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Controlled Wheelchair by Head Motion

Mohammed Nabil AL-Thaibani

Loay Nabil AL-Saeedi

Shehab Mohammed AL-Sayaghi

Ramzi Raoof Saran

Ramzi Ali AL-Roainy

Supervised By:

Dr: Mohammed Al-Olofi

Dr.Waleed Al-Talabi

UAE University
High Education Ministry
Republic of Yemen

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Contact Information

Author1: Loay AL-Saeedi

Email: loay.252.2013@gmail.com

Mobile NO: +967771121564

Author: Mohammed AL-Thebany

Email:

Mobile: +967775315025

Author2: Shehab AL-Sayaghi

Email:

Mobile No: +967773155445

Author: Ramzi Sarran

Email:

Mobile: +967777714029

Author: Ramzi AL-Roainy

Email:

Mobile: +697772446044

Abstract

An electric wheelchair is propelled by means of an electric motor rather than manually. Persons with mobility impairments often traditionally use these. Quadriplegics are one of the many physically disabled people that require such electric wheelchairs. They have paralysis of all four limbs and the torso that may be caused due to spinal cord injuries, strokes or cerebral palsy. They have no control over their hand movements and cannot grasp things or perform motions that might allow them independence over their movements.

They only have control over their head motions. For this reason, a head-motion controlled wheelchair would provide them with the flexibility of navigation. The tilting movements of the head in the four directions-forward, backward, right or left-would cause the wheelchair to move in the signalled directions. This paper represents a novel approach to developing a head-motion controlled wheelchair and aims to replicate the electric wheelchair on a small-scale basis and show its working and advantages over other electric wheelchairs available in the market.

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Chapter: Introduction

1.1 General overview

The introductory chapter describes the need for and benefits of wheelchairs and systems for their provision. It also defines the requirements of adequate wheelchairs and introduces the reader to the stakeholders and their roles.

Perhaps the most important fields of this technology is motion recognition that is human needed in most areas of his life, especially those who suffering from physical disability, such as not being able to move, and who cannot act like a human being normal, and now with the use of head motion recognition has become a unable human life is easier as he be able to control his movement alone and without help others.

It is a wheelchair through the movement of the head to alleviate the suffering of people with quadriplegia and give them another opportunity to move freely. The sensor to be moved towards it was filled using an intelligence algorithm, and in addition, a sensor (HC-SR04) was implanted under the chair and a certain distance was determined to prevent the chair from colliding with fixed objects or falling into holes.

And here, we began our thinking and our search to find an effective system capable of providing service to the community, whose member suffers from a deficit in the movement and thus achieve psychological comfort and reassurance to them.

1.2 The Problem Statement

- What are the needs of this project?
- What are the difficulties we encountered?
- Why specially we select this project ?
- What are the benefits of making this project?

1.3 The History of Wheelchairs and Their Development

Wheelchairs are one of the most effective and widely used types of medical support devices today. They are used in hospitals, retirement homes and private dwellings. There are dozens and dozens of wheelchair types. They are manual or electric power. They are made for indoors or outdoors, and there are countless customizable features that allow you to choose the perfect wheelchair configuration to meet your functional and comfort needs.

- **5th century BCE:** The earliest record of a device resembling a wheelchair dates back to China. Early versions came from wheeled furniture designs. It’s believed the Chinese used wheelbarrows to move disabled people around.

- **12th century:** It’s believed the concept of the wheelbarrow and crude versions of the wheelchair began to be used around this time in Europe.

- **1655:** The first self-propelled wheelchair is developed. It was invented in Germany by disabled watchmaker Stephan Farfler. His design included three wheels and he could move it with the use of a rotary handle on the front wheel. Around the same time frame, German inventor and mechanic, Johann Hautsch, developed a series of rolling chairs.

- **18th century:** Wheelchairs began to become a normal fixture in medical catalogues. They were advertised as transportation devices for patients. They resembled armchairs with two larger wheels at the front and a smaller wheel at the back

- **The Future of Wheelchairs**
- There is no doubt modern wheelchairs have complex designs and functionality. Implementation of new technology, robotics and artificial intelligence will lead the way for future designs. We are now at the point in the development of the wheelchair where inventors are working on a device that allows people to control the wheelchair with their heads motion

1.4 Motivations and Contributions

Wheelchairs are the most common assistive or mobility devices for enhancing mobility with dignity. Besides the Convention, these guidelines are an expression of who is commitment at the Fifty-eighth World Health Assembly to provide support to Member States in building up a system for producing, distributing and servicing assistive devices who gives priority to the provision of affordable assistive devices of good quality.

These guidelines focus on head motion wheelchairs and the needs of long-term users. Some of the recommendations in the guidelines , however, are equally applicable to other types of mobility aid or device (such as hand-powered tricycles) and for other types of user.

1.5 Aims and Objectives

The main goal of this thesis is to facilitate the motion of paralytic patient who are totally disabled to move their body parts even their hands are disabled to shake. Here the benefit depends on controlled wheelchair by head motion and will make the mobility easer for patients to transport from area to another without difficulties.
There are also other goals of this thesis, and these are:

- To promote personal mobility with the greatest possible independence for people with disabilities.
- This project aims to alleviate the suffering of quadriplegic patients.
- This project aims to reduce material cost.
- His project Aims to transmission for advanced and easy-to-use technology.

1.6 General Idea

The idea in the design of this project focuses on the construction of four motion commands are used directly to move the wheelchair. The function of this project is to build an intelligent and accurate system in order to be able to identify the motion entered by moving the head and gives the best performance in response to these motion commands entered.

1.7 Methodology

1.6.1 Remote control

It is the device that moves the chair to the direction the user wants by means of a helmet or a head strap.

1.6.2 What this device?

It is a group of optical sensors that are located at the top of the chair in the form of a chair diagonal. These sensors receive the light emitted by the user's helmet, while the light emitted by the helmet is focused on one or two sensors and then sends a signal to the programmer, then the programmer sends an electrical signal to the electrical circuit related to This sensor is used to perform a specific movement, and these sensors include several movements, as shown in Figure (), and each free has an electrical circuit.

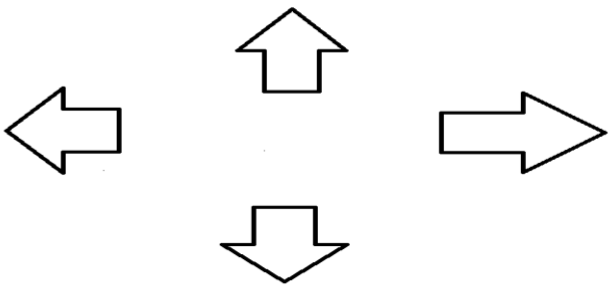


figure 1.5.2: direction of the wheelchair

1.6.3 Main ingredients

- LDR sensor
- Pic16f877A
- really 12v
- motor 12v

1.6.4 Working principle

The optical sensor is a variable resistance that decreases when light falls on it, as shown in the figure. When light is shone on the sensor, its resistance decreases

1.8 The Result

The stimulation output is done through proteus software. The simulation of This wheelchair is created for the disable patient those who lost their leg or paralyze of the leg. The aim of the project to use wheel chair without the help of companion. This can be further modified in future.

1.9 The project team

Project team consists of two groups of different specializations Engineering Communications group and Biomedical Group. Communications engineering team will be responsible for processing photolights signals and convert it to the orders and then the Biomedical teams will analyze such orders responsible for moving the wheelchair.

1.10 Literature Review

The principle of head motion recognition was presented many years ago, a lot of people and researcher worked and still works in this field to use it in different applications. By group search in the internet and university library they found different documents and papers in this field as following.

The first project : head motion Recognition Security System was done by SHR Lu (xl76) and Shihjia Lee (sl362), at 2006: The function of this speech recognition security system is to have a system that will only unlock upon recognizing a type password written by the administrator or password holder. In this project team work used a tiny Pic77a microcontroller to process head motion to discrimination between different directions.

The second one : was done by Khalid T. Al-Sarayreh, Rafa E. Al-Qutaish, Basil M. AlKasasbeh, Using the motion Recognition Techniques to Reduce the Electricity Consumption in Highways: This paper aims at using the sound recognition techniques in order to turn on the lights only when there are cars on the highway and only for some period of time. Linear Predictive Coding (LPC) method and feature extraction used to apply the motion recognition. Furthermore, the Vector Quantization (VQ) used to map the motion into groups in order to compare the tested ditections[Journal of American Science 2009].

finally: movement Control for Car Using the h-bridge driver was done by MartinPetriska, Dušan Považanec, Peter Fuchs. This paper presents a design of motion module designed for using in cars. The module communicates with driver by human head motion. It informs driver about the state of car equipments and recognizes his motion commands. This feature makes it easy to control a lot of car equipment by human head motion. The system consists of board with driver, large memories and analog codec. Accordingly actual situation in movement recognition and movement synthesis with aspect for application in car technology.

1.11 The plan team:

The following tables define the main tasks in the project introduction and project itself:

T1	Project Definition	1W
T2	Collecting data	2W
T3	Analysis	3W
T4	Theoretical calculation	4W
T5	Documentation	3W
T6	Prepare for presentation	2W

Table 1.1: Time scheduled table for project introduction

The time of the project introduction is scheduled over 12 weeks, table 2 shows how the work was scheduled over this time:

WEEKS / TASK	1	2	3	4	5	6	7	8	9	10	11	12
T1	■											
T2		■	■									
T3				■	■	■						
T4						■	■	■	■			
T5								■	■	■		
T6											■	■

The following table defines the main tasks in the project:

T1	Collecting data	3W
T2	Analysis	2W
T3	Implementation	4W
T4	Building and testing the system	3W
T5	Documentation	7W
T6	Prepare for presentation	3W

Table 1.3: Time scheduled table for project

The time of the project is scheduled over 16 weeks, table 4 shows how the work was scheduled over this time:

WEEKS / TASK	1	2	3	4	5	6	7	8	9	10	11	12
T1												
T2												
T3												
T4												
T5												
T6												

Table 1.4: Time plan table for project

1.12 Project Contents

The project is divided up to six chapters; the chapters follow each other logically to get the complete idea about the project.

Chapter 1: discussed the definition of the project from multiple sides, its objectives and importance. Then taking about the time plane and the estimated cost of the system components that are needed to implement the designed system. Finally, the difficulties that the group had been faced.

Chapter 2: Talk about the theoretical background of the project, hardware and software we needed to implement the project.

Chapter 3: Project conceptual design and the detail objective of the project . We dealt with way of implement the project and draw the block diagram.

Chapter 4: system implementation: This chapter discus how we implement and built the system as we design in chapter 3.

Chapter 5: system testing: In this chapter we test each part of the system as we implemented in chapter 4 and verify from result.

Chapter 6: provides the concluding after working the system, and suggestion for Future work.

1.13 Reference

1. Development of Wheeled Balancing Wheelchair for Lower Limb Disabled Person: Design of Wheelchair Platform Seonghee Jeong1 and Kazuki Kozai2 1Division of Mechanical and Control Engineering, O.E.C.Univ.,Osaka 572-8530, Japan.

2. Development of the Control System of Voice-Operated Wheelchair with Multi-posture Characteristics. Duojin Wang, Hongliu Yu Shanghai Engineering Research Center of Assistive Devices Institute of Rehabilitation Engineering and technology University of Shanghai for Science and Technology Shanghai, China.

Chapter2: Theoretical Background

2.11 Introduction:

This chapter show the theoretical background about our project, we starting by submitting detailed informations about motion recognition on moving head, head motion neutrality, how its propagate in materials, the effect of noise, then show the signal processing, ldr sensors describe its circuit and how its work, finally we show the objective, performance and the ultrasonic sensors, microcontroller (pic16f877a).

2.12 LDR SENSORS (FOR HEAD RECOGNITION):

2.12.1 What the LDR SENSORS:

Ldr sensors can be used as technology recognition for a motion like head motion which this technique is used in our project. These sensors are used to convert the head motion of human to electrical signals, then transformed into coding for making the wheelchair moves instead of joystack.

The processor usually converts the head motion of human into electrical signals by using A/D conversion system which can be processed by a digital computer or microcontroller.

2.12.2 Why do we want LDR SENSORS?

The main goal of using ldr sensors is to get efficient ways for humans to communicate with the wheelchair, some advantages are achieved by ldr sensors. For example, the person who is not able to move any part of his body exception his head.

The costs the these sensors is cheap and is available for easily buying, also the these sensors will be structured with ambarella for making the wheelchair more comfortable.

2.13 Head Motion Recognition

2.13.1 What is Head Motion Recognition?

Head motion recognition is the technology by which moving the head, motion by humans are converted into electrical signals, these signals are transformed into coding patterns that can be identified by a computer.

Processor usually converting a motion signals into a sequence of pulse involves several essential steps. First, a hat picks up the signal of the movement to be recognized and converts it into an electrical signal. A modern motion recognition system also requires that the electrical signal be represented digitally by means of an analog-to-digital (A/D) conversion process, so that it can be processed with a digital computer or a microprocessor. This motion signal is then analyzed (in the analysis block) to produce a representation consisting of features of the movement.[1

2.13 The nature of LDR Sensors:

This section show details about the ldrs.

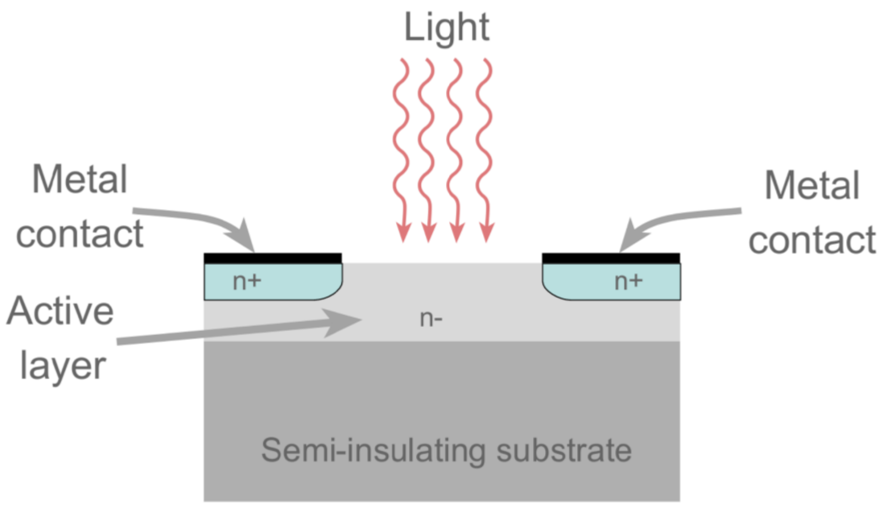
2.13.1 LDR Characteristics:

Light dependent resistors, LDRs or photoresistors are electronic components that are often used in electronic circuit designs where it is necessary to detect the presence or the level of light.

LDRs are very different to other forms of resistor like the carbon film resistor, metal oxide film resistor, metal film resistor and the like that are widely used in other electronic designs. They are specifically designed for their light sensitivity and the change in resistance this causes.

2.13.2 Photoresistor / LDR structure:

Structurally the photoresistor is a light sensitive resistor that has a horizontal body that is exposed to light. The basic format for a photoresistor is that shown below:



The active semiconductor region is normally deposited onto a semi-insulating substrate and the active region is normally lightly doped.

Figure 2.2: LDR Structure

2.13.3 LDR frequency dependence:

The sensitivity of photoresistors is shown to vary with the wavelength of the light that is impacting the sensitive area of the device. The effect is very marked and it is found that if the wavelength is outside a given range then there is no noticeable effect.

Devices made from different materials respond differently to light of different wavelengths, and this means that the different electronics components can be used for different applications.

2.13.4 LDR circuits:

There are many circuits that are used for light dependent resistors. These LDR circuits can be based around bipolar transistors, FETs operational amplifiers, etc. However, the basis of most of the LDR circuits is a potential divider, and then this can be used with various other circuit to process the voltage as required.

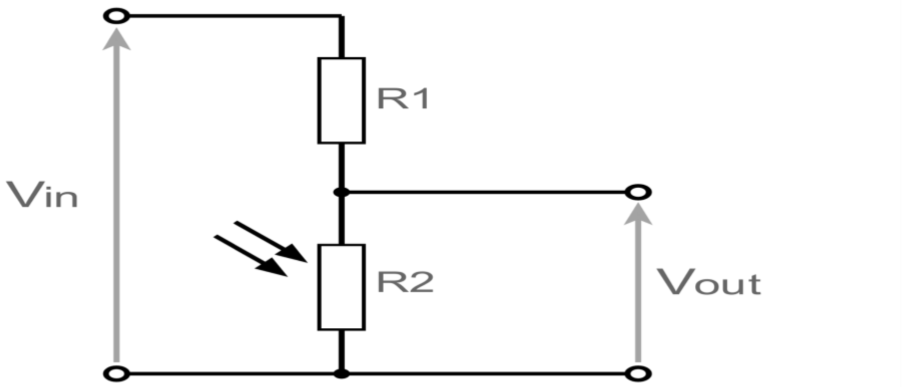


Figure 2.3: LDR Circuit

It is quite straightforward to calculate the output voltage using the formula below.

$$V_{out}=V_{in}(R_2R_1+R_2)$$

Max power dissipation	This is the maximum power the device is able to dissipate within a given temperature range. Derating may be applicable above a certain temperature.
Maximum operating voltage	Particularly as the device is semiconductor based, the maximum operating voltage must be observed. This is typically specified at 0 lux, i.e. darkness.
Peak wavelength	This photoresistor specification details the wavelength of maximum sensitivity. Curves may be provided for the overall response in some instances. The wavelength is specified in nm
Resistance when illuminated	The resistance under illumination is a key specification is a key parameter for any photoresistor. Often a minimum and maximum resistance is given under certain light conditions, often 10 lux. A minimum and maximum value may be given because of the spreads that are likely to be encountered. A 'fully on' condition may also be given under extreme lighting, e.g. 100lux.
Dark resistance	Dark resistance values will be given for the photoresistor. These may be specified after a given time because it takes a while for the resistance to fall as the charge carrier recombine - photoresistors are noted for their slow response times.

2.14 The Project Components:

2.14.1 Ldr sensors:

2.14.1 What are the ldr sensors:

A photoresistor or light dependent resistor is an electronic component that is sensitive to light. When light falls upon it, then the resistance changes. Values of the resistance of the LDR may change over many orders of magnitude the value of the resistance falling as the level of light increases.

2.14.2 DC-Motor:

2.14.2.1 What is the DC-Motor:

A **DC motor** is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

2.14.2.2 DC-Motor Specifications:

- Motor Construction:

  Brush motors have the armature windings on the rotor. The magnetic fields are commutated via direct contact of brushes with the rotor commutator.

  Brushless motors have their armature windings on the stator and the field on the rotor. They rely on internal noncontact sensing devices to activate external commutating electronics.

  Compound wound motors are designed with both a series and shunt field winding. They are often used where the primary load requirement is heavy starting torque, and adjustable speed is not required. They can exhibit speed variation from no-load to full-load. Applications include elevators, hoists and industrial shop equipment.

- DC Motor Specifications

Motor accepts 6V DC input voltage.

Motor accepts 9V DC input voltage.

Motor accepts 12V DC input voltage.

Motor accepts 24V DC input voltage.

Motor accepts 48V DC input voltage.

Motor accepts 72V DC input voltage.

Motor accepts 90V DC input voltage.

Motor accepts 160V DC input voltage.

2.14.3 Ultrasonic Sensor:

Ultrasonic Sensor HC-SR04 is a sensor that can measure distance. It emits an ultrasound at 40 000 Hz (40kHz) which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.
The configuration pin of HC-SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The supply voltage of VCC is +5V and you can attach TRIG and ECHO pin to any Digital I/O in your Arduino Board.

Figure 2.14.3: ultrasonic HSR

2.14.4 Microcontroller:

A microcontroller (also microcontroller unit, MCU or µC) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, watchdog timer, serial and analog I/O etc. Program memory in the form of EEPROM (Electrically Erasable Programmable Read Only Memory) or ROM (Read Only Memory) is also often included on chip, as well as a typically small amount of RAM (Random Access Memory).

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems.

Figure 2.5: PIC Microcontroller

2.14.5 RELAY 5V:

A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

Figure 2.6: relay 5v.

2.14.6 Transistors:

A **transistor** is a semiconductor device used to amplify or switch electrical signals and power. The transistor is one of the basic building blocks of modern electronics.[1] It is composed of semiconductor material, usually with at least three terminals for connection to an electronic circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Some transistors are packaged individually, but many more in miniature form are found embedded in integrated circuits.

Most transistors are made from very pure silicon, and some from germanium, but certain other semiconductor materials are sometimes used. A transistor may have only one kind of charge carrier, in a field-effect transistor, or may have two kinds of charge carriers in bipolar junction transistor devices. Compared with the vacuum tube, transistors are generally smaller and require less power to operate. Certain vacuum tubes have advantages over transistors at very high operating frequencies or high operating voltages. Many types of transistors are made to standardized specifications by multiple manufacturers.

Figure 2.7: transistor PNP

2.14.7 Resistors:

A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

Figure 2.8: Resistors

2.14.8 Potentionmeter:

A **potentiometer** is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.[1] If only two terminals are used, one end and the wiper, it acts as a **variable resistor** or **rheostat**.

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

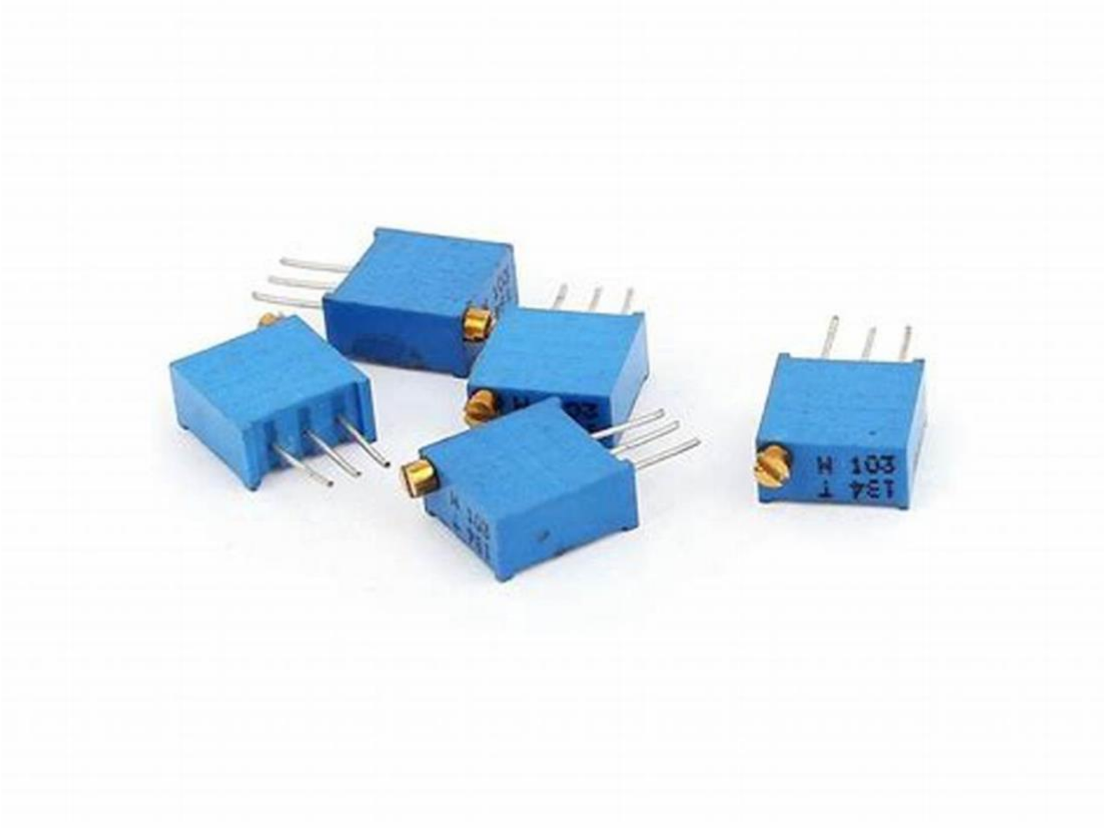


Figure 2.9: potentiometer

2.14.9 Diodes:

A **diode** is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other.

A diode vacuum tube or thermionic diode is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate.

A semiconductor diode, the most commonly used type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals.[4] Semiconductor diodes were the first semiconductor electronic devices. The discovery of asymmetric electrical conduction across the contact between a crystalline mineral and a metal was made by German physicist Ferdinand Braun in 1874. Today, most diodes are made of silicon, but other semiconducting materials such as gallium arsenide and germanium are also used.

Among many uses, diodes are found in rectifiers to convert AC power to DC, demodulation in radio receivers, and can even be used as temperature sensors. A common variant of a diode is a light emitting diode, which is used as electric lighting and status indicators on electronic devices. Diodes may be combined with other components to form logic gates.

Figure 2.10: Diode 2N22

2.14.10 Dc/Dc Voltage lower:

Voltage drop can be accomplished by using several means. It is important to understand the application at hand for determining the component and precision needs. A simple resistor can also be utilized for achieving desired voltage drop. However, this leads to power loss and is not an option in applications involving any form of storage element as power consumption is a key aspect of it [1]. This demands the need for a slightly more sophisticated implementation of a power electronics device such as a regulator and the converter used for voltage step-down is termed a Buck converter. The circuit diagram of a step-down or buck converter is shown in Figure 2.11

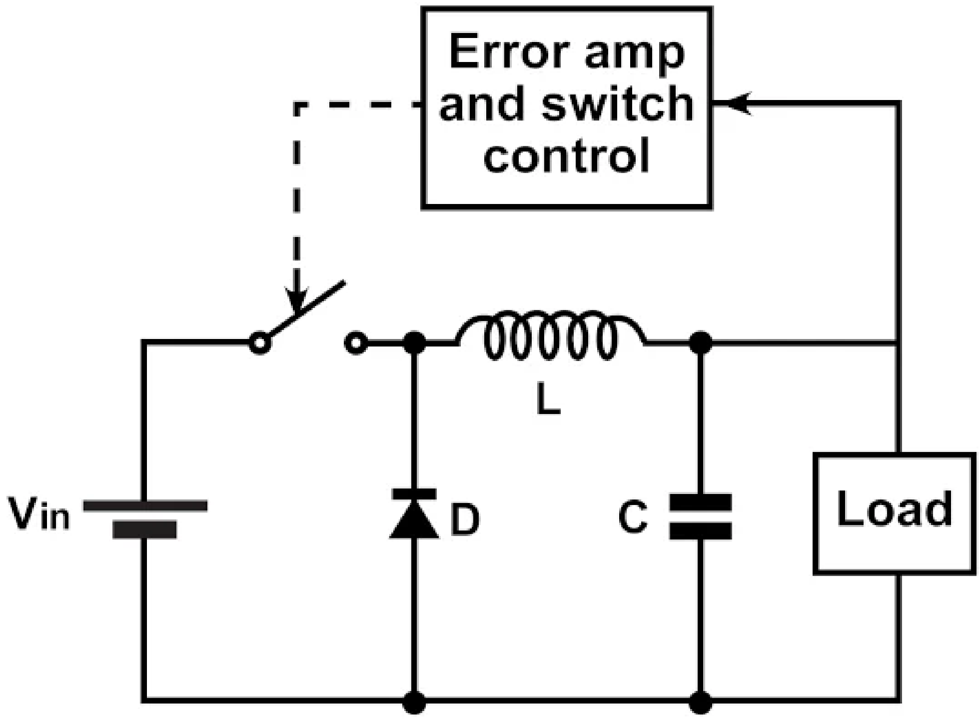


Figure 2.11: *Circuit diagram of a Buck converter.*

2.14.10.1 High-level Operating Principle:

A Buck converter is used to step-down a DC voltage from the input to the output [3]. The operation of the circuit is dictated by the conduction state of the switch. The switching transistor is placed between the input and output side and typically switches on and off continuously at high frequency. In order to effectively maintain the continuity of output, energy is stored in the inductor during the ON period of the switch, and the same is utilized during the OFF period of the switch.

During the steady-state operation of the circuit, two modes of operation can be defined based on the inductor current value. If the inductor current never reaches zero, it is termed a continuous conduction mode. However, if the inductor current reaches zero, then it is said to be operating in discontinuous mode.

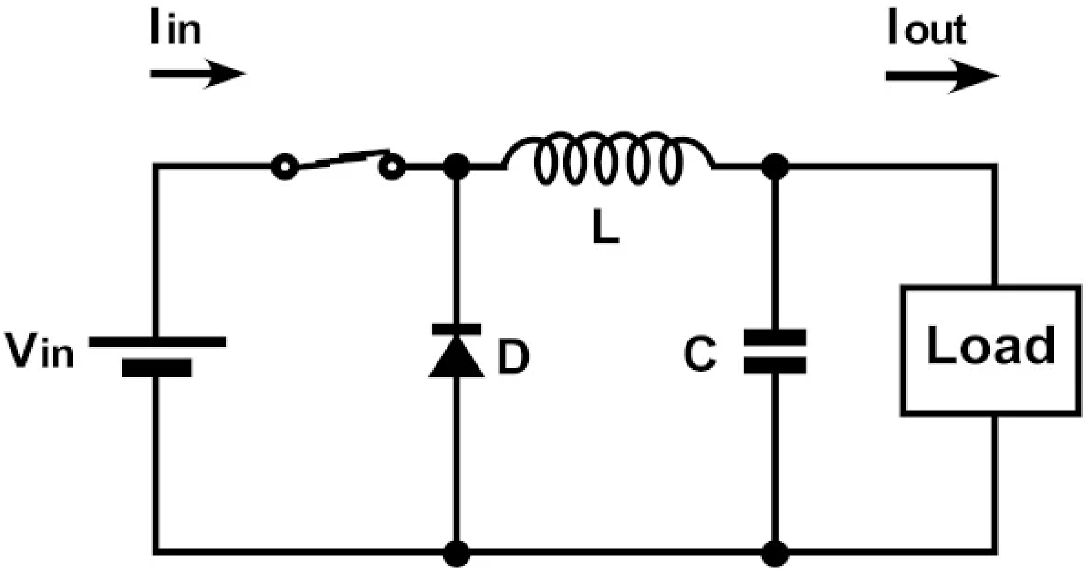


Figure 2.12: *On-state operation of Buck converter*

Chapter 3 : Design System

3.1 Introduction:

This chapter is about the conceptual design and it is importance in any project, because this part is the heart of the project, and gives the reader a vision about the project and make him familiar with the work. This chapter specifies the design procedure of project and gives a description for all ideas included in this project. We will start this chapter by showing the design option, then we will put a block diagram for the project to show how the parts of the project interconnected and interact with each other. After that we will show a flowchart which summarizes all steps. Finally, we will show the way the project work and the facilities provided to patient.

3.2 The design option:

In this project we follow a strategy to choose the right hardware for head motion recognition, Such as flexibility, reusability, high performance, short development time, and cheap.

The following is the comparison of some alternative available for Digital Signal Processing with Pic-Controller (hardware applied in our project):

- **Pic16f877a microcontroller:**

  The PIC microcontroller **PIC16f877a** is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses **FLASH memory technology**. **On other hand,** It does not have an internal oscillator like other Pic16f84a.

- **Pic16f877 microcontroller:**

  PIC16F877 is one of the advanced and commonly used **Peripheral Interface Microcontroller** from Microchip. Simplicity, quality, ease of availability and low price makes them ideal for different applications. Also, this PIC features all components that modern microcontrollers have. There some features of **pic16f877** which are included in the following:

  35 instructions are only there, Single-cycle instructions are used here. While, two-cycle instructions are used for program branches,

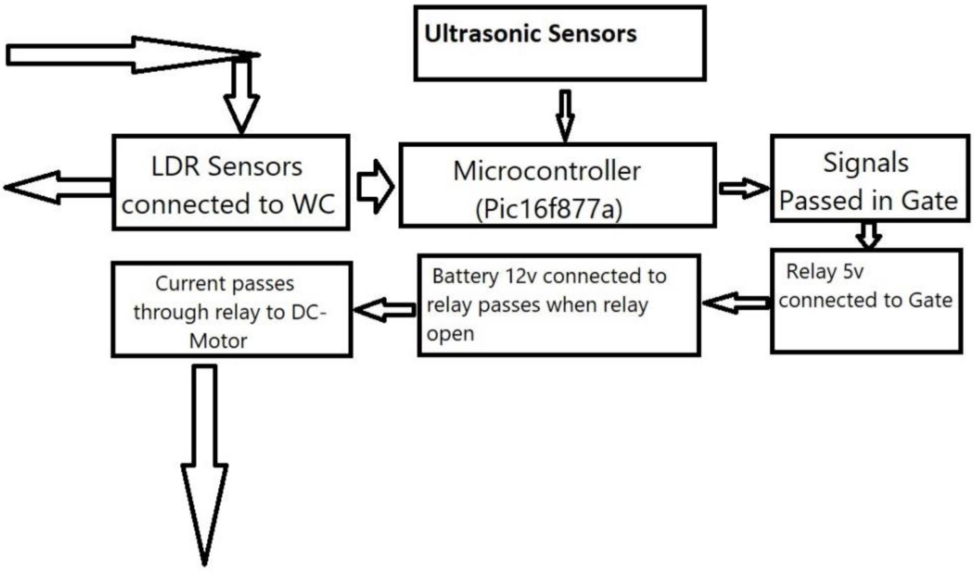
DC – 20 MHz clock input DC – 200 ns instruction cycle is the operating speed.8K x 14 words of Flash Program Memory, Data Memory RAM of 368 x 8 bytes, EEPROM Data Memory of 256 x 8 bytes.Pin out compatible to other 28-pin or 40/44-pin.Voltage range of 2 to 5.5 V and Low-power, high-speed Flash/EEPROM technology.

3.3 The General block diagram:

Photoresistor signals resulting from a LDR Sensors, will receive to microcontroller, which will convert to electrical signals and process this signals.

Microcontroller is very important in this system, its work as interface between ldr sensors and wheelchair, and it's responsible for the movement and direction of wheelchair.

Communication group will focus and specialize in signal processing. For example, after signals are processed, they pass through a gate pf diode and transistor to the relay to open then make the current from the battery pass to the motors of the wheelchair for motion and direction.



Wheelchair is moving

This block diagram has the phenomena of the wheelchair operation. While patient moves his/her head this LSR sensors will send signals to the microcontroller and the microcontroller will receive this signal for processing and give to relay by sending the processed signals to electronic gate. Finally, the current will be generated to move the wheelchair.

3.4 Sensor Design:

We will use the (ultrasonic and ldr) sensor, and the operation principle of this sensor is relates the distance that measure away from it with the yield output voltage according to the relation (1 inches =9.8mV) , in this section we will discuss two cases that are; the straight direction case and the slope direction case.

Chapter 4 : System implementation

4.1 Introduction:

In the previous chapter we presented the design principles for feature extraction from every motion command which controlled wheelchair by using light lamb emitted toward LDR sensor, In this chapter we will discuss the detailed software design and interfacing connection between sensors and microcontroller. This chapter provides a description about project details which can be summarized by understanding the way how a system builds to achieve.

4.2 Input motion command:

motion command will be emitted the light from lighter tied on medical hat which will be around the head across the LDR sensor.

Each motion will make the wheelchair move to special direction and differ from the other motion and we have six motions.

a) Front
b) Back
c) Right
d) Left
e) Front with 30 degree right
f) Front with 30 degree left

4.3 System implementation:

4.3.1 LDR SENORS:

The photoresistor sensor is implemented as a light sensor to receive the coming light from the lighter and this is the main part for moving the wheelchair, and there are more than 200 LDR Sensor implemented in the board of the wheelchair which are put in six sided. The microcontroller must have to understand and stop if there is no light and change the direction while the light direction moves to another side.

Figure 4.1: The photoresistor sensor is implemented as a light sensor

last implementation steps After many attempts, experimentation and simulations via the computer and through the educational pieces look at the pictures [].

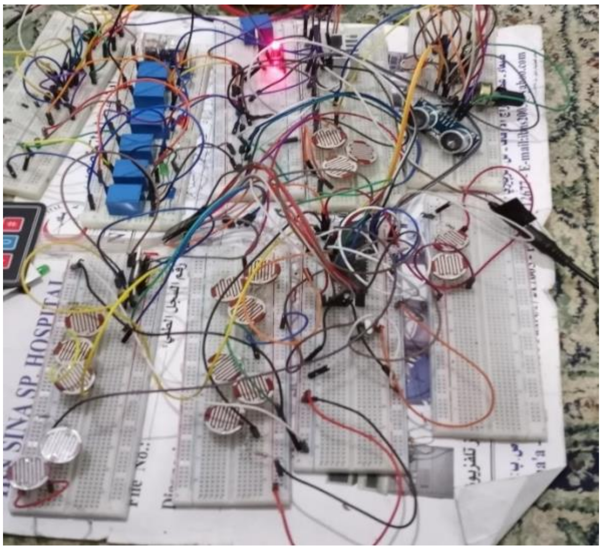


figure 4.2: Ldr sensors implementation

And reaching the required result to achieve the goal and choosing the necessary practical pieces, we started working on the project in a practical way, where a normal board was made by connecting the pieces to each other with regular wires as shown in the picture[Figure 4.3].

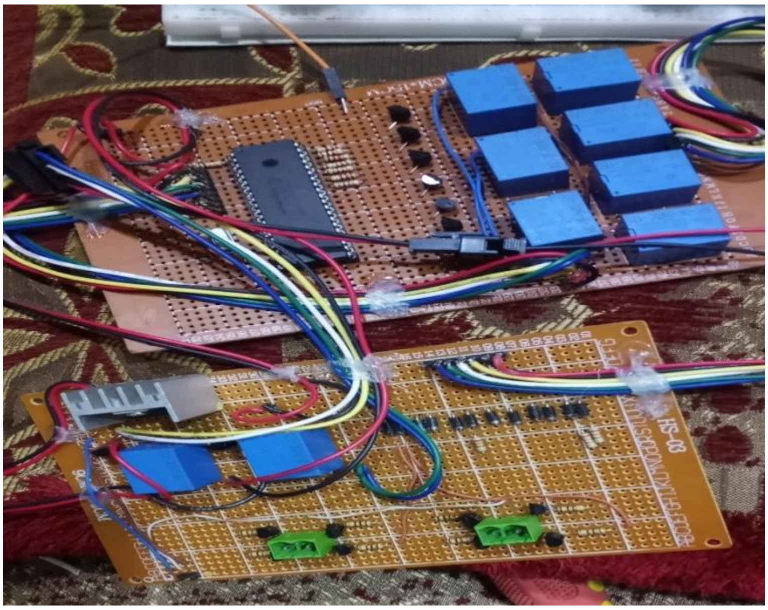


Figure 4.3 : Welding board through wires

Then we worked to make the hailstones industrial and ready for the labor market, so we designed and planned them using PCB planning programs, and we printed these hailstones by special printers on special paper with a special ink as well, then printed this paper on copper hail plates and put them in a FeCL solution to remove copper and make lines Copper wire for connection, then the process of piercing the places of the electronic parts, and then installing these parts on the board by welding, as shown in the pictures [Figure 4.4] , each process …

Figure 4.4 : Making a practical board process by hand

4.3.2 Ultrasonic Sensor:

HC-SR04 sensor implemented in this project as protection stage, that means if the sensors detect an object or obstacle in specific range from a wheelchair the microcontroller have to understand that action and must stop movement or change direction of motion, even if motion command found.

4.3.3 Power Up System:

DSK bored and PIC microcontroller need 5 V DC power supply to operate, but the buttery voltage that provide power to motors is 12 V DC. So that, we use voltage regulator to get 5v from 12v buttery to running DSK kit and PIC ,that's called 7805 voltage regulator . The pins of this regulator and how there are connect shown in the figure (4.3.3) below.

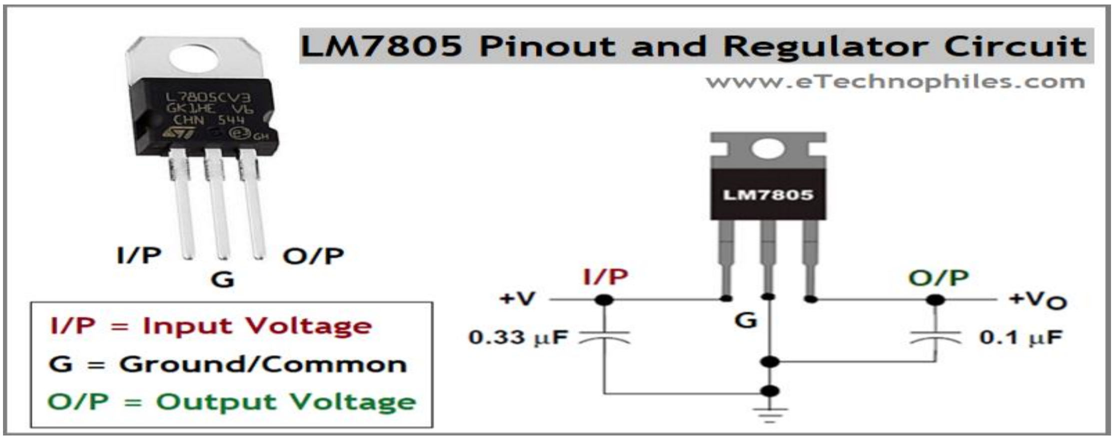


Figure: 4.3.3 LM7805 pinout and regulator circuit

And we will show you the board we designed for power up system and how it works, the ciruit design us shown below.

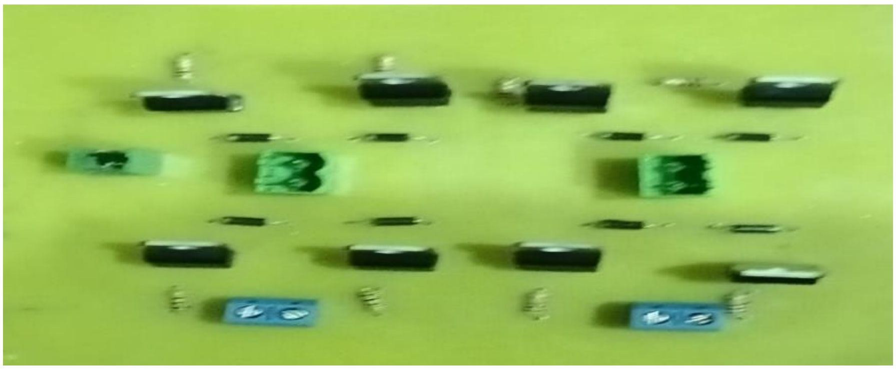


Figure: 4.3.4 : Directions controller

4.4 System Schematic Circuits:

we will explain each components in the project and how each one works with the other. We have made a simulation by the proteous to explain the operation principle of the wheelchair. The figure 4.4 below will show the schematic circuits.

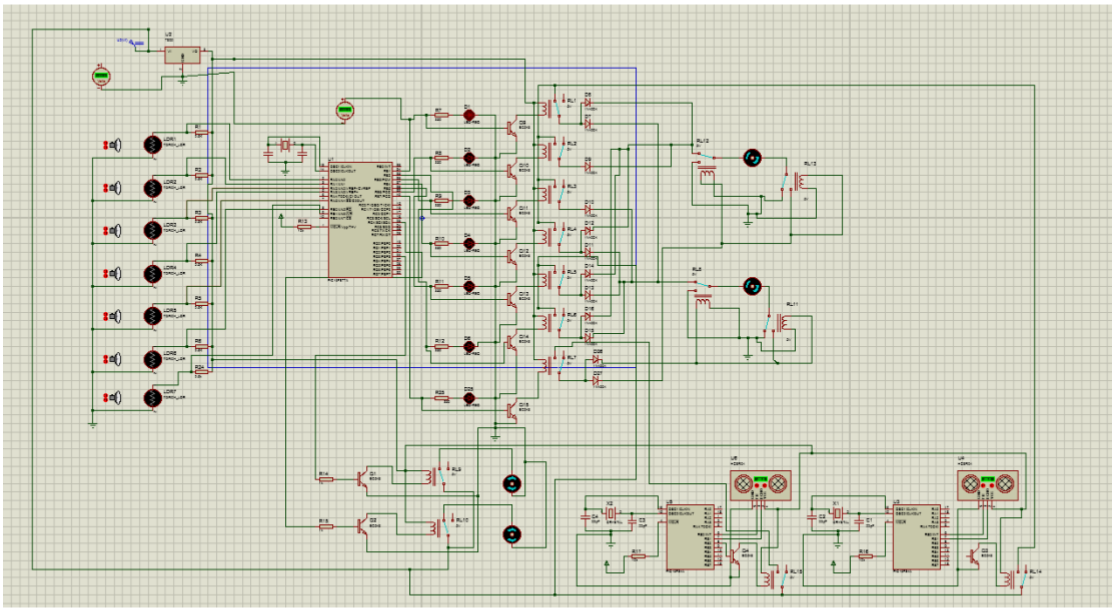


Figure: 4.4 : Simulated by proteous

4.5 The implementation board:

This part talks about the hardware components and how it works inside the board, which shown in the following parts:

4.5.1 The analog input:

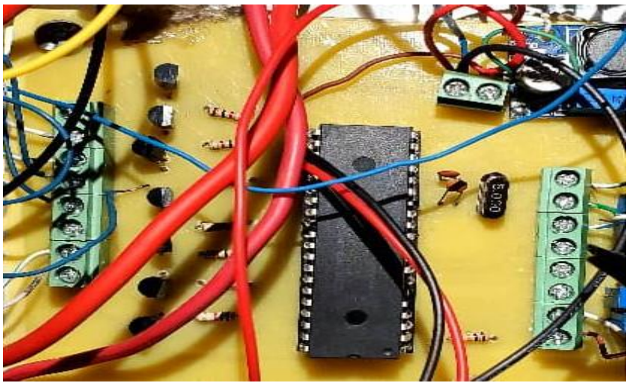


Figure: 4.5.1 The mother`s board

Here we show the analog input that connected to the microcontroller and how it works, we use variable resistors (potentiometers) to decrease the sensitivity of ldr sensors just make it able only when special light emitting toward it as it is shown in figure(4.5.1).

4.5.2 The principal operation of ultrasonic:

This parts we will show how the ultrasonic works and how theu are connected to the board.

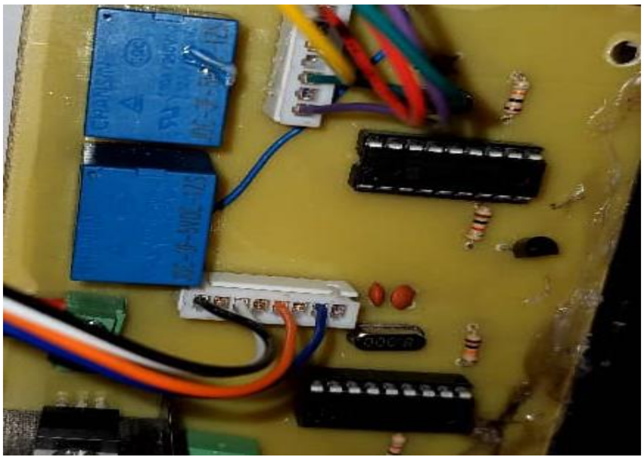


Figure: 4.5.2 : The protection circuit board

There are two ultrasonic for the back and front and each one of them connected to microcontroller kind of 16f84a as it shown in figure(4.5.2)

4.5.3 The gate of the motor:

This part is connected to the microcontroller with transistors 2N222 and resistors and also connected to 7 relays 5v to pass current from the battery 24v toward the motors of the wheelchair as it shown in figure 4.5.3.

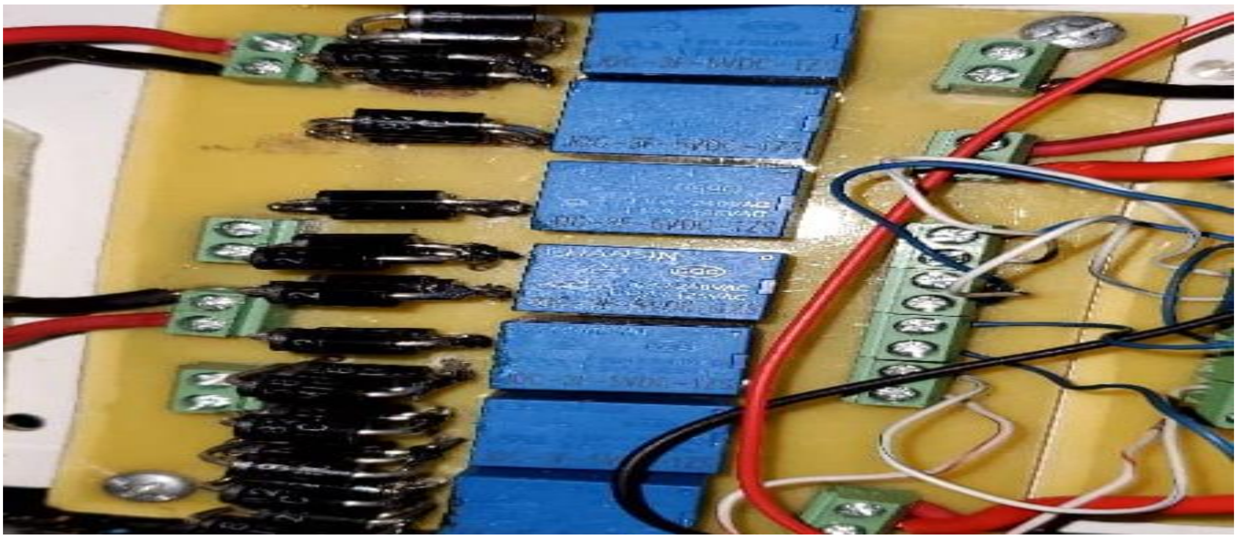


figure: 4.5.3: In return, specify the signal

4.5.4 The driver of the motors:

This part it talks about driver of the motors and how it works with the motors.

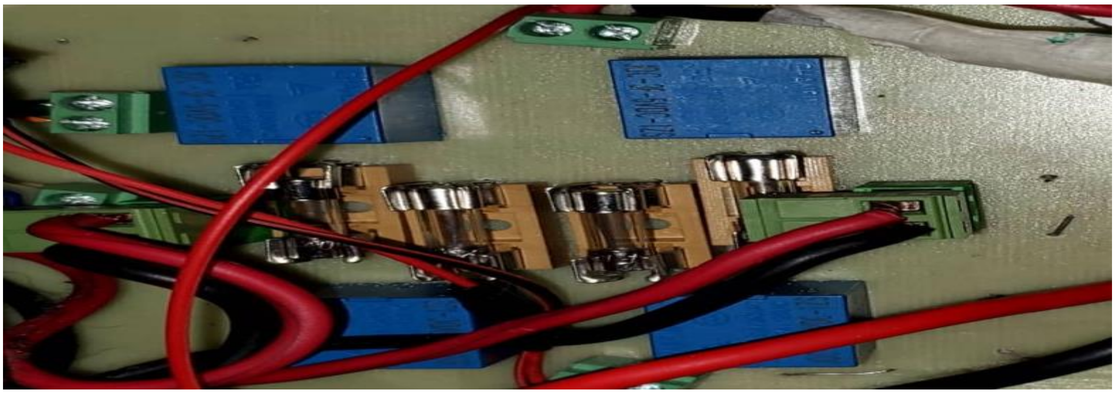


Figure: 4.5.4 drivers

The drivers is processed for four direction which each direction will send signal or pulse to specific relay to open. For example, when the patient moves his head for the front the two relays of the front will open, when the patient moves his head for the back two other relays of the back will open to move the wheelchair backward and also as the same as when the patient move his head left/right.

Chapter 5: System Testing

5.1 Introduction:

After system implementation, the system must be tested to ensure that the system work properly or not, of course for an effective testing, the system must be divided to many subsystem, and checked after each subsystem to make sure that each subsystem achieve its main function and verify the location of error if its exist.

The testing can be done by seeing the output after each stage, if it's as required then passes to the next stage and so on; in other word, testing the device if its works or not, these treatment causes easily and fastest way to find the error, this process reduce times and effort.

5.2 DSK Board Testing:

After power up DSK and watch LEDs, we use DSK diagnostic utility to test DSK functionality, at the beginning diagnostic status will be "Idle".

5.3 Ultrasonic Sensor Testing:

To ensure that, the sensor which we used is operate properly, we must check it according to its operation principles, first testing was to see the maximum output voltage that can be produced, that's happened when there's no object along the whole range of the sensor, that's equal (R=20cm=7.88 inches). According to its basis that every 1inch distance that the object located away from the sensor gives (V=VCC/512=9.8mv) if VCC =5V, maximum output voltage resulted around (V=2.5V), which is exact value from datasheet, as it shown in the figure (5.3) below.

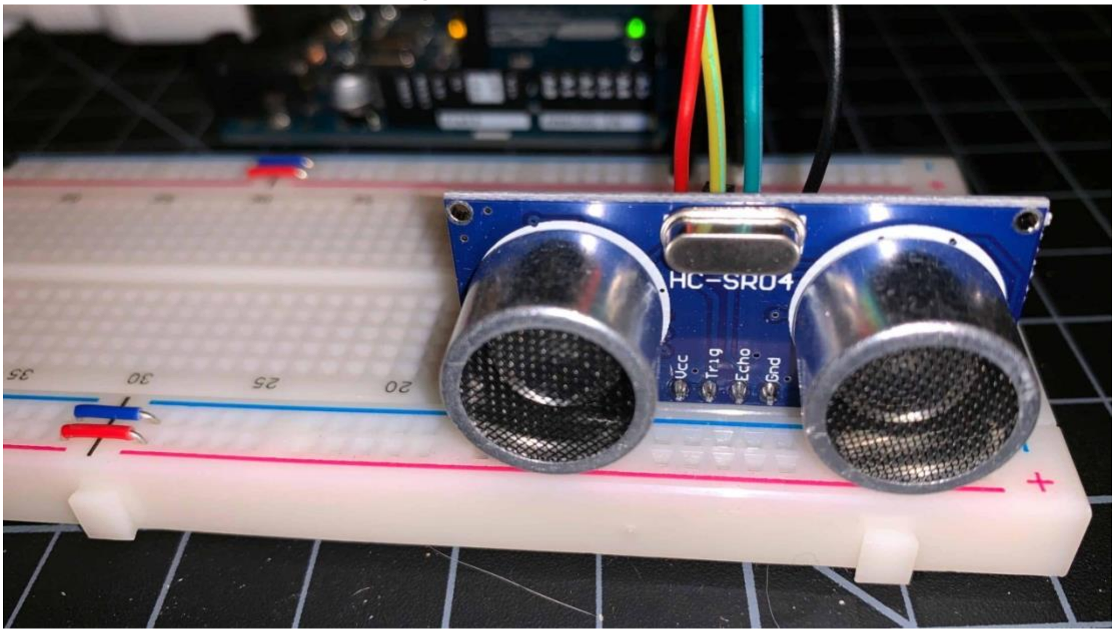


Figure 5.3: TESTING ULTRASONIC

5.4 The Batttery of DC-Motor 24v:

In the beginning we had a problem a current that coming from the battery, the current was high which caused a damaged with diode and transistors they could not afford the coming current from the battery.

After many tests and we searched for the problem, we used **DC/DC 8A STEP DOWN XL4016** for the solution, which is shown below.

Figure: 5.4 : DC/DC 8A STEP DOWN XL4016

5.5 Dc-Motor

It is kind of 24v which its current is 8A, while the patient move his/her head to one of the six directions, the is open and current passes throw the gate to motors and make wheelchair moves, the motor is shown below.

Right

Left

5.6 Relay 5v:

We used 7 relay to be able to control the directions of the wheelchair by the relay. The forward has two relays connected to microcontroller and battery as same as the back, the left and right each one of them has relay connected to the pin in microcontroller, as shown below in fig 5.6.

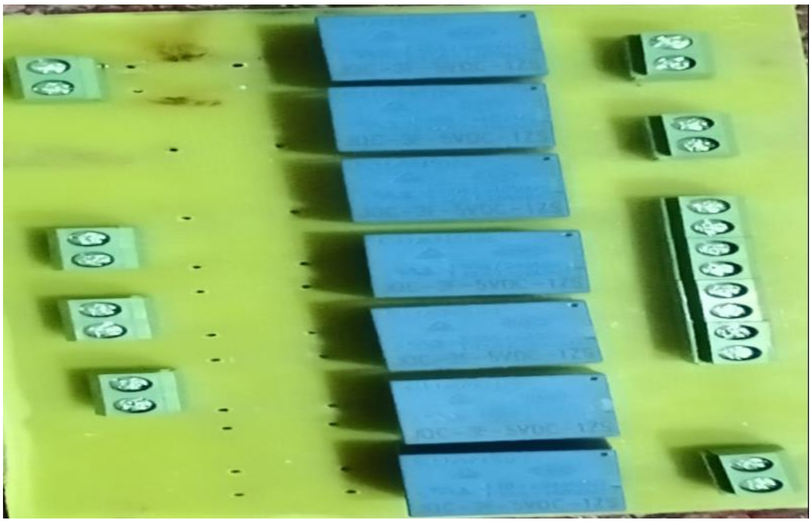


Fig 5.6 : Relays board

These relays are connecting to the pins with a gate is shown if fig (5.7), which the processed signals that come from pic is send to relay throw the gate then it opens to pass current to motors for movement.

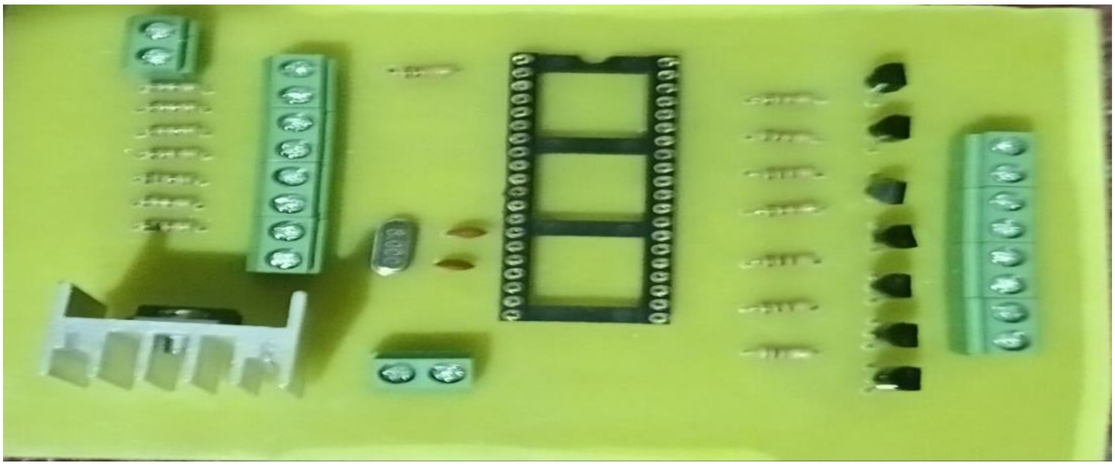


Figure: 5.7 Processed signals board

This method is considered an industrial method and prevents the problems of connecting the parts and the occurrence of error. After assembling all the files and parts of the electronic device, they were placed and arranged in an look at the pictures [Figure 5.8].

Figure 5.8 : Board box

After designing the canopy, the LDR sensors were placed in the form of groups installed on wooden planks that were cut and drilled manually, and the sensors were connected to each other by welding, then these panels were installed on the ceiling of the canopy from the inside with screws to facilitate the maintenance process.

look at the pictures [Figure 5.9 and Figure 5.10].

Figure 5.9 : Installation and welding of LDR sensors

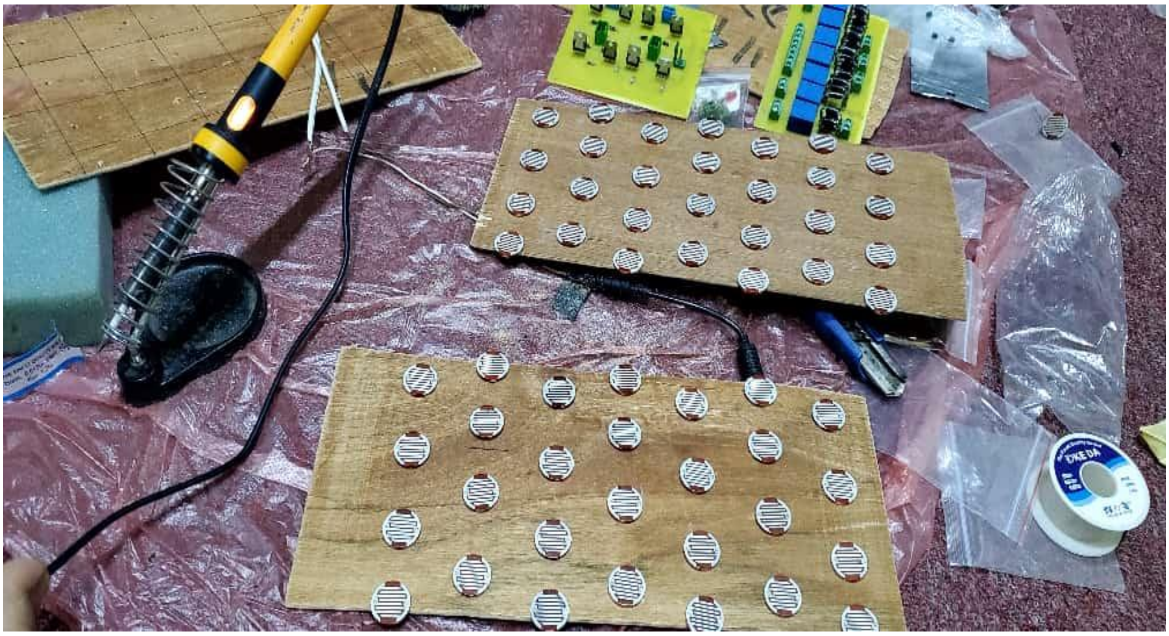


figure 5.10 LDR sensor

Chapter 6 : The Result

6.1 Introduction:

The project that has been done was a step for developing the idea of motion recognition. Also the project was a good step in developing motion recognition on proteous Program. Mean while we have some recommendations and suggestions for the future work. The following section will discusses them.

6.2 System Achievements:

Almost all the goals of our system have been achieved. In this point the main achievements of the system are discussed and the ways of achieving it. We build system of motion recognition on eclectronic circuit using ldr sensors and it progtammed in microC program that have six motions. Also the project has sensing unit that controls the movement of wheelchair.

We can in the future, convert the motion recognition into EEG recognition to our system to be more compatible to our needs in practical life; also we can connect more than device such as sensor to enhance protection process in our project.

6.3 Real Learning Outcomes:

After the implementation of the project we have an expert in the following points:

- How we can invest what we learn in our studying “using ldr to build motion recognition system".
- Learn how to use and program 16f877a microcontroller.
- Faces many problems with proteus simulation Blocks and learn how to solve it.

6.4 Recommendations:

After our work on this project and after facing many problems during the implementation, we as a project team, see that the following points may be a good improvement for this project in order to make it more sense and more reliable:

- Increase number of sensing and protection unit.
- Select the most resisting transistors and stronger to not get ruined.
- Enhance on the system to be more efficient to noise area.

6.5 Future Steps:

Here, there's some points that’s relates to our project, that formed development sides that can be taken over our project.

- We are using ldr sensor and IR sensor, but in the future wheelcair is adjustable by use the matlab program to make the wheelchair controlled by EEG.
- Anyone can use our system to control many operations, such that housing controlling i.e.
- The system can be develops by entering many modification on it, that leads to better controlling by Wheelchair, such that the speed of the Wheelchair.

Reference

1) http://www.answers.com/topic/speech-recognition .
2) Markus Forsberg, Why is Speech Recognition Difficult? , February 24, 2003 ,page(2- 7) available at http://www.speech.kth.se/~rolf/gslt_papers/MarkusForsberg.pdf.
3) http://en.Wikipedia.org./wiki/sound.
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6) http://www.echelonembedded.com/dsphwlab/files/ChassaingBook_Chap1.pdf
7) http://en.wikipedia.org/wiki/Microcontroller.
8) **Development of Wheeled Balancing Wheelchair for Lower Limb Disabled Person: Design of Wheelchair Platform Seonghee Jeong1 and Kazuki Kozai2 1Division of Mechanical and Control Engineering, O.E.C.Univ.,Osaka 572-8530, Japan.**
9) **Development of the Control System of Voice-Operated Wheelchair with Multi-posture Characteristics. Duojin Wang, Hongliu Yu Shanghai Engineering Research Center of Assistive Devices Institute of Rehabilitation Engineering and technology University of Shanghai for Science and Technology Shanghai, China.**