UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HUMAN MOVEMENT SUPPORT USING RADIO FREQUENCY

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronic Engineering Technology (Telecommunications) with Honours

by

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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 Bachelor's Degree in Electronic Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

.....

(HASRUL' NISHAM BIN ROSLY)

ABSTRAK

Project Human support Movement ini dikawal oleh peranti Radio Frekuensi. Di mana menggunakan Arduino sebagai satu medium yang bertindak mengawal keseluruhan projek. Setiap manusia mempunyai keupayaan yang berbeza dan terhad seperti keupayaan dari segi melakukan kerja dan pergerakkan yang lebih banyak dari biasa Tujuan projek ini adalah untuk meringankan beban kerja manusia. Selain itu, tujuan projek ini juga memberi sokongan untuk memudahkan manusia dalam pergerakan. Pada bahagian litar penerima, penerima RF akan menyahkod isyarat RF yang dihantar oleh pengguna dengan menggunakan peranti RF sebagai pengantaran dan kemudian dihantar kepada pengawal mikro (arduino). Kemudian pengawal mikro mengesan isyarat yang diterjemahkan dan memandu pemandu motor itu untuk menghidupkan motor. Ciri-ciri projek ini ialah dapat memuatkan beban sehingga maksimum 70 kg dan boleh dikawal sehingga jarak 70 meter.

ABSTRACT

The project is Human Support Movement control by Radio Frequency device. It used Arduino as medium to control the movement. Every human have difference capability. People with limited ability may have trouble while moving and working. The purpose of the project is to ease human work load. In other hand, It gave support to disable people in their movement. At the receiver circuit, RF receiver will decode RF signal transmit by user and then pass it to microcontroller (arduino). After that microcontroller will detect the decode signal and drive the motor driver thus turn on the motor. The feature of this project is that it load up to 70kg maximum and can be remote at a range of 70 meter.

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DEDICATION

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

This thesis is dedicated to

My beloved family,
My Friends,
and my lecturer
Thanks for their encouragement and support.

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I would like to express my heartily and sincerity thankfulness to my project supervisor , Mr Hasrul' Nisham Bin Rosly for the guidance, advices, encouragement and attention given throughout the development of my final year project and while writing this report Human Movement Support using Radio Frequency. Without his continued support and interest, the project would not be like what it likes today.

My gratitude goes to my beloved family and all my friends that always gives courage and supports me to achieve the goal of my project. Thank for their moral support and great care that they had given to me. Even though they are not always with me, but the family bond keeps us together every moment.

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LIST OF SYMBOLS AND ABBREVIATIONS

AM	Amplitude Modulation
AC	Alternating Current
BR	Basic Rate
DC	Direct Current
FM	Frequency Modulation
IDE	Integrated development environment
LE	Low Energy
PSoc	Programmable System-on-Chip
PSM	Projek Sarjana Muda
PWM	Pulse Width modulation
RC	Radio controlled
RCW	Remote Control Wheelchair
RFID	Radio Frequency Identification Detector
SIG	Special Interest Group
USB	Universal Serial Bus
UTEM	Universiti Teknikal Malaysia Melaka

CHAPTER 1
INTRODUCTION

1.1 Overview

This chapter will briefly discuss on the project background. This chapter also elaborates the problem statement, the objective of this project, and the scope of this project.

1.2 Project Background

Human Movement Support using radio frequency is a product that will ease the burden of unable person to walk, to carry and to lift thing. Human Movement Support is eco-green because not produce smoke. This product is equipped with fully automatic remote control. The connection between remote control and this product is based on RF transmitter receiver and transmitter. This product use three magnetic motor to move this product. Besides, Arduino transmitter and receiver kit is using to control the movement of wheel to turn right, turn left ,forward and reverse.

Motors dc take electrical energy and produce mechanical energy. It usually provides rotary mechanical motion. The machines that utilizes the properties of a magnet for mechanical energy. It suitable for systems that use electrical input along with magnetic.

Radio frequency is a small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through Radio Frequency (RF) communication.

1.3 Objectives

The objectives of this project are as stated below:

1) To study about Arduino and radio frequency.

2) To design and develop Human Support Movement to easy to use and eco-green.

3) Construct and implement Human Support Movement via Radio frequency.

1.4 Problem Statements

1) **Student and Staff have to walk for a long distance at university**.

Student and staff have to walk for a long distance, as university covered with a wide area. The distance between car park to lecture hall are distant, including the distance to practical laboratories. The distance are tiring and exhausting for staff and student thus ignite uncomfortable situation as their arrival at lecture hall. With the aid of this device, it will help in overcome the drawback of the situation.

2) Need to carry a huge stuff with bare hands.

This device will be able to lift heavy loads and objects, for a long distance when being put on it .With the aid of this device, task and situation will be more efficient and less tiring for human being, specifically for students and staff.

3) Security force use extra energy when patrolling around shopping mall.

Normally, security Department/forces need to patrol every 2 hours. By the aid of this device, security patrol will be able to patrol around the mall complex without wasting too much of energy.

1.5 Project Scope

This project is focusing on developing a human movement by using radio frequency to turn on magnetic motor by transmitter frequency for a long distance application.

The scope of work for this project is:

1. Analyze the radio frequency (transmitter and receiver).
2. Determine the right magnetic motor (with suitable torque).
3. To test the Arduino radio frequency successful or not.
4. Design and implement of Human Support Movement to suitable and safety to use.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Literature review has been carried out throughout the whole project to obtain realistic information in completing this project. The main sources for this project are previous projects carried out by scientist and other sources such as books, journals and articles, where being obtained from SciVerse Science Direct and other reliable sources on human movement and radio frequency. This chapter also elaborates about related research which being conducted from previous project.

2.2 Radio and Frequency Local Area [1]

2.2.1 Invention

The present invention relates to an apparatus and a method for transmitting data between Radio Frequency (RF) terminals and one or more host computers, and more particularly, to an apparatus and a method of efficiently routing data through a network of intermediate base stations in a radio data communication system.

The present invention solves many of the problems inherent in a multiple-hop data communication system. The present invention comprises an RF Local-Area Network capable of efficient and dynamic handling of data by routing communications between the RF terminals and the host computer through a network of intermediate base stations. In one embodiment of the present invention, the RF data communication system contains one or more host computers and multiple gateways, bridges, and RF terminals. Gateways are used to pass messages to and from a host computer and the RF Network. A host port is used to provide a link between the gateway and the host computer. In addition, gateways may include bridging

functions and may pas information from one RF terminal to another. Bridges are intermediate relay nodes which repeat data messages. Bridges can repeat data to and from bridges, gateways and RF terminals and are used to extend the range of the gateways. The RF terminals are attached logically to the host computer and use a network formed by a gateway and the bridges to communicate with the host computer. To set up the network, an optimal spanning tree is created to control the flow of data communication. The roots of the spanning tree are at the gateways; the branches are the bridges; and non-bridging stations, such as RF terminals, are the leaves of the tree. Data are sent along the branches of the newly created optimal spanning tree. Nodes in the network use a backward learning technique to route packets along the correct branches. One object of the present invention is to route data efficiently dynamically, and without looping.

Another object of the present invention is to make the routing of the data transparent to the RF terminals. The RF terminals, transmitting data intended for the host computer, are unaffected by the means ultimately used by the RF Network to deliver their data. It is a further object of the present invention for the network to be capable of handling RF terminal mobility and lost nodes with minimal impact on the entire RF data communication system.

2.3 RF Transmitter and Receiver

An RF module (radio frequency module) is a (usually) small electronic devices used to transmit and receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and receiver.

RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency. In addition, reliable RF communication circuit requires careful monitoring of the manufacturing process to ensure that the RF performance is not adversely affected. Finally, radio circuits are usually subject to limits on radiated emissions, and require

Conformance testing and certification by a standardization organization such as ETSI or the U.S. Federal Communications Commission (FCC).

For these reasons, design engineers will often design a circuit for an application which requires radio communication and then "drop in" a pre-made radio module rather than attempt a discrete design, saving time and money on development. RF modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are sometimes used to replace older infra red communication designs as they have the advantage of not requiring line-of-sight operation

2.3.1 Commercial Applications

Research has been done to extend the range on radio transmission and according to the company Linear Access [2], its industrial and commercial grade radio receiver and transmitter can operate at distances greater than 20 miles. This receiver is three times more immune to noise interference due to its sensitivity of a -118db. With. Radio transmitters can also be implemented in to embedded devices using the ATMEL 8-bit Microcontroller [3] which is designed to interface with a 2.4 GHz transceiver through proto-board header pins. The small radio transmitter receiver system uses a 1.5V-3V power source, but only operates on two different frequencies, 35 MHz and 2.5 GHz.

2.3.2 Underlying Technology

The fundamental component of a radio frequency transmitter is its frequency oscillator. An oscillator modulated with an information signal then carried out to an antenna where it can be broadcast to a radio receiver. The receiver then accepts the radio signal and demodulates the signal using its own oscillator, and the original signal is obtained. Due to the variability in location of the receiver, an amplifier is used to boost the demodulated signal to a use able level. The frequency ranges used are from 3Hz – 300 GHz [8]. The whole radio spectrum is partitioned to several different ranges in order to decrease traffic and noise. Interference will

occur when multiple devices are trying to use the same frequency. Information such as audio and television pictures are modulated differently depending on the application. AM radios are broadcasted at 30Hz-300 kHz [8], while wireless networks and door openers operate at 3Hz-30 GHz [8].

2.3.3 Building Blocks for Implementing the Technology

The radio transmitter is comprised of an information signal, oscillator, and modulator. An LC Oscillator [8] is a simple implementation for an oscillator, and can be used with a modulator to modulate information signal with the oscillator and carry it to the antenna where it can broadcasted. Modulation can be implemented with an op amp. The two most common forms of modulation are Amplitude Modulation (AM) and Frequency Modulation (FM). Amplitude Modulation forces the amplitude of the oscillator to vary with the information signal, while Frequency Modulation allows the frequency of the oscillator to vary with the information signal. The components to a radio receiver are the antenna, tuner, amplifier, and demodulator [5]. When a radio signal is broadcast, the signal falls onto the radio receiver's antenna. The antenna transfers the radio signal to a tuner which utilizes a band-pass filter that has a high gain in the band-pass and a low gain at all other frequencies to suppress all other frequencies except the desired frequency that contains information. An amplifier is used to boost the signal and to raise the operating voltage of the demodulator. The demodulator is used to extract the information from the amplified signal. In an amplitude modulated signal, a rectifier diode [5] is used to extract the information from the signal. The information can then be carried to a speaker or data acquisition device where it can be played or processed.

2.4 Remote Control Technology

One of the existing technology available is radio controlled technology that have been used in the remote car control industry. RC technology are often use in the remote control car. Besides, RC consist four specific part in order to make RC technology work properly. Basicly RC tecnology have transmitter, receiver, motor and a power source. The remote control will

acts as a transmitter. Antenna and circuit board inside the RC toy will act as receiver. The receiver receives the signals that is send to the RC car through the transmitter so the car can be controlled by user. To control the RC toy, transmitter will sends radio waves to the receiver. The transmitter must has power source. The power source are either power engine or rechargeable batery.

2.5 Remote Controlled Wheelchair [9]

Figure 2.1 : Remote Controlled Wheelchair

The Remote Control Wheelchair (RCW) is a system equipped with an onboard controller similar to a traditional powered wheelchair. However, RCW is an alternatif version of this concept but the add of a few components and adjustment. Taking existing systems into consideration, the RCW aims to improve the safety for the wheelchair bound individual. This will be achieved by the use of controls and sensors.

In addition to the onboard controls, the RCW is equipped with a remote control that allows caregivers to drive the wheelchair from an external location. It is also equipped with an emergency stop button to allow for an immediate halt if an emergency occurs. A laser range finder is used to detect steep drop in front of the wheelchair. Ultrasonic sensors are used to

detect nearby objects. These sensors are used to prevent collision into objects and avoid drop-offs.

The RCW aims to improve the quality of life of physically or cognitively disabled individuals by giving them independent movement capabilities. Person use this wheel can move with easy when the wheelchair approaches an obstacle, the sensors will prevent the wheelchair from colliding into objects or falling down a plane. LEDs will indicate when objects are detected and determined to be a hazard. The caretaker will supervise the wheelchair bound individual and determine if they are fit to operate the wheelchair. If the caretaker determines that the wheelchair bound individual is not fit to operate the wheelchair, the caretaker will take over control of the wheelchair remotely. An indicator on the wheelchair will show who has control.

2.5.1 Hardware Block Diagram

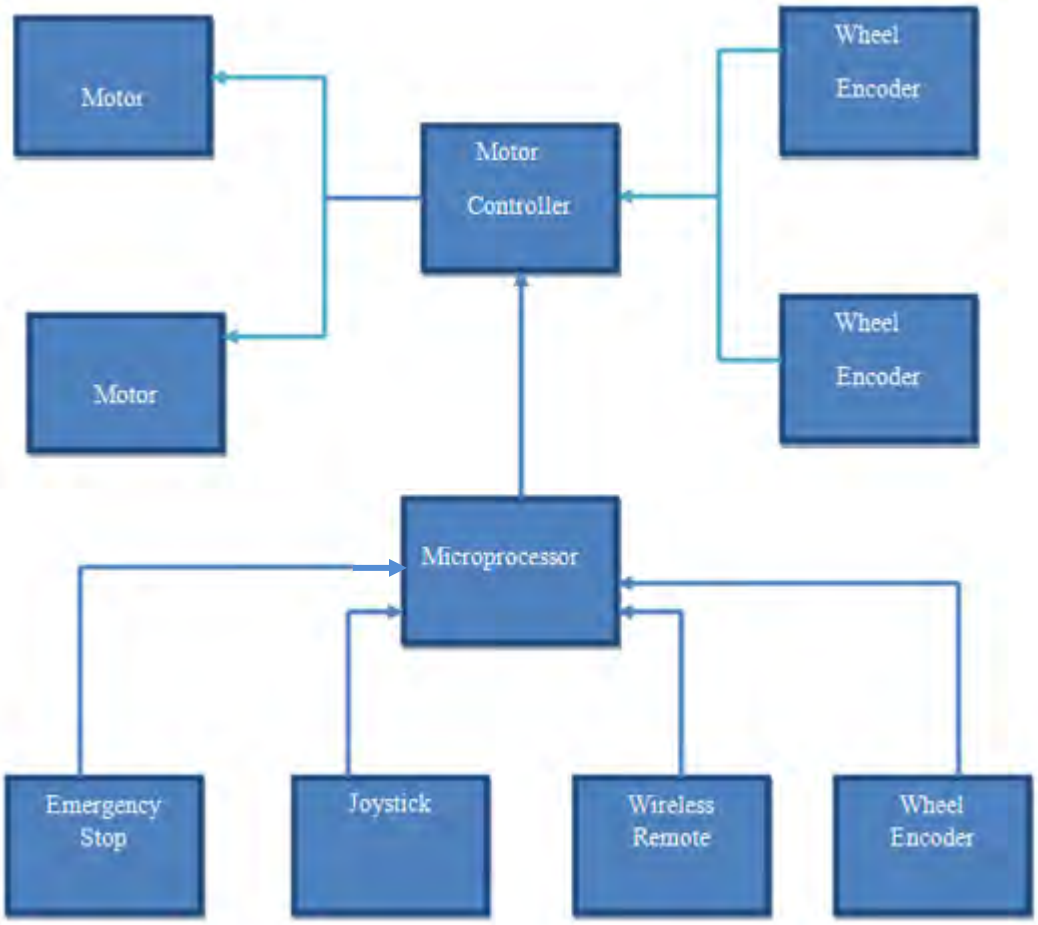

Figure 2.2 : The hardware diagram of the Remote Control Wheelchair

Compared between the use of 802.11 interfaces and Bluetooth, the Bluetooth becomes a better option in terms of wireless communication because of its lower power consumption and more range of usability. With this compatible with the microcontroller, the device can move freely with the caretaker is ensure within the range. However, there are other option that are available for wireless communication but due to the time and hardware option available nearby, these 2 become the only option that can be used at the moment. Within the PSoC