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NECK MOVEMENT BASED WHEELCHAIR TO ASSIST THE PHYSICALLY CHALLENGED PEOPLE

N. KARTHIKEYAN
Assistant Professor (Sl.Gr),florakarthi1988@gmail.com
Department of Electronics and Communication Engineering, Velalar College of Engineering and Technology, Erode, India
S. AARTHI[1], M. GOPINATH[2], N. HARINI[3]
[1,2,3] Final year students, aarthisundaram2000@gmail.com
Department of Electronics and Communication Engineering, Velalar College of Engineering and Technology, Erode, India

Abstract - *In this paper design and implementation of a neck movement controlled wheelchair is developed for the paralysed people by employing neck movement recognition. The wheels of wheelchair can easily controlled with the help of accelerometer also by using button control in the Android app (Blynk app). Here the most significant device is accelerometer, Node mcu. The challenging problem faced by quadriplegics and paralyzed people is their need for independent mobility. They need external help to perform their daily activities. The main objective of this project is to provide an automated system for disabled people to control the motor rotation of wheelchair based on neck movement of paralysed person. To facilitate these people for their independent movement, accelerometer is fitted on person neck. Based on the neck movements, the accelerometer will drive the motor fitted to the wheelchair. The wheel chair can be driven in any of the four directions and it can also be controlled by using android app (Blynk app). The ultrasonic sensor helps to avoid obstacles. The temperature sensor and heartbeat sensor constantly measure the parameters of patient.*

Keywords: NODE mcu, Temperature sensor, Heartbeat sensor, Blynk app, Accelerometer.

I. INTRODUCTION

The challenging problem faced by quadriplegics and paralyzed people is their need for independent mobility. This wheelchair is specially designed for those patients who are unable to move their limbs except their head. They need external help to perform their daily activities. The main objective of this project is to provide an automated system for disabled people to control the motor rotation of wheelchair based on neck movement of physically challenged person. This wheelchair is operated by detecting the motion of the neck and providing such paralysed patient, a certain degree of independence and freedom in their movement. To facilitate these people for their independent movement, accelerometer is fitted on person neck. s Based on the neck movements, the accelerometer will drive the motor fitted to the wheelchair. The wheel chair can be driven in any of the four directions and it can also be controlled by using android. The automated wheelchair is based on simple electronic control system and the mechanical arrangement that is controlled by a Controller. We used accelerometer one of the components of the inertial measurement unit (IMU).Accelerometer detects the movements of the neck and send signals to the micro-controller which is node mcu. The accelerometer is used to measure the movements of neck and convert them to an analog signal by using encoder and decoder protocols, and send them to other connected devices by using an RF transmitter and an RF receiver.

A microcontroller is used to analyze the encoded signals and translate them into useful commands. A Node mcu microcontroller is used to directly connect the devices in order to perform fully in wireless control. The Temperature and the Heartbeat sensors constantly measure the parameters which are also displayed on the blynk app. The design we proposed is cost effective and simple. No specific calibration is required before use. Additional characteristic of wheelchair in the hardware design is that it can be operated in 2 modes i.e. either manually or by using patient neck. By using an android app which is blynk app the wheelchair can be moved in 4 directions. The Ultrasonic sensor can help the rider control the wheelchair by taking over some of the responsibility for steering and avoiding objects until the user is able to handle the job. The Temperature and the Heartbeat sensors constantly measure the parameters of the patient which would cross its threshold values then the buzzer rise up.

II. EXISTING SYSTEM

Wheelchair is a gadget utilized by paralysed and physically challenged peoples for their transportation reason. A few sorts of smart wheelchairs are accessible in the market. Various methods have been proposed for allowing disabled persons, including a quadriplegic to control a motorized wheelchair. There are proposed methodologies in recent times which involve various gestures like hand gesture, voice controlled, EEG based system etc.

A. Motion Recognitions

Motion recognition is a process in which a receiver recognizes user's motion. In this context, motions are expressional movements of human body parts, such as: fingers, hands, arm head, face, legs. The purpose of these movements can be information transfer or the interaction with the environments.

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B. Voice Controlled

This work describes a wheelchair for physically disabled people & developed it using voice recognition kit and MEMS motion sensor. User dependent voice recognition system had been integrated in the wheelchair. In this way they had obtained a wheelchair which can be driven using both motion and voice commands.

III. PROPOSED SYSTEM

In the proposed system wheelchair motion, patient's health condition, SMS alert, Android application (Blynk app), and to avoid obstacles in the path of the wheelchair facilities are available. And also

This system has two methods

1. **Manual system**
2. **Android application**

In **manual system,** the patient has to move their neck for the wheelchair motion.

In **android application,** Blynk app has the button options to move the wheels of wheelchair.

This prototype can be operated in both the methods, manual system is enabled when the wheelchair operates with neck movement, taking motion as an input signal for the movement of wheelchair in a particular direction. An accelerometer (tilt sensor) is used to track these motions. This sensor is fitted to neck of the patient. The variations of the trapped and those signals are fed as inputs to the micro-controller. Now based on these variations the micro-controller is programmed to take decisions which in turn control the movement of wheelchair. If person tilt his neck in right or left direction above, chair will move in right or left direction. Android application is enables when the person needs to move the wheelchair by using blynk app.

IV. SYSTEM DESIGN AND DEVELOPMENT BLOCK DIAGRAM.

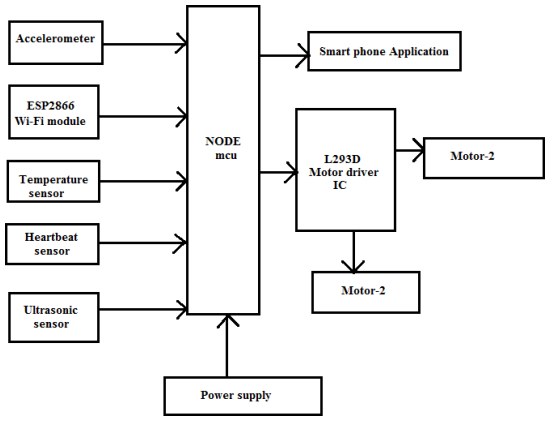

Figure 1: Block Diagram of the Proposed System

HARDWARE MODULES

1) NODE mcu

Node mcu is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. Node mcu is an open source IoT platform. The Node mcu is an open source software and hardware development environment that is built around a very inexpensive System-on-a- Chip called the ESP8266. Node mcu was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi- Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications.

Figure 2: Image of NODE mcu

2) ACCELEROMETER

An accelerometer is an electronic sensor that measures the acceleration forces acting on an object, in order to determine the object's position in space and monitor the object's movement. Accelerometers have many uses in industry and science. Highly sensitive accelerometers are used in inertial navigation systems for aircraft and missiles. Vibration in rotating machines is monitored by accelerometers. Micromachined microelectromechanical systems (MEMS) accelerometers are increasingly present in portable electronic devices and video-game controllers, to detect changes in the positions of these devices.

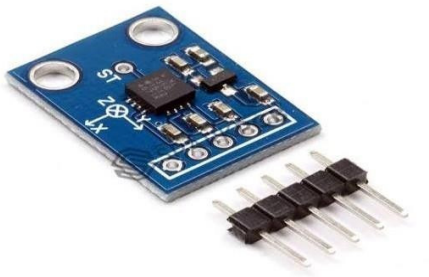

Figure 3: Image of Accelerometer

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3) MOTOR DRIVER IC

L293D is a Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any single L293D IC. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. A voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction. Hence H-bridge IC is ideal for driving a DC motor.

Figure 4: Image of Motor driver IC

4) VOLTAGE REGULATOR

7812 is a famous voltage regulator IC which is being widely used in 12V voltage regulator circuits. It is a complete standalone voltage regulator. It has two capacitors, one on the input and second one on the output of 7812 in order to achieve clean voltage output and even these capacitors are optional to use. To achieve 12V 1A current, 7812 should be mounted on a good heat sink plate. 7812 has built in over heat and short circuit protection which makes it a good choice for making power supplies. 7812 input voltage range is 14V to 35V. Exceeding the voltage range may damage the IC.

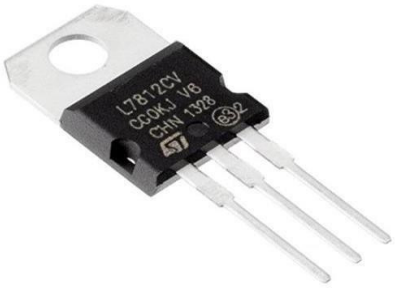

Figure 5: Voltage regulator IC 7812

5) POWER SUPPLY

A power supply is a device that converts one voltage to another more convenient voltage while delivering power. Power supplies are designed from the output back to the input. Since they are designed after the amplification stages, it is tempting to think of them as an afterthought; indeed, some commercial products reflect this attitude. It is most important to realize that an amplifier is merely a modulator and controls the flow of energy from the power supply to the load.

6) TEMPERATURE SENSOR

LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The conversion of the output voltage to centigrade is also easy and straight forward. LM35 can measure from -55 degrees centigrade to 150-degree centigrade. The accuracy level is very high if operated at optimal temperature and humidity levels.

Figure 6: Temperature sensor

7) HEARTBEAT SENSOR

The pulse sensor is a plug & play sensor. This sensor uses an easy optical pulse sensor along with amplification & cancellation of noise to make a circuit. By using this circuit, we can get fast and reliable heartbeat readings. This circuit can be operated with 4mA current and 5V voltage to use in mobile applications. The working of this sensor can be done by connecting it from the fingertip or human ear to Node mcu board. So that heart rate can be easily calculated. Pulse sensors use the photoelectric method.

Figure 7: Heartbeat sensor

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8) ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins.

Figure 8: Ultrasonic sensor

9) DC MOTOR

A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation. A DC motor is any of a class of rotary electrical motors . 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.

Figure 9: DC motor

10) ESP8266 Wi-Fi Module

The ESP8266 is a very user friendly and low cost device to provide internet connectivity. The module can work both as a Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making Internet of Things as easy as possible. It can also fetch data from internet using API's hence it would access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing the building of single-chip devices are capable of connecting to Wi-Fi. The voltage consumption of this wi-fi module is 3.3V.

Figure 10: ESP8266 Wi-Fi Module

SOFTWARE

1. Arduino IDE
2. Blynk app

V. IMPLEMENTATION RESULTS AND DISCUSSION

The hardware modules are assembled together and connected together and verified the working of systems, movement of wheelchair and the health monitoring system and SMS notification.

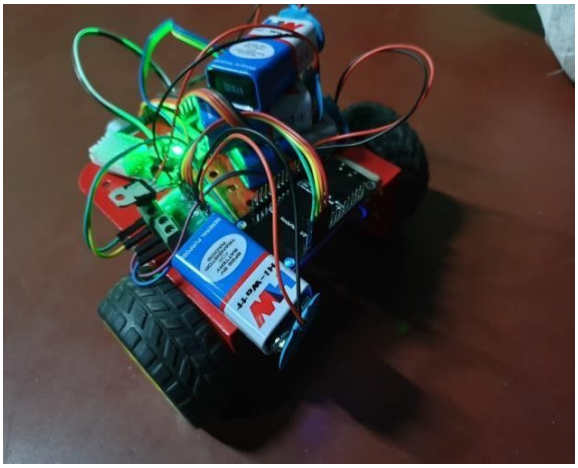

Figure 11: Hardware module of the proposed system

The implementation result of the proposed system is made to display in Blynk Application which is installed in the Smart phone. In this proposed system the health monitoring part shows the patient's temperature and heartbeat rate and if any abnormal parameters is deducted it send an SMS alert.

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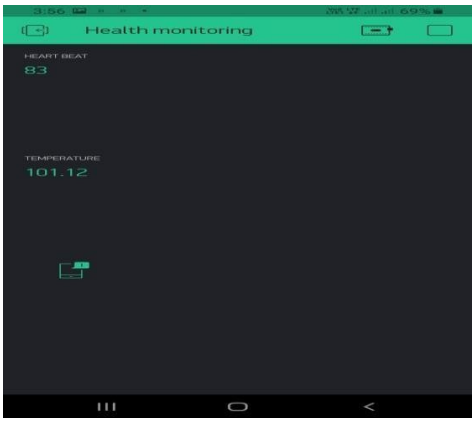

Figure 12: Model Implementation Result

VI. ADVANTAGES AND APPLICATIONS

ADVANTAGES

- It is user friendly
- It can be operated both by the android app and neck movement.
- Without any external help the paralyzed person can operate his own wheel chair.
- Sensors are easily available and less cost.
- It provides independence, freedom, mobility and easy to use.
- It is low power consumption, compact and robust sensing.
- Due to wireless communication data rate is faster.

APPLICATIONS

- It can be used in medical applications.
- For socially assistive robotics.
- Construction and Industrial application for trolley control.

VII. CONCLUSION AND FUTURE SCOPE

CONCLUSION

This system is designed for paralysed people who usually depend on others in their daily life especially in getting from one place to another. This system will assist the handicapped and paralysed peoples to make them self-dependent for the purpose of movement for which these people are dependent on other most of the times. A person with disabled legs and arms can use this wheel chair efficiently if he is able to move his neck. The android app mechanism would bring more convenience for the disabled people over joystick control. Also, temperature and heartbeat is constantly measured and during emergencies message is sent to the family members.

FUTURE SCOPE

- Instead of using tilt sensor, optical sensor can be used to detect eye retina to move wheel chair accordingly.
- Voice command IC's can be used to interface with microcontroller.
- Another limitation of this system is that it works only when the battery is charged and to overcome this we can find a way to automatically charge the battery with the help of movement of the wheelchair.
- Further advancements in this wheelchair are possible by decreasing the power requirements of the wheelchair.

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