Automatic Wheelchair for the Paralyzed Patient Using Eye Blink Movement Detection

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***Abstract*:** The "Automatic wheel chair for the paralyzed patient using eye blink movement detection" is a smart wheelchair, designed to help the paralyzed patients who move on a wheelchair instead of caretaker move the wheelchair by his/her hand, the wheelchair will automatically move to the corresponding direction as the patient blink his/her eyes with the help of IR sensor (Eye blink detector). The wheelchair will monitors the heart rate continuously using heart rate sensor and gives the beep sound when it detects any abnormalities in the heart rate level and also sense the obstacles in all the four sides of the wheelchair using ultrasonic sensor and gives the different beep sound using buzzer.

***Index Terms* - ARDUINO, Board, Infrared Sensor, Intelligent Wheelchair, paralyzed patient, Ultrasonic Sensor.**

I. INTRODUCTION

Throughout the world there are lot of disabled people who depends on other person's help. Due to this the demand for care equipment has increased which helps to improve their quality of life. Since from the last 20 years the dependency on wheelchair is the common aid for the disabled persons. A properly prescribed wheelchair is the useful device in regenerating a person with a disability into the community. Though the various types of wheelchair were designed but the number of persons who are paralyzed dependent on others has not reduced. So we have developed a wheelchair prototype exclusively controlled by the blinking of eyes and also able to detect the obstacles, night time movement and user movement. The keys to this flexibility are the eye blink sensor [IR sensor] is mounted on the glasses of user's. Even though there is lot of models to control the wheelchair, e.g. vision based head gesture technique, voice recognition technique, EOG eye tracking technique and EMG signal technique. There is at least some disadvantages for every technique (i.e.) in the voice recognition technique it is not applicable for paralyzed patient who can't speak. In EOG techniques the users feel uncomforted and they can't look around freely. In this technique, we propose new methodology to control the wheelchair by the eye blink sensor (IR sensor). This system will drive the wheelchair based on the blinking of eye. It is normally a hand free technique and also low cost when compared to other techniques.

II. SYSTEM MODEL

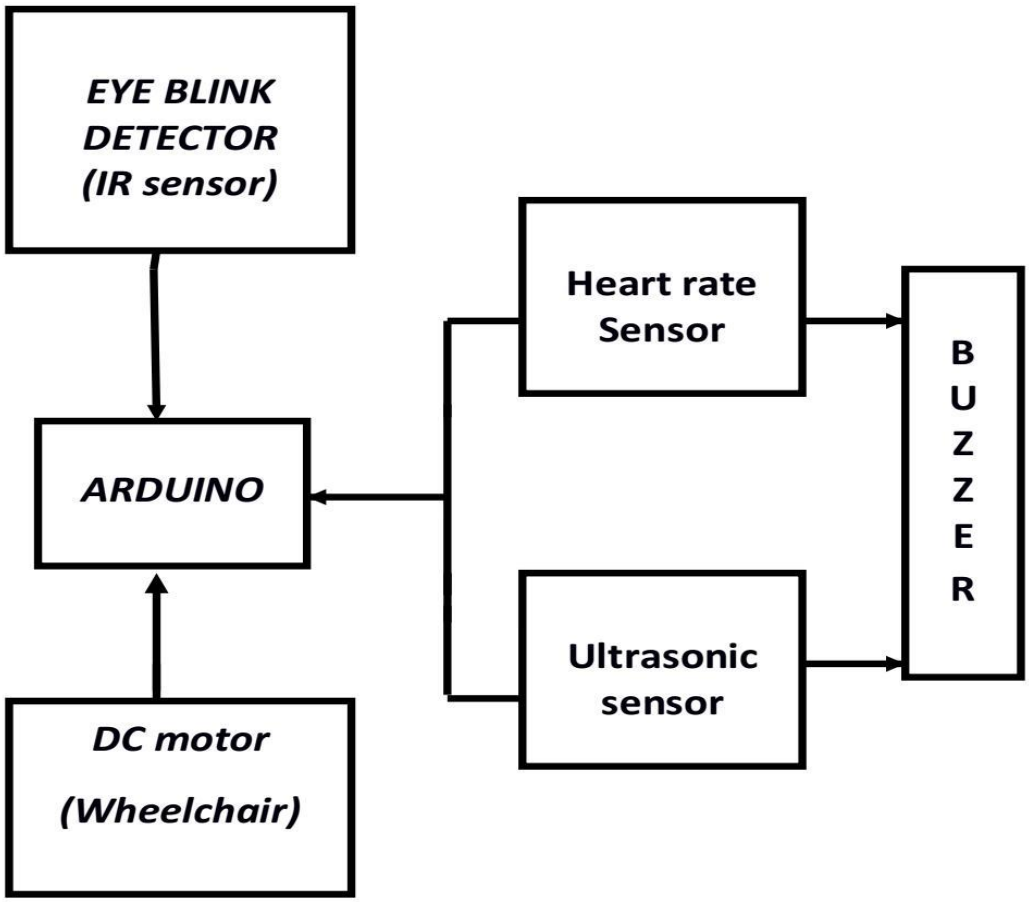

Fig 1. Block diagram of proposed model

2.1. IR SENSOR:

Fig (1) shows that there will be an eye blink sensor (i.e.) IR sensor at the glasses of the user. The eye blink sensor detect whether the eye is in open or closed position. According to that it moves the wheelchair. The wheelchair can also be started and stopped by eye blinking. The eye blink sensor works by illuminating the eye and eyelid area with infrared light, then monitoring the changes in the reflected light using a photo transistor and differentiation circuit. The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye. The digital eye blink is indicated by the LED. The digital output signal is directly connected to the microcontroller. The DC voltage of 5V is applied. Black wire is ground, next middle wire is brown which is output and red is positive supply. When eye is closed, LED is OFF and the output is at 0V. The LED blinking on each eye blink is viewed. The output is high for eye close and can be given directly to microcontroller for interfacing applications. The high voltage of 5V is applied LED gets ON when eye is in closed position. The low voltage of 0V is applied LED gets OFF when the eye is in open position.

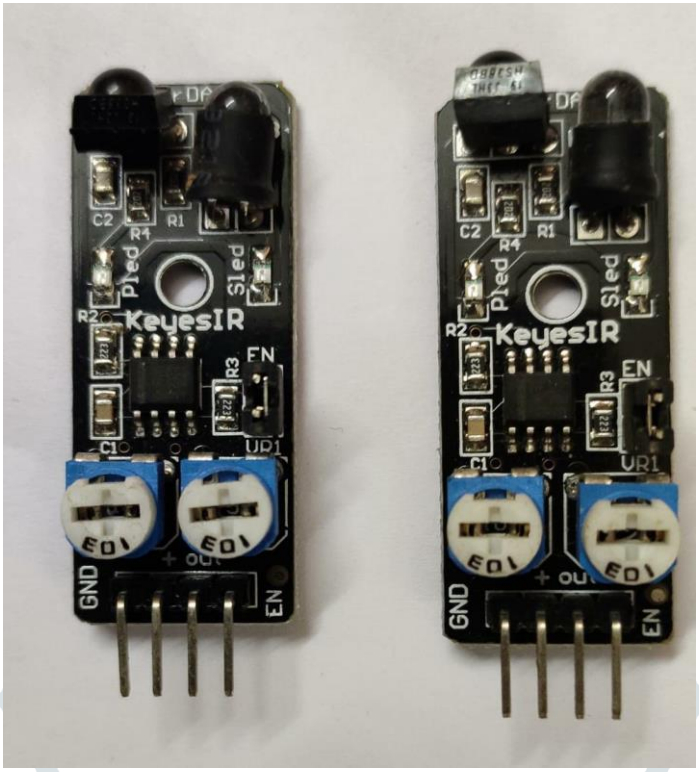

Fig 2. IR Sensor

2.2. ARDUINO UNO:

It is a single-board microcontroller to form exploitation natural philosophy in multidisciplinary comes a lot of accessible. It plays a serious role in our project and every one alternative elements area unit controlled by the ARDUINO. It consists of a simple open-source microcontroller board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language complier and a bootstrap loader that runs on the microcontroller to be programmed. The board is equipped with sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansions boards and other circuits. The board consist of 14 analog pins and 6 digital pins. The serial communications interfaces, including universal serial bus (USB) which is also used for loading programs from personal computers. The microcontroller is typically programmed using a dialect of features from the programming languages C and C++.

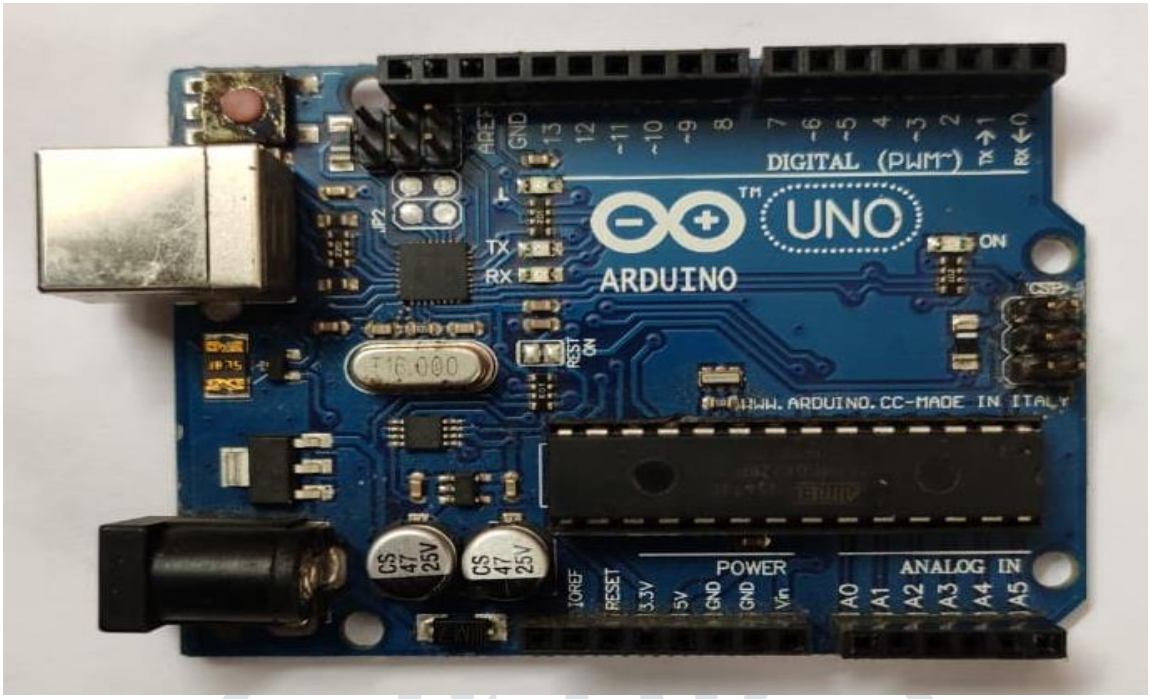

Fig 3. ARDUINO UNO

In addition to using traditional complier tool chairs, the ARDUINO project provides an integrated development environment (IDE) based on the processing language project.

2.3. DC MOTOR:

A DC motor is an electrical device in which it can be used to push or rotate an object with the higher precision. DC motor is an electrical motor which converts electrical energy to mechanical energy. We use DC motor in our project to rotate the wheelchair. We use two DC motors which consist of permanent magnets. Permanent magnets have a linear torque-speed profile making them easy to control.

Fig 4. DC Motor

2.4. MICROCONTROLLER:

ATmega-328 is basically an Advanced Virtual RISC (AVR) microcontroller. It supports the data up to 8 bits. ATmega-328 has 32KB internal built-in memory. This microcontroller has a lot of characteristics. ATmega-328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM).

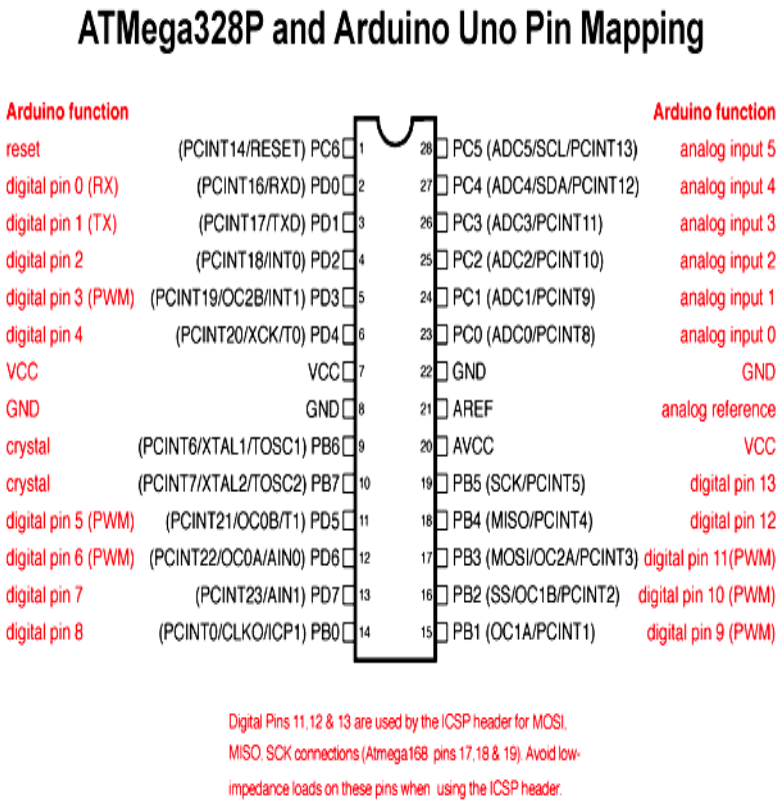

Fig 5. Pin diagram

This property shows if the electric supply supplied to the microcontroller is removed even then it can store the data and can provide results after providing it with the power supply. The features of ATmega-328 are good performance, low power consumption, real time counter having separate oscillator, 6 PWM pins, programmable code for software security, thought put up to 20 MIPS etc. It is used in the ARDUINO.

2.5. BUZZER:

A buzzer is a audio signalling device which may be mechanical, electromechanical or piezoelectric. In our project we use buzzer for the patient safety. Both heart rate sensor and ultrasonic sensor are connected to the buzzer. The wheelchair continuously monitor the heart rate of the patient and gives a beep sound when any abnormalities detected in our heart rate and it also sense the obstacles in front of it using ultrasonic sensor and gives a different beep sound using the buzzer.

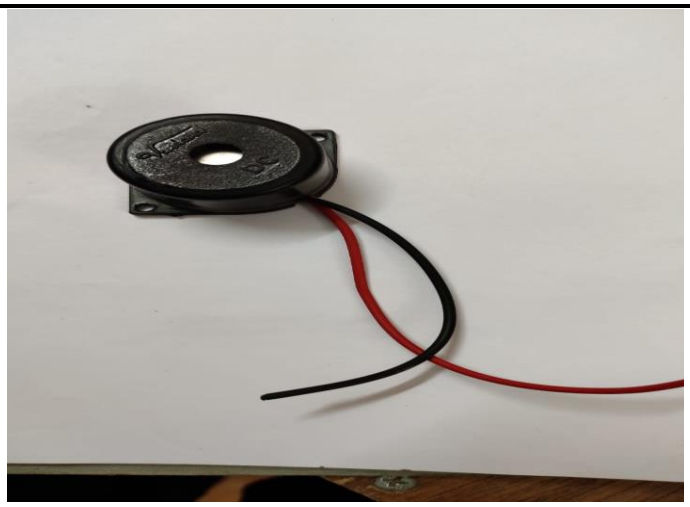

Fig 6. Buzzer

2.6. ULTRASONIC SENSOR:

Generally it is a distance measuring sensor. It used to detect the obstacles from certain distance around the sides of the wheelchair. Here we use four ultrasonic sensors which is placed at the bottom of the wheelchair. The ultrasonic sensor completely stops the wheelchair when it detects any obstacles and it gets reset to operate again. For any obstacle detection by 50cm around the wheelchair, the ultrasonic sensor is programmed in the ARDUINO UNO to stop the wheelchair immediately and gives a beep sound using buzzer.

Fig 7. Ultrasonic sensor

The ultrasonic transmitter transmits ultrasonic waves, this wave travel in air and when it gets objected by any material it gets reflected back towards the sensor this reflected wave is observed by the ultrasonic receiver. The ultrasonic sensor transmits and receives the signal to the ARDUINO with the help of transmitter and receiver. The practical measuring distance of the ultrasonic sensor is 2 cm to 80 cm. For theoretical its distance up to 2cm to 450 cm.

2.7. HEART RATE SENSOR:

A heart rate sensor is a personal monitoring device measures the heart rate of the patient. The heart rate sensor is based on the principle of photophlethysmography. The heart rate sensor measures the heart rate in beats per minute using the LED light with the help of LED light sensor. The sensor measures light and reflect backs. When the light past under your skin the blood pulses the light reflections will vary. The variations in light reflection are interpreted as heart beats. When the heart rate goes abnormal the buzzer produces sound to notify.

Fig 8. Heart rate sensor

2.8. LIQUID CRYSTAL DISPLAY:

A Liquid Crystal Display (LCD) is a flat-panel display device. It uses the light modulating properties of liquid crystal to display. Its display is made up of millions of pixels. The LCD are made by passive matrix or an active matrix display grid. The active matrix (LCD) is also called as Thin Film Transistor (TFT) display. LCD composed of many layers. It also contains two polarized panel filters and electrodes. It works on the principle of blocking the light rather than emitting the light. Hence LCD are used to display the heart rate of the patient. It is connected to the heart rate sensor. It continuously displays the heart rate of the patient.

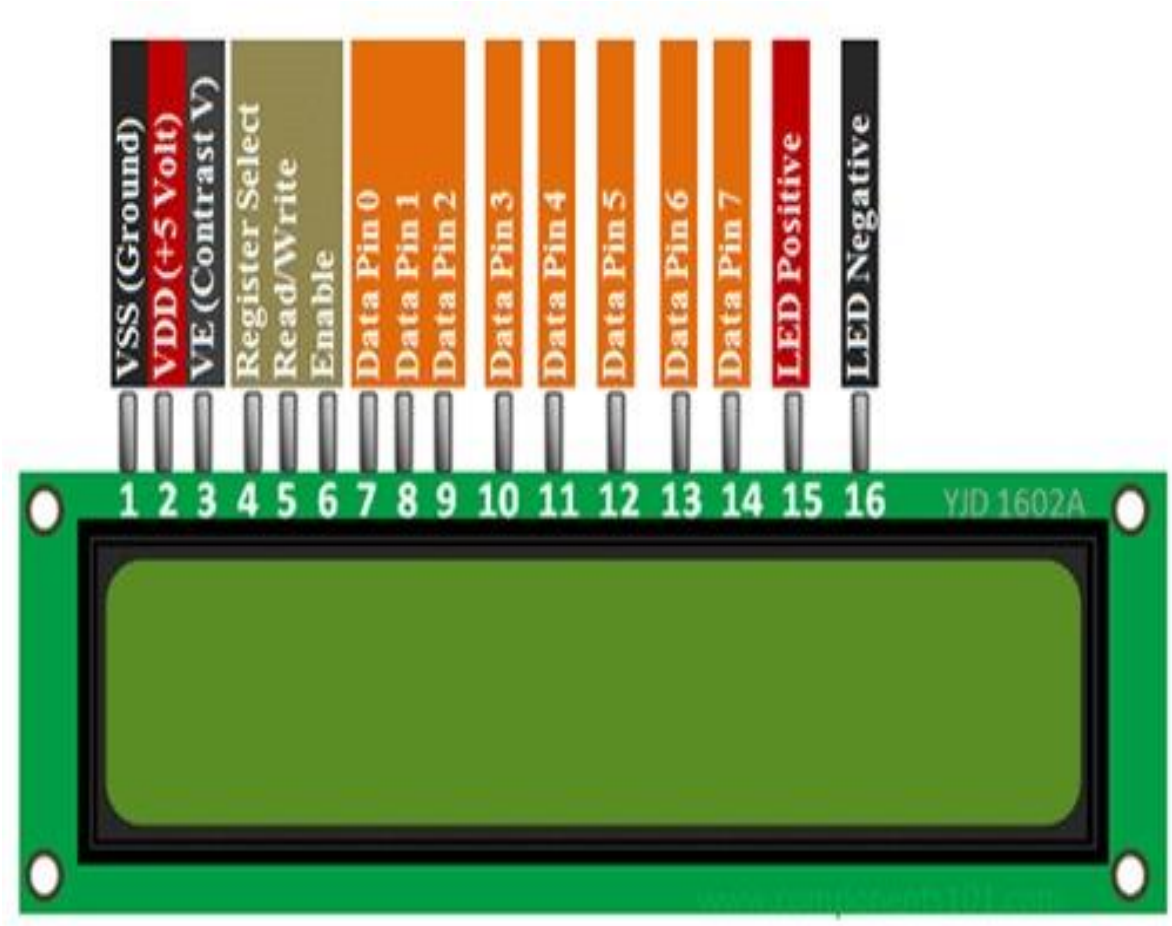

Fig 9. Liquid crystal display

2.9. WHEELCHAIR:

A chair may be a chair with wheels, used once walking is tough or not possible because of unwellness, injury, or incapacity. Wheelchairs comes in an exceedingly completely different style of formats to meets the particular wants of their users. Here the chair is specially designed for the unfit patients. The ability provide is given to the chair by the battery. It consists of DC motors to maneuver the chair. The chair is connected on to the ARDUINO. The ARDUINO is programmed to work the chair in line with the signals received from the attention blink detector and supersonic detector.

Fig 10. Wheelchair diagram

Left Eye Blink	Right Eye Blink	Movement of Wheelchair
Open	Open	Forward
Close	Close	Backward
Close	Open	Right
Open	Close	Left

Fig 11. Truth table for eye blink movement

Thus we can get four logics wheel chair movement from the above truth table. It indicates as follows:

- Open- 1
- Close-0

Direction of wheelchair	Left motor movement	Right motor movement
Forward	Forward	Forward
Backward	Backward	Backward
Left	Backward	Forward
Right	Forward	Backward
Stop	Stop	Stop

Fig 12. Truth table for wheelchair movement

III.WORKING

The goal of our project is to control the wheelchair by eye blink. It is specially designed for paralyzed patient. The power supply is given for the IR sensor, ultrasonic sensor, heart rate sensor, ARDUINO, motor control board, DC motors, buzzer and wheelchair.[1]T he eye blink sensor is a highly sensitive sensor which is capable of detecting the eye blink. The eye blink sensor is based on the IR sensor. The eye blink sensor is placed on the optics to sense the eye blink. The eye blink sensor receives the signal from the eye of human. The received signal was sended to the microcontroller. The microcontroller is presents on the ARDUINO. The ARDUINO is programmed to receives the signal to operate the wheelchair. The programmed ARDUINO moves the wheelchair according to the eye blink detected by the eye blink sensor.

The ultrasonic sensor is used to detect the obstacles around the wheelchair. The ultrasonic sensor is placed at the bottom of the wheelchair. The ultrasonic sensor stops the wheelchair completely and it gets reset to operate again. The ultrasonic sensor is programmed to detect the obstacle by 50cm surroundings. The buzzer starts to produce beep sound automatically when the ultrasonic sensor detects the obstacles. The ARDUINO is programmed to produce beep sound when the ultrasonic sensor detects the obstacles. The ultrasonic sensor can detect the obstacle both in day and night time. Similarly, the eye blink sensor also senses the eye blink both in day and night time. The piezoelectric crystal presents on the ultrasonic sensor works to detect the obstacle. The ultrasonic sensor receives and transmits the signal to the ARDUINO with the help of receiver and transmitter.

The heart rate sensor is placed on the wrist of the patient. It is used to measured the heart rate in beats per minute using an optical LED light source and an LED light sensor. The light shines through the skin, and the sensor measures the amount of light that reflects back. The light reflections will vary as blood pulses under the skin past the light. The variations in the

light reflection are interpreted as heart beats. If the heart rate gone abnormal the buzzer starts to produce the beep sound.

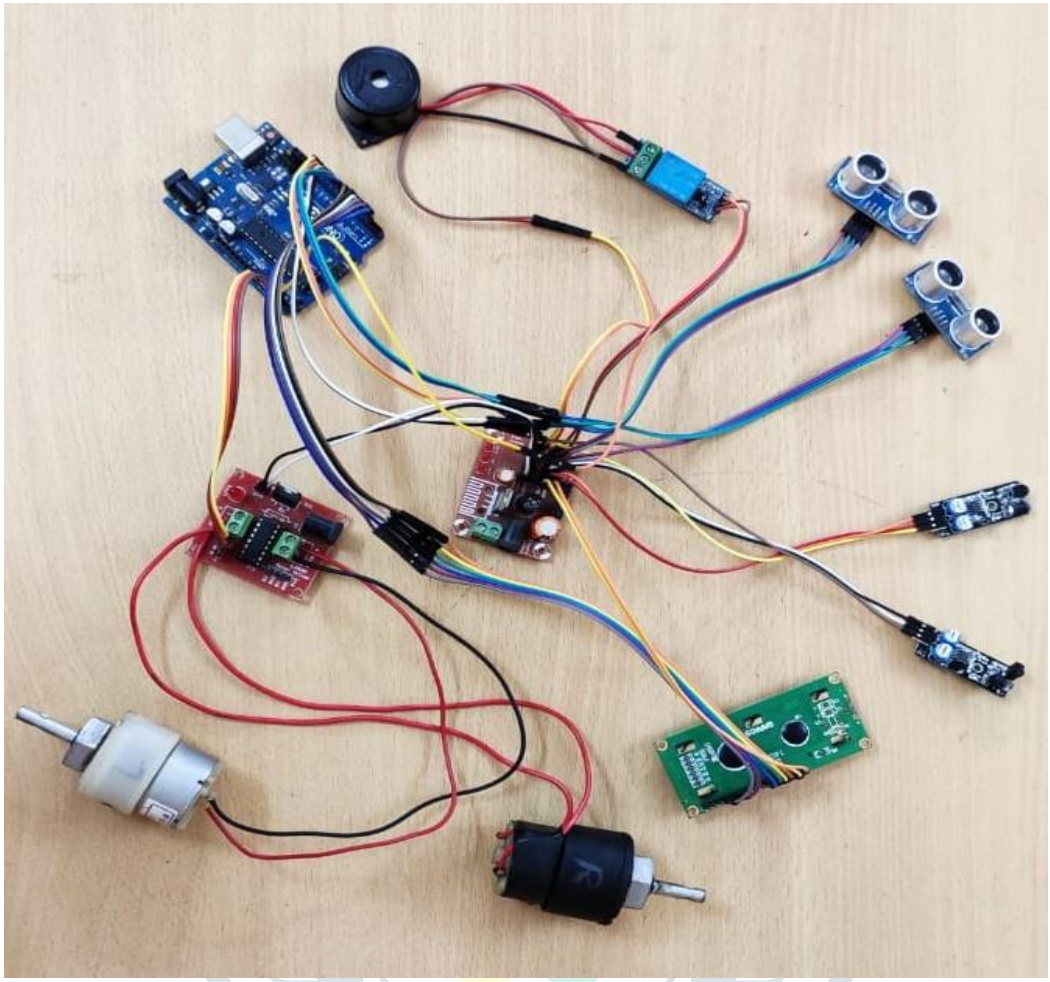

Fig 13. Prototype module

The motor control board is used to control the DC motors. Here one motor control board is used. It is an assemble to control the motors in central location. Thus the wheelchair works with the help of human eye blinking.

IV.FEATURES

The features of this designed system are user friendly system. It can be easily monitored, easy to understand the working module, low power consumption system, helpful for the paralyzed patients who can't able to move independently, reduces the human activity, reduces the physical strain, gives spontaneous output, detects the obstacle near the surroundings of wheelchair and monitors the heart rate of the patient continuously.

V.RESULTS

The automatic wheelchair for the paralyzed patient using eye blink was successfully designed. Then we can also detect the obstacle around the surroundings of wheelchair. The heart rate of the patient can also be monitored using the heart rate sensor. The buzzer produces the sound during the abnormal or critical heart of the patient is detected.

VI. CONCLUSION

To help the paralyzed patients who are able to move independently without the help of the care taker. The main goal of this system is to take care of the paralyzed patient and also monitor the patient heart rate. This model also generates notification during the patient heart rate gone abnormal. The framework is designed, executed and successfully proposed the framework.

VII. ACKNOWLEDGEMENT

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