VOICE CONTROLLED WHEELCHAIR

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PROJEK SARJANA MUDA II

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Sesi Pengajian : 2009/2010

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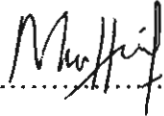(COP DAN TANDATANGAN PENYELIA)

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Tarikh: 30/04/10

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ABSTRACT

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people who is having difficulty to walk due to illness (physiological or physical), injury, or disability. In this project, the wheelchair is equipped with voice control or recognition module. The user can instruct the wheelchair through the voice recognition module(VRM) to move forward, backward, left or right. Ultrasonic sensor also is added to sense any obstruction.

The project scope will be used recognition module to move wheelchair to right, left, forward or backward direction, to use ultrasonic sensor to detect any obstacle, to design motor driving circuit, to design power supply for each module in the system and to troubleshoot the circuit should any problem arise. For this project, the voice controlled wheelchair is used voice recognition to control the wheelchair direction movement. A sensor is used to detect any barrier to make the wheelchair safe and reliable.

The expected outcome of this project is the wheelchair direction movement can be controlled by voices whether the wheelchair goes to the right, left, forward or backward direction. An additional sensor is included to sense any incoming barrier during the wheelchair movement.

ABSTRAK

Kerusi roda merupakan kenderaan yang mempunyai roda dimana pengguna boleh duduk di atasnya seperti kerusi biasa. Kerusi roda ini boleh digunakan secara manual (memutar roda dengan tangan) atau melalui sistem automatik. Kerusi roda digunakan oleh orang-orang yang mengalami kesukaran untuk berjalan disebabkan oleh penyakit (fisiologi ataupun fizikal), kecederaan, atau kecacatan. Dalam projek ini, kerusi roda dilengkapkan dengan alat kawalan suara. Pengguna boleh memberi arahan kepada kerusi roda melalui alat kawalan suara untuk menggerakannya ke hadapan, belakang, kiri atau kanan. Pengesan ultrasonic juga ditambah untuk mengesan sebarang halangan.

Skop projek ini tertumpu pada alat kawalan suara untuk menggerakkan kerusi roda ke arah kanan, kiri, hadapan atau belakang, menggunakan alat pengesan ultrasonik untuk mengesan apa jua halangan, mereka litar memandu motor, mereka bekalan kuasa untuk setiap modul di dalam sistem dan mengenalpasti setiap masalah yang berlaku. Bagi projek ini, alat kawalan suara digunakan untuk mengawal pergerakan arah kerusi roda. Alat pengesan digunakan untuk mengesan sebarang halangan untuk memastikan kerusi roda tersebut selamat dan dipercayai.

Jangkaan hasil daripada projek ini adalah arah pergerakan kerusi roda tersebut boleh dikawal dengan suara samada kerusi roda tersebut ke hadapan, belakang, kiri atau kanan. Alat pengesan disertakan untuk mengesan sebarang halangan semasa kerusi roda tersebut bergerak.

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CHAPTER I

INTRODUCTION

This chapter will briefly discuss on the project overview. The objective, scope, and thesis outline will be presented in this chapter.

1.1   Project Background

A wheelchair is a chair mounted on large wheels. It is designed to make mobility easier for a sick or disabled person.. A motorized wheelchair or electric-powered wheelchair (EPW) is a wheelchair that is moved around by means of an electric motor and navigational controls rather than manual power. Motorized wheelchairs are useful for those who are too weak to or otherwise unable to move around themselves in a manual wheelchair. They may also be issued to those with cardiovascular conditions. Figure 1.1 shows the flow from voice recognition module(VRM) and ultrasonic sensor to motor controlled wheelchair ; the VRM module and ultrasonic sensor will send the signal to PIC, then from PIC to motor control's wheelchair. An ultrasonic sensor functions when the wheelchair meet some obstacle during the wheelchair movement.
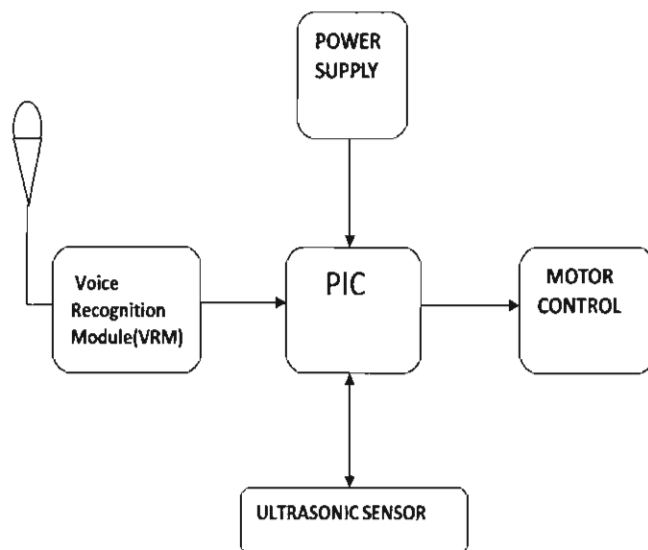
Figure 1.1 : Block Diagram of Voice Controlled Wheelchair

1.2 Objectives

1) The objectives of this project are to design a wheelchair that can controlled by voice recognition module. Below are the main objectives:

1.2.1 To control wheelchair movement according to the requirement.

1.2.2 To use LED indicator to ensure the direction.

1.2.3 To determine suitable sensor usage.

1.2.4 To program PIC based on desired requirement.

1.3   Problem Statement

Some aspect such as safe, comfortable and efficient use of all transportation mode is needed for all wheelchair users.

This section discusses the relevant issues or problems in that the wheelchair user would face in their daily lives. These issues are divided into 3 aspects - *Physical*, *Psychological*, and *Socioeconomic*.

First would be the *Physical* aspect which delves into the tangible problems encountered by the wheelchair user and their difficulties in mobility once they leave the comfort of their homes. Under the *Physical Issues* would be information related to *Education, Food, Recreation, Sanitation, Shopping, Sports, Travel* and *Workplaces*.

Secondly, the Psychological aspect elaborates on the emotional and psychological welfare of a wheelchair user and gives a deeper insight at different stages of their disability.

Lastly, not forgetting the social and economic implications that the wheelchair user individuals face, this aspect focuses on how these people cope with society and more importantly their finances.

Every wheelchair has a different design and feel, so it is wise to add some additional function to make user feel comfort and safe such as attach voice recognition module and sensor.

1.4   Scope of Work

An undergraduate project is noted that it is not expected to be perfect design. To fulfill the requirement of the project, there must be a border in which the student should attain. This project scopes are list as below :

1.4.1   To use recognition module to move wheelchair to right, left, forward or backward direction.

1.4.2   To use ultrasonic sensor to detect any barrier.

1.4.3   To design motor driving circuit.

1.4.4   To design power supply for each module in the system.

1.4.5   To troubleshoot the circuit problem.

1.5   Expected Outcome

The expected outcome of this project is the wheelchair direction movement can be controlled by voice whether the wheelchair goes to the right, left, forward or backward direction. The additional sensor also will be added to sense any incoming barrier during the wheelchair movement.

1.6   Project Methodology

This part will explain about the path that was taken for the hardware realization. First, before start of the project, the information and knowledge about recognition module, sensor system and PIC was analyzed. This is the first method called literature review. The information about wheelchair motor and sensor system is found from the internet, books and others. From the sources, the aspects involved with this project like circuit used and type of sensor can be determined. Following that, the best one was chosen to the project.

For this project, the voice controlled wheelchair will use voice recognition to control the wheelchair direction movement. A sensor will be used to detect any barrier to make the wheelchair more safe and reliable.

Generally, the role of the sensor system is to read the data from the sensing element itself, and deliver it in the form required by the user (be it a human being or an information system) and the user of the sensor's output(data or information) is called the 'application'. For this project, ultrasonic sensor was chosen. The types and how does it work was studied in detail during this project.

Then, the PIC need to be programmed based on requirement. The suitable programming software was chosen. Next, verify the coding. If any error, reprogram the PIC. Lastly, the overall circuit will be troubleshoots and tested. The case for the entire circuit is designed where the wheelchair can move forward, backward, right or left by using voice controlled system.

1.7   Working Flowchart

START

LITERATURE STUDY

RECOGNITION MODULE

Find a good configuration

Design a circuit connection to PIC

Design LED indicator

Design LED indicator's circuit connection to VRM

NO

Circuits Testing & Troubleshooting

NO

YES

ULTRASONIC SENSOR (US)

Design of US circuit and fabricate

Ultrasonic connection

NO

Circuits Testing & Troubleshooting

YES

MOTOR CONTROL CIRCUIT

Design of H-bridge circuit

Use switch and suitable IC and relay to run the motor

NO

Use proper motor to move the wheelchair

Circuits Testing & Troubleshooting

A   YES

CONTINUE...

A

```
        ┌─────────────────────────┐
        │  POWER SUPPLY MODULE    │
        └─────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────┐
        │  Power to run PIC, VRM, │
        │  and US are used low    │
        │  current               │
        └─────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────┐
        │  Power to run Relays and│
        │  Motor are used high    │
        │  current               │
        └─────────────────────────┘
                    │
                    ▼
            Circuits Testing &
            Troubleshooting
                    │
                    ▼
        ┌─────────────────────────┐
        │      HARDWARE           │
        │     REALIZATION         │
        └─────────────────────────┘
                    │
                    ▼
                (  END  )
```

Figure 1.2 : Flow chart

PERANCANGAN PROJEK

SENARAIKAN AKTIVITI-AKTIVITI UTAMA YANG DICADANGKAN. NYATAKAN JANGKA MASA YANG DIPERLUKAN BAGI SETIAP AKTIVITI.

Timeline header (left to right):

2009: JULAI (1 2 3 4), OGOS (5 6 7 8), SEPTEMBER (9 10 11), OKTOBER (12 13 14 15 16), NOVEMBER (17 18 19 20), DISEMBER (1 2 3 4), JANUARI (5 6 7 8)

2010: FEBRUARI (9 10 11 12), MAC (13 14 15 16), APRIL (17 18 19 20)

Semester / break markings:
- TAKLIMAT PSM
- CUTI PERTENGAHAN (OGOS)
- PEMBENTANGAN PSM (SEPTEMBER)
- CUTI ULANGKAJI (OKTOBER)
- PEPERIKSAAN AKHIR SEMESTER (NOVEMBER)
- CUTI AKHIR SEMESTER (NOVEMBER)
- CUTI PERTENGAHAN (JANUARI)
- CUTI ULANGKAJI (MAC)
- PEPERIKSAAN AKHIR SEMESTER (APRIL)

AKTIVITI PROJEK:

- PROPOSAL
- LITERATURE RIVEW
- RECOGNITION MODULE
  - -find a good configuration and test.
  - -design LED indicator.
  - -design a circuit connection to PIC and test.
- ULTRASONIC SENSOR
  - design of ultrasonic circuit, fabricate and test.
  - ultrasonic connection and ...
- MOTOR CONTROL RCUIT
  - design & test of H-bridge cuit.
  - use switch to run motor ntrol.
  - use suitable IC & relay to ... the motor.
  - use proper motor move the wheelchair.
- POWER SUPPLY MODULE
  - -Power to run PIC, VRM, and US are used low current.
  - -Power to run Relays and Motor are used high current.
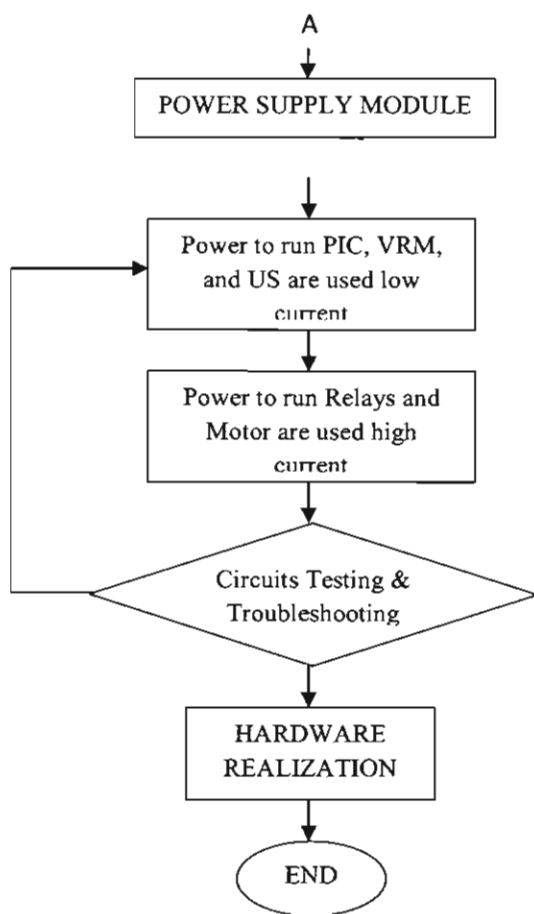- CIRCUITS
- STRUCTURE
- TROUBLESHOOT
- FINAL REPORT

1.8   Thesis Outline

This thesis is divided into five chapters. In chapter one, an introduction of Voice Controlled Wheelchair is presented along with the project objective, problem statement, scope of work, expected outcome and methodology in order to achieve the desired goal.

Chapter two provides a literature reviews on the research of the components that are used in the project.

Chapter three describes the overall project that has been identified along with an explanation of programming and hardware design.

Chapter four shows the results that have been obtained along with the discussion.

Finally, chapter five discusses the conclusion and some suggestions to make this project much better.

CHAPTER II

LITERATURE REVIEW

This chapter explains literature review based on current and exist technologies and information has been done in order to create a specific research about this project. Research hypothesis is been described clearly.

There are different types of voice recognition module such as SRI-01, SRI-02, SRI-03, SR-06, and SR-07. The SRI-03 has ten (1-10) numbered logic outputs. Each output corresponds to one target word. Output is activated when word is recognized. Using this interface allows the Speech Recognition Kit to active or deactivate 10 electrical circuits or devices using the TTL logic signal. This SRI-03 speech recognition different with SR-06. The SR-06 performs speech recognition independently in a stand alone mode, or it can function as a slave to a host processor in CPU mode. In stand alone mode, the circuit can recognize up to 40 words lasting one second each [1].

The voice recognition module can be use in technology such as Speech Controlled Robotic Arm(SCRA). The SCRA incorporates three kits; the OWI Robotic Arm, SR-06 Speech Recognition Circuit and the SRI-01 OWI speech interface circuit. By connecting these kits together, a powerful speech control system capable of controlling the OWI-Robotic Arm Trainer using voice commands. The SR-06 speech

recognition circuit allows us to train any word in any language to control the robotic arm. For voice controlled wheelchair, SR-06 has been chosen.
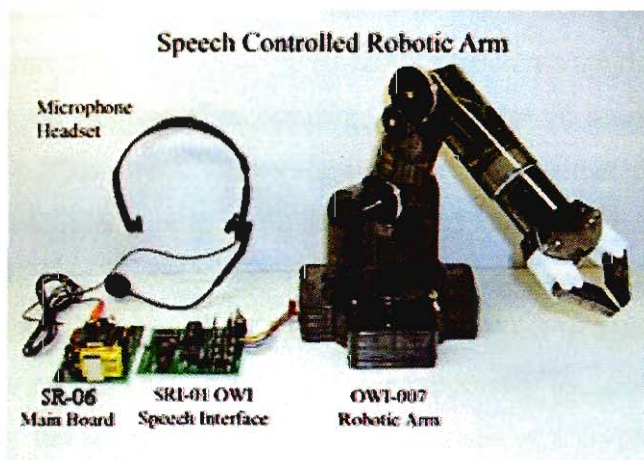

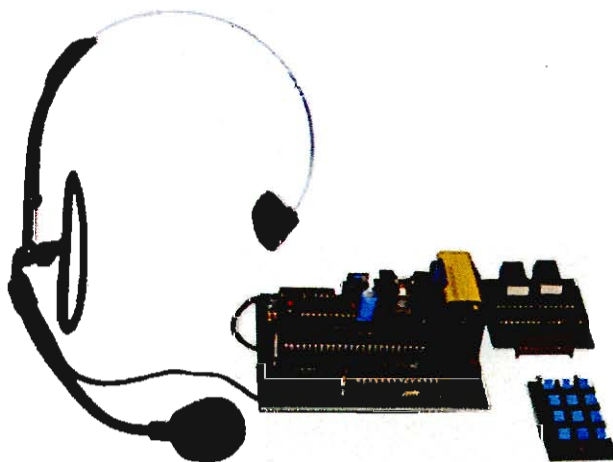Figure 2.1 : Speech Controlled Robotic Arm

2.1 Voice Recognition Module (VRM)/ Speech Recognition Module

Figure 2.2 : Voice Recognition Module SR-06