ULTRASONIC AVOIDANCE SYSTEM FOR MOTORIZED WHEELCHAIR APPLICATION

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Industrial Electronic)

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I would to dedicate this thesis to my family and somebody special, whose encouragement and support with a great help in completing it

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ABSTRACT

The purpose of this project is to develop an ultrasonic avoidance system for motorized wheelchair application. This system allow the wheelchair to change its path automatically when there are static objects that obstructing it. Overall this project used the ultrasonic sensor to detect the object obstructs the wheelchair. The ultrasonic sensor will send output signal to PIC to process and then the output from the PIC will trigger the motor to change it way to either left or right direction. But before the PIC trigger the motor, the infrared sensor placed on left and right side of the wheelchair will check whether there is any object is on the wheelchair path before changes its path to the left or right. The main objective of this project is to help handicap user automatically maneuver the wheelchair out of dangerous situation and avoid the wheelchair from colliding with any static objects by using the ultrasonic sensor.

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ABSTRAK

Projek ini bertujuan bagi menghasilkan satu sistem yang akan diaplikasikan pada kerusi roda dimana secara automatiknya sistem ini membolehkan kerusi roda tersebut menukar laluannya sendiri sekiranya terdapat objek yang menghalang laluan. Secara keseluruhannya sistem ini menggunakan penderia ultrabunyi bagi mengesan objek yang menghalang laluan kerusi roda. Apabila penderia ultrabunyi mengesan objek yang menghalang laluan kerusi roda, isyarat akan dihantar ke 'PIC' dan seterusnya diproses untuk kerusi roda menukar haluannya secara automatic samada ke kiri atau ke kanan bagi mengelakkan dari berlakunya perlanggaran dengan objek yang menghalang laluannya. Pergerakkan motor samada ke kiri atau ke kanan akan ditentukan pula oleh penderia infra merah yang terdapat dikiri dan dikanan kerusi roda dengan memeriksa terlebih dahulu samada terdapat objek atau tidak sebelum membuat pusingan. Tujuan utama sistem ini dibina adalah untuk memastikan pengguna kerusi roda berada dalam keadaan yang selamat disamping memudahkan lagi pengguna kerusi roda yang kurang upaya tanpa perlu menggerakkan kerusi roda mereka.

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LIST OF ABREVIATIONS

PSM	-	Projek Sarjana Muda
PIC	-	Peripheral Interface Controller
PCB	-	Printed Circuit Board
I/O	-	Input and Output
A/D	-	Analog to Digital
IR	-	Infrared
DC	-	Direct Current
MOSFET	-	Metal Oxide Semiconductor Field-Effect Transistor
IC	-	Integrated Circuit
UART	-	Universal Asynchronous Receiver Transmitter
CPU	-	Central Processing Unit
BASIC	-	Beginner's All-Purpose Symbolic Instruction Code
PWM	-	Pulse Width Modulation
V	-	Voltage

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CHAPTER I

INTRODUCTION

This chapter explains about the introduction to the project, problem statement, objectives and scope of the work for the project. It also has some explanation about the methodology that is used for this project.

1.1 Introduction to Project

This project is about an ultrasonic avoidance system for motorized wheelchair application. This system controls the wheelchair movement from colliding by detecting objects in several distances. This system enables the wheelchair to detect any static object in front of it and changed its way to avoid the collision with that object. The wheelchair continues to move after it changed the way and when no more objects in front of it. For this system, the ultrasonic sensor placed in front of the wheelchair used to detect the object that obstructs the wheelchair. Besides that, there are two dc motor added to control movement to left and right of the wheelchair movement.

The entire program of this system was controlled by using PIC microcontroller. PIC microcontroller is an important part for this system because it is a main processing unit to process the output signal from the ultrasonic sensor and also controls the DC

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motor through the motor driver by controlling the movement and direction of the motor automatically.

1.2 Problem Statement

Mostly current wheelchair that is used today doesn't have a system that allows the wheelchair to automatically detect the object that obstructs the wheelchair. Sometimes the wheelchair user met with accident because the wheelchair is unable to avoid the objects in front of it. The problem has caused the creation of system that allows the wheelchair to automatically avoid collision with the static object at certain distance. This system has 1 ultrasonic sensor at the front and 2 infrared sensor at the left and right side of the wheelchair.

1.3 Objective of Project

The main objective of this project is to help the handicapped user to automatically maneuver the wheelchair out of dangerous situation by avoiding the wheelchair from colliding with static objects by implementing the ultrasonic collision avoidance system.

Second objective is to develop the PCB circuitry of PIC microcontroller and motor driver for the ultrasonic collision avoidance system and also to learn how to do the programming coding for the system by using the PIC microcontroller.

Third objective is to learn about the ultrasonic sensor and infrared sensor as it is very important for this project. It will send signal or data to microcontroller to activate the motor accurately. If the sensor cannot send the data at the perfect timing, motor will lose control and the wheelchair cannot perform its operation.

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1.4 Scope of Work

The scope of work for this project is it covers the design of the hardware for the wheelchair that can detect static object that obstructing the movement of the wheelchair. This project will be focused on two circuits which are PIC circuit consisting 3 sensors and motor circuit. This project studies about the component movement detection system and the PIC programming. After that, this project is started by with developing and constructing the circuit and integrating it with the wheelchair. The main component of this project is the PIC microcontroller which requires the use of C language in order to build the program.

1.5 Methodology

Phase1:-

Discussing with supervisor, Mr Mazran bin Esro and show the project progress. More information gained about the ultrasonic avoidance system for motorized wheelchair application from supervisor, internet, books, journal, thesis, and so on. The concept & desired result for this system have to understand. After that, the datasheet of component is collected involved such as motor, sensor, IC and PIC microcontroller.

Phase2:-

For this phase, some research that relate to this project scope is done. So that the best method can be chosen. Literature survey is done from journal and internet.

Phase3:-

This phase includes circuit motor driver finding and PIC studied before proceed to the ultrasonic avoidance system for motorized wheelchair application system designed.

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Phase4:-

After the circuit that will be used is decided, the circuit function is simulated using the PROTEUS (ISIS 6 Professional) software. When the motor driver circuit successfully works in the simulation, construction of the circuit is done and tested.

Phase5:-

C programming language has been chosen as the programming language. For the programming the CCS C Compiler software is used to test the program whether it can be used or not. If successfully, the next stage is to run the programming by using the PROTEUS (ISIS 6 Professional) software to see whether the program can function with the circuit.

Phase6:-

Then the circuit operation had been tested. After finishing on testing circuit on the breadboard, the drawing of the PCB layout for motor driver and PIC circuit is done by using PROTEUS (ARES 6 Professional).

Phase7:-

The software part is combined with hardware part to get the final result. After that, the functional, ability & weakness of the circuit design is tested. The troubleshooting of the circuit is done if any error at the hardware and software part. The circuit also redesign if needed.

Phase 8:-

This phase is to design a casing for the system. This casing is to prevent the circuit from any damage. Finally, the submission of full report of this ultrasonic avoidance system for motorized wheelchair application is done.

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1.6 Thesis Structure

The thesis structure is about the flow of the project. This thesis has five chapters which are introduction, literature review, research methodology, result and discussion, and conclusion and suggestion.

Chapter I is about the project overviews the introduction of project, objective, problem statement, scope of work, and project methodology are briefly discussed which purposely is to provide the reader the basic understanding of the project.

Chapter II is embracing the literature review of the project which includes the concept, theory, perspective and the method of the project that is used in order to solve the problem occurred and any hypothesis that is related with the research of methodology.

Chapter III is about the research methodology of the project. This chapter will discuss the method or approach that is used in this project development including the hardware and software aspect.

Chapter IV is about result and discussion in the project. It also discusses briefly on the observation, results and the analysis of the project that is gained during the development of project. This chapter also consists of the recorded data analysis and the result of the project.

Chapter V is about the conclusion and suggestion after finishing. The suggestion is for improvement process in the future research and the conclusion is an overall review of the project.

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CHAPTER II

LITERATURE REVIEW

This chapter are describing about the literature review that has been studied to get information to complete the project.

2.1 Introduction to Ultrasonic Avoidance System for Motorized Wheelchair

Ultrasonic avoidance system for motorized wheelchair has the capability to detect the object that obstruct the wheelchair path and avoid from collision with that object.

The ultrasonic avoidance system for motorized wheelchair consists of three basic elements: PIC micro controller and it's associated with c programming, DC motor subsystem and sensory subsystem. For this project, the ultrasonic avoidance system for motorized wheelchair is constructed to prevent the handicapped user from any dangerous situation. This ultrasonic avoidance system for motorized wheelchair was programmed to detect the object that obstruct the wheelchair path and avoid it automatically. The basic block diagram of the ultrasonic avoidance system for motorized wheelchair is illustrated as the Figure 2.1.

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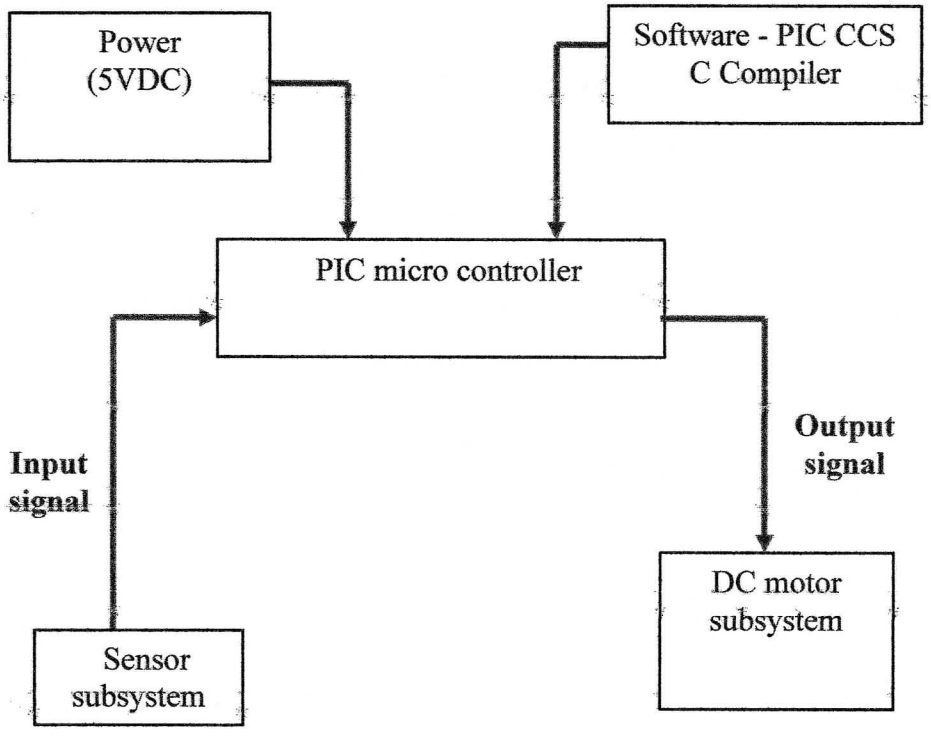

Figure 2.1 Basic block diagram of system

2.2 Overview of Obstacle Avoidance Wheelchair System

Earlier system that provided collision avoidance was developed by Scott and Munro in 1985. The wheelchair was driven using a joystick and provides collision avoidance using three ultrasonic sensors that are placed with one pointing forward, one to the left and one to the right. The chair would slow down if an obstacle that was less than one foot away on either side or less than six feet away in the front. The chair would hit an obstacle at a maximum speed of ¼ foot per second that allowing a user to pull up to a desk.

In 1981, 1983 and 1990 The Ultrasonic Head Controlled Wheelchair was build by Jaffe. He uses two ultrasonic sensors to measure forward, backward, left and right components of the motion of a user's head. This information can be used to drive a powered wheelchair with no navigation assistance or can be used with the assistive

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