alhamdulillah, thank you Allah because of His blessing, I finally complete and finish my final year project successfully.

During the process to complete my project objective, I do a lot of research either by using internet, reading past year thesis, reference books and journal. With the guidance and support from peoples around me, I finally complete the project due to the time given. Here, I want to give credit to those who helped me to achieve what I had achieved in my final year project.

I would like to express my sincere and gratitude and respect towards my project's supervisor, En. Khairul Azha Bin A.Aziz for his kind, encouragement and suggestions. Without his continued support and interest, the project would not be like what it likes today. May Allah bless and reward him for his sincere, endeavour and contribution in the way of knowledge.

I also want to thanks to my beloved parents because without them, I will not be able to do well in my final year project. They did give me a lot of support, both from money and moral support to help me continue for what I had started on.

Thank you to all lecturers, staffs, friends and all who has directly and indirectly involved on this project. Your helps and cooperation will never be forgotten. May Allah bless and reward them for their sincere, endeavour and contribution in the way of knowledge.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

SDK	-	Software Development Kit
VB	-	Visual Basic
GUI	-	Graphic User Interface
API	-	Application Programming Interface
RAM	-	Random Access Memory
ROM	-	Read Only Memory
UART	-	Universal Asynchronous Receiver/Transmitter
USART	-	Universal Synchronous Asynchronous Receiver/Transmitter
RF	-	Radio Frequency
DC	-	Direct Current
AVD	-	Android virtual devices
B4A	-	Basic for android
USB	-	Universal serial port
PC	-	Personal computer
UI	-	User interface
PCB	-	Printed circuit board
MCU	-	Multipoint control unit
PWM	-	Pulse width modulation
SPI	-	Serial peripheral interface
GND	-	Ground
PWR	-	Power

CHAPTER 1
INTRODUCTION

This section basically guides the author in preparing the entire report content including the graphical illustrations which can be found in appendices. The REPORT CONTENT should be divided into appropriate chapters as guided here. Standard margins on this page, and on all text pages, are 4 cm left, 2.5 right, 2.5 top and 3 cm bottom.

1.1 Background

Wireless Android-Based Wheelchair Control and Systems a system where the DC motor is used to move the wheelchair. Nowadays, handicapped people face problem to control wheelchair by themselves. Sometimes they need other people to help them. This project will provide a new way to control the movement of wheelchair which are turn to the left, turn to the right, move forward and reverse. Electric appliances can also be switched on and off without using any wire. The overall wheelchair operation uses DC motor and motor driver module combined with microcontroller system which is IOIO board.

Wireless Android-Based Wheelchair Control and System consists of android device and a control box that can be attached to standard wheelchairs to control the movement by using a DC motor and send wireless signal to Radio Frequency Receiver by means of Radio Frequency Transmitter. Bluetooth communication protocol is used to communicate sensory and command information between the android device and the control box.

There are 4 options for basic motions of a wheelchair to be applied by the user. The four conditions of the wheelchair can be described as:

(a) Moving forward

(b) Moving backward

(c) Turning to the right

(d) Turning to the left

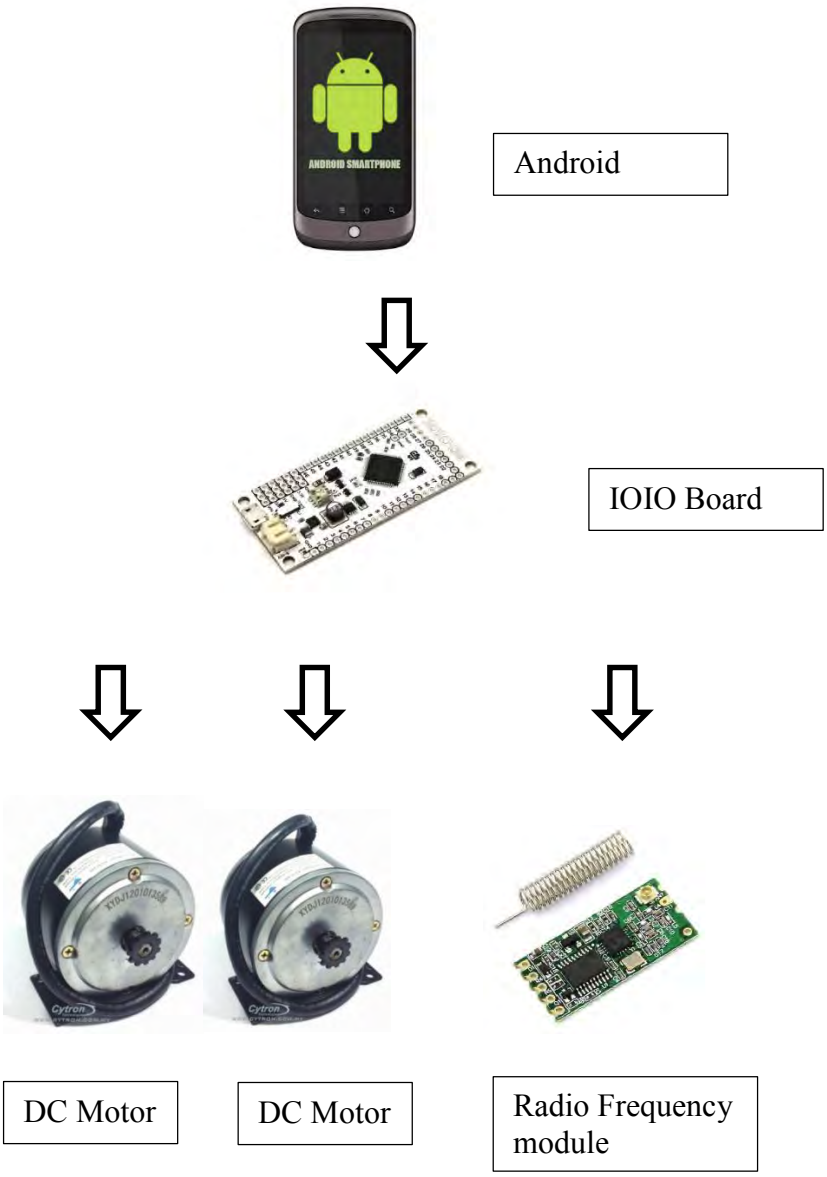

Figure 1.1: Block diagram of the overall project.

1.2 Problem Statement

Nowadays, the number or elderly people has increased. Some live with their children, some live in adult foster home and some even live by themselves. The problem arises when the elderly people lose their ability to move around. Not everyone can be present to help them at all time. Patients involved in physical injuries and disabilities with good mental strength struggle to get through places using the conventional hand powered wheelchair. A wheelchair is a chair with wheels, designed to be a replacement for walking. A wheelchair is a device used for mobility by people for whom walking is difficult or impossible, due to illness or disability. To face this problem, an android device that can control DC motor will be developed.

1.3 Objective

The project is implemented in order to achieve the following objectives which are:

(a) To develop a system that can control the movement of a wheelchair by using android.
(b) To design android control interfaces which are D-pad, Joystick and voice.
(c) To design android system that can control electrical appliances.

1.4 Scope of Project

The scope of this project is to study the basic of android from several published papers and books as well as to study the code used to control the movement of the Android-based wheelchair controller. This project focus mainly on how to apply what that have been learned about the android application. The parameters for this project can be divided into several parts which are:

1.4.1 The basic concept of android application

In this project, android application is used to control the movement of the wheelchair. Android is a software bunch comprising not only operating system but also middleware and key applications. Android applications can control two electrical appliances and dc motor.

1.4.2 The basic movement of the wheelchair

The movement of the wheelchair is controlled by the android application. The wheelchair can move to the right and to the left as well as move forward and backward. All of these movements can be controlled by using android application.

1.5 Project Methodology

In order to produce a good project, there are several procedures that must be followed. Initially, information about the wheelchair problem must be identified. Then, more information about the wheelchair problem is gathered from the journals, internet, books and also articles. Besides that, the research continues with the search on the basic concept of android application and also search on coding for basic4android software to be programmed at the android device. Next, after finishing the research, the coding will be simulated in Android Visual Device (AVD) or android phone in order to identify whether the coding can be simulated without any error. After that, the hardware for the android-based wheelchair controller will be designed. Lastly, the hardware will be combined with the coding to get the complete android-based wheelchair controller that will be controlled by android device.

1.6 Thesis Structure

Chapter 1:

The first chapter introduces brief idea of the project. It focused on the overview of the project, detailing the objectives, the problem statement, scope and outcome of the project.

Chapter 2:

Projects background is discussed in this chapter. The method concept, theory, and some characteristic of component of hardware that are used in this project is discussed in this chapter. This chapter also defines terms used in this project and discussed the concept of the research and how it is related with the theory.

Chapter 3:

Chapter 3 describes the methodology used in this project. The schedule or steps that need to be completed and the detailed reports of studies that were done to achieve the aim of the project are presented.

Chapter 4:

Chapter four presents the result and discussion. All the simulations, data collection and analysis obtained will be discussed in detail. The results will be compared with the objectives outlined in order to arrive to some hypothesis and conclusion.

Chapter 5:

Chapter five states the conclusion and future work that can be undertaken. Some recommendations and suggestion on how to improve the performance of the system based on the desired results will be given.

CHAPTER 2
LITERATURE REVIEW

This chapter presents literature review on the development of the wheelchair control as well as android system. The development of the different control system of the wheelchair that aim to help disable people to move freely is discussed. The advantages and disadvantages of each wheel chair development are also presented and compared. This chapter also presents the development of the android system as android system will be utilized in this project.

2.1 Wheelchairs History

To improve quality of life for the elderly and disabled people, electric-powered wheelchairs (EPWs) have been frequently deployed over the last 20 years. In response to the demands of wheelchair users for equal access, hand-propelled wheelchairs, electrically controlled wheelchairs, and automated-guided wheelchairs have been developed.

The development of wheelchair have begun over the past 1000 years and the designs of the wheelchair have been changed within recent decade.

2.2 Previous Development of Wheel Chair Technology

2.2.1 Development of Autonomous Robotic Wheelchair Controller Using Embedded Systems

Chung, Hung, Chin and Ko (2007) developed Autonomous Robotic Wheelchair Controller Using Embedded Systems. In general, an autonomous robotic wheelchair includes the techniques of obstacle sensing and avoidance, local path navigation, and friendly interactions with users when compared to conventional powered wheelchairs. Most of researches on autonomous robotic wheelchairs used the personal computer as the supervisory controller since its powerful computing capacity and familiar coding environment. Nevertheless, the personal computer is not feasible to the wheelchair users due to inefficient size, lower reliability and larger power consumptions.

By using the embedded computing architecture, the proposed robotic wheelchair controller performs characteristics of compact size, better reliability and lower power consumptions while the benefits of powerful computing capacity and familiar coding environment are maintained. Theses fuzzy logic based navigation functions are fused together to solve practical situations of the robotic wheelchairs.

2.2.2 Voice Activated Wheelchair Controller

Rockland (1998) has done simulation of voice activated wheelchair controller. The Voice Activated Wheelchair Controller (VAWC) project was designed to develop a feasibility model for activating a wheelchair using a low-cost speech recognition system. A microcontroller was programmed to provide user control over each command, as well as to prevent voice commands from being issued accidentally.

An AES-88 microcontroller trainer (AESCorporation) was used as the main CPU for the system. The output from the SRS came from the seven segment displays, since each word could be associated with a number. The microcontroller program contained a table, which associated each number with the specific word.

2.2.3 Electronic Wheelchair Controller Designed For Operation By Handoperated Joystick, Ultrasonic Non-Contact Head Control And Utterance From A Small Word-Command Vocabulary

CoFle (1995) has developed electronic wheelchair controller by handoperated joystick. The primary objective at the outset of the research and development undertaken in this project was to investigate use of non-invasive control mechanisms to assist seriously disabled wheelchair users. An entire range of 'contact' switches exists such as pneumatic chin operated switches, tilt and touchswitches. Although undoubtedly useful in certain situations.

The project microprocessor design was carried out using the Motorola M68705R3 controller. More recently this work has been updated and replaced using the popular Motorola microcontroller MC68HC 11.Control programmes were written in assembly language mnemonics and assembled and simulated using ASMHCI 1 and PCBUGI 11 respectively.The principal design programme processes information inputted on two lines assigned to apotentiometric joystick. Positional adjustment of the joystick results in two low level analogue voltage signals on output channels of the potentiometer. Digital signals on the microcontroller output lines are latched and passed through D to Aconverters (ZN559E) resulting in analogue voltages which are further scaled and fed to the controlling pins of the UC3637 PWM converters This in turn effects speed and directional movement of the wheelchair motors and wheels.