JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AUTOMATED WHEELCHAIR USING SPEECH AND GESTURE WITH REAL TIME HEALTH MONITORING SYSTEM THROUGH IOT

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Abstract : A hybrid voice and gesture-controlled wheelchair prototype was developed using a commercially available manual wheelchair to assist people with both upper and lower limb disabilities. An Arduino microcontroller processes the voice command from the speech recognition module and controls the motor movement of the wheelchair. Bluetooth module was also used to do away with messy wiring. Along with this flex sensor are used to detect the gesture of the person and control the wheel chair. Health Monitoring is also done by connecting heart beat pulse oximeter sensor and body temperature for health condition any abnormalities information will be shared to family doctor and emergency unit using IOT.

Keywords: Flex Sensor, MAX30100, Arduino UNO, LCD Display, IOT platform, Bluetooth Module.

I. INTRODUCTION

The wheelchair is the most ubiquitous equipment used by people with lower limb disability. It enables them some degree of freedom in mobility and independence as opposed to those with both upper and lower limb disabilities. Most of the wheelchairs available in the market are manual in nature with some available with motorized option. Anything beyond that is custom made which is costly and not within the reach of most people. People with severe lower and upper disabilities have to resort to costly electronic controlled wheelchairs or be totally dependent on another person to move them around in their manual wheelchairs. Motorized wheelchairs controlled through joystick, softball, finger, tablet, chin and head are readily available at a high cost but most of them do not cater for those with upper limb disability. The advances in speech recognition technology have made it possible to control any electronics-based device using voice command. This technology is capitalized for voice-controlled wheelchair to assist those with both upper and lower limb disabilities. A variety of voice-controlled wheelchairs have also been developed by other researchers. The World Health Organization (WHO) has estimated that of the 75 million people who need assistive technology such as wheelchair, only 5% to 15% of those have access to one.

II. EXISTING SYSTEM

In the existing system we are using joystick for controlling the wheel chair and manual operation has been done due to which it will be hard to operate the wheel chair as always we need to hold the joystick for instructions. And in existing system a health monitoring system has never been implemented within the wheelchair model itself which could be crucial to life saving of disabled patient.

Drawback in the existing system

- Manual operation with joystick
- No Health Monitoring for wheel chair person
- No connectivity to doctor for emergencies
- No gesture or voice recognition system

III. PROBLEM STATEMENT

Independent mobility with real-time health observation is crucial for development of physical, cognitive, communicative and social skill for physically impaired people. This project is thus aimed at the development of more sophisticated control scheme for general electric powered wheelchair with focus on health monitoring systems. The main problem of the wheelchair is that cannot be used by disabled person, so the type of artificial aid needed by a disabled person in order to move about depends, to a large extent, on the level of his incapacity. So we do not need for handles behind the seat to allow it to be pushed by another person. Another problem which is not generally addressed is need for monitoring of health in normal, immediate or critical situations of the disable patient's underlying challenges. With advancement of technology we need systems to overcome real-time health challenges some patients face in disability.

IV. LITERATURE SURVEY

The system comprises two major parts.

1. Wheelchair movement and

2. A real-time health monitoring system, both of which accompanied by the wireless transmission system.

The paper "Robot Control by Accelerometer Based Hand Gesture using Arduino Microcontroller" published in International Journal of Recent Technology and Engineering-Volume 7, Issue 4, November 2018 by Pankaj Kumar Gautam, Sudhanshu Pandey, Vishwajeet Kumar Nanda, represents the framework of an automated wheelchair which moves by the control of hand gesture. Here an accelerometer is used to sense the direction of the hand and move the robot accordingly. In our model, we are using the accelerometer ability along with the gyroscope to have precise information about the orientation.

The paper "Design of Hand Gesture Controlled Robot using Arduino Lilypad" published in International Journal of Engineering and Advanced Technology, Volume 8, Issue 6S, August 2019 by Balaji Sivakumar, Pravin Kumar, Bhuvaneswari Balachander, presents the model of wheelchair controlled by hand gestures. Here, an encoder and decoder are used to deliver the data, and different forms of hand gestures are defined. We are using the encoder and decoder in our model so that the data is transferred securely to the receiver from the transmitter.

The paper "Gesture Controlled Robot Using Arduino and Android" published in International Journal of Advanced Research in Computer Science and Software Engineering, Volume 6, Issue 6, June 2016 by Premangshu Chanda, Pallab Kanti Mukherjee, Subrata Modak, Asoke Nath, represents a model of hand gesture controlled robot, Here the gestures are controlled by an Android operated application and transmitted via Bluetooth. In our model, we use an RF module, as the range of Bluetooth is generally short compared to an RF module.

The paper "A hand gesture-based wheelchair for a physically handicapped person with the emergency alert system" published in International Research Journal of Engineering and Technology, Volume 3, Issue 4, April 2016 by Prof. Chitte p.p., Miss: Khemnar S.B., Miss: Kanawade A.A. Miss: Wakale S.B, represents a model of hand gesture controlled wheelchair with the alert system. Here, the IR sensor is used to control the movement of the wheelchair and to detect the obstacle, and an alert system is designed in case of an emergency. In our model, we make use of an ultrasonic sensor to detect the obstacle, and an alert system is used for health monitoring.

The paper "Automated Gesture-Based Wireless Wheelchair Control by Means of Accelerometer" published in International Journal of Engineering and Advanced Technology, Volume 9, Issue 1, October 2019 by V Sridevi, P. Ishwarya, P. Surya Chandra, N. Suresh Kumar, presents a model of the hand gesture controlled wheelchair. Here the ultrasonic sensor is used for obstacle detection.

The paper "Tongue Operated Wheelchair for Physically Disabled People" published in the International Journal of Latest Trends in Engineering and Technology, Volume 4, by Monika Jain and Hitesh Joshi, presents a model of tongue controlled technology for people with a severe disability. Here a permanent magnet is placed on the tongue whose magnetic field is measured by the magnetic sensors. The sensor signal is transmitted and processed to control the wheelchair but it is really painful as the permanent magnet is pierced on the tongue.

The paper " A Survey on Health Monitoring System by using IoT" published in the International Journal for Research in Applied Science and Engineering Technology, Volume 6, Issue 3, March 2018 by M.Saranya, R.Preethi, M.Rupasri, Dr.S.Veena, gives us a basic understanding and information about heath detection and monitoring of patients and various forms of performing them.

The paper " E-health monitoring system" published in International Conference on Applied Internet and Information Technology June 2016 by Aleksandar Kotevski, Natasha Koceska, and Saso Koceski, gives us an insight on using our electronic gadgets to monitor our health by regularly maintaining the records of the patients and alert when an emergency arises by intimating the doctor. In our model, we are storing the records of the patient in a nearby remote device.

The paper "Raspberry-Pi Based Health Monitoring System" published in the International Journal of Advanced Research in Electrical, Electronics, and Instrumentation Engineering, Volume 4, Issue 8, August 2015 by Chetan T. Kasundra and Prof. A. S. Shirsat, focuses on the measurement of important parameters. Here, the wireless transmission of the data takes place through the Bluetooth module and Raspberry acts as a controller. It also presents a health care system that is more flexible.

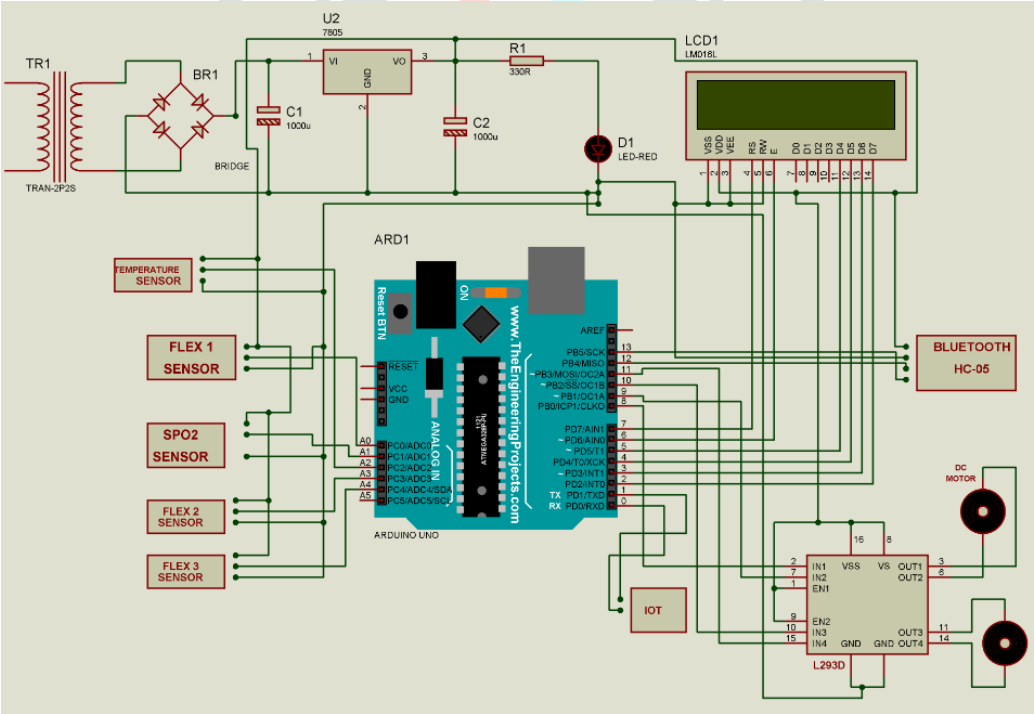
V. PROPOSED SYSTEM

In this proposed system we are operating the wheel chair using gesture and voice commands here voice commands will be passed to mobile phone via Bluetooth instruction which will then be decoded and motors will be operating. Biomedical sensors are also placed in wheel chair for checking the health monitoring and updates will be given via IOT for any emergency cases.

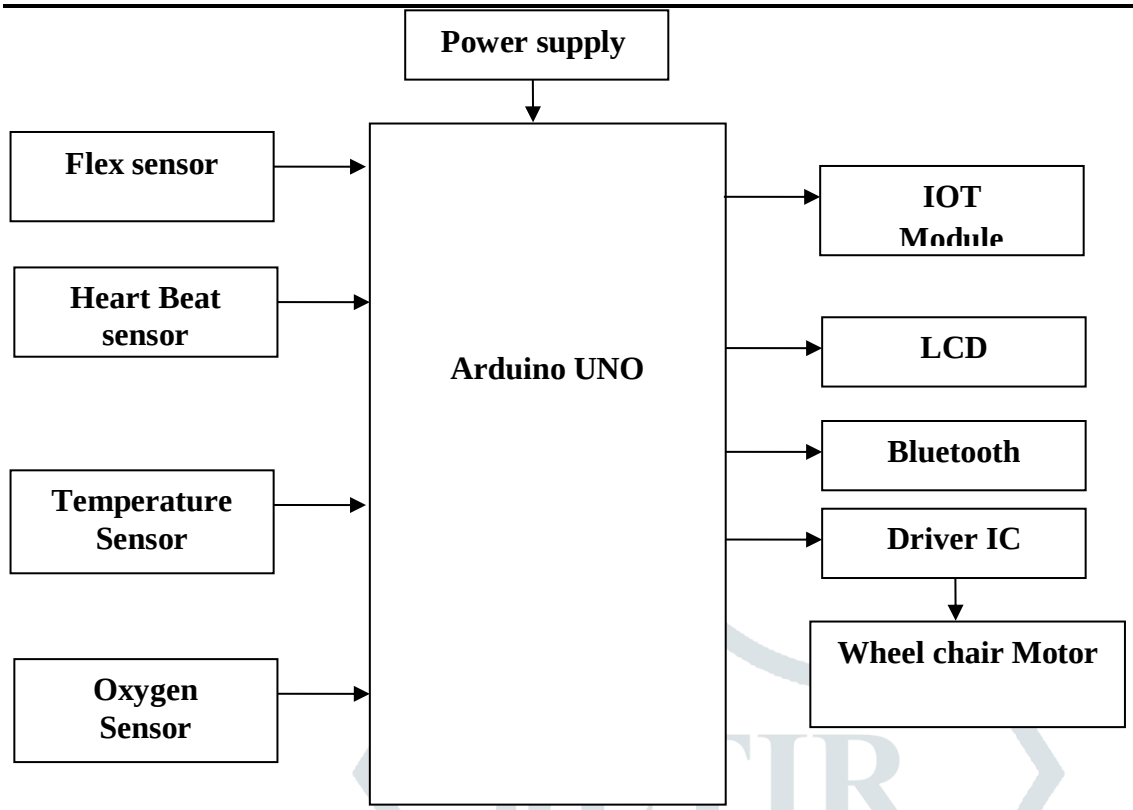
Advantages:

- Gesture based wheel chair control
- Health Monitoring continual
- Voice control using wireless Bluetooth
- IOT used for update the medical status

VI. IMPLEMENTATION



CIRCUIT DIAGRAM



The system can be divided into two sections before merging their applications altogether during the operation of the prototype project model,

Common to both sections,

a) Power Source
b) Arduino Uno/Mega
c) IOT platform [ESP8266]
d) LCD

1.Automated Wheelchair using Speech & Gesture

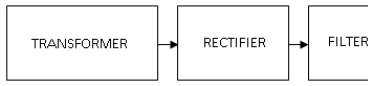
a) Two motors
b) Bluetooth Module (Voice control via App) [HC-05]
c) Flex sensor (Gesture control)
d) Motor Driver [L293D]

2.Real-time Health Monitoring System:

a) Heartbeat sensor
b) Temperature sensor [LM35DT]
c) Oxygen sensor [MAX30100]
d) IOT based app

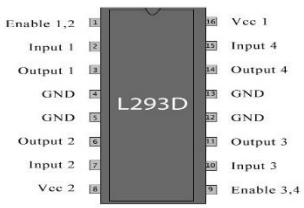
SOFTWARE REQUIREMENTS:

- Embedded C
- Ardruino IDE



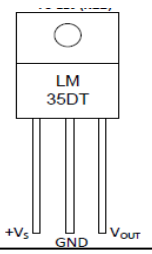
i)Power Source Block Diagram

ii) Arduino UNO

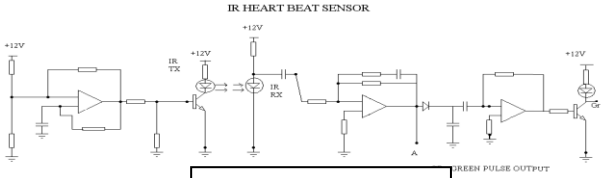


iii) Motor Driver

iii)MAX30100 (SPO2)

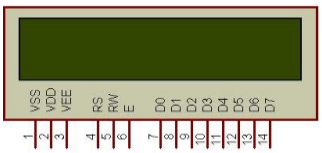


iv)LM35DT (Temperature)

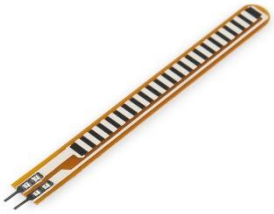


v)Heartbeat Sensor

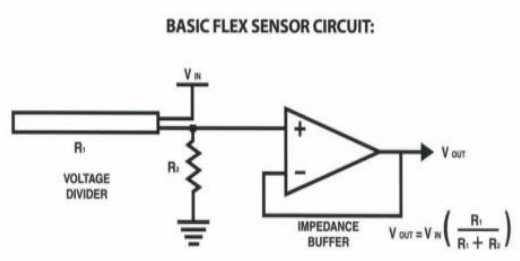
vi)HC-05 (Bluetooth Module)



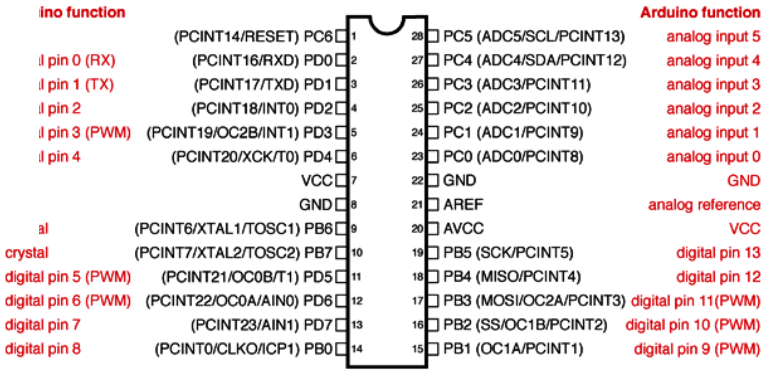
vii) 16x2 LCD



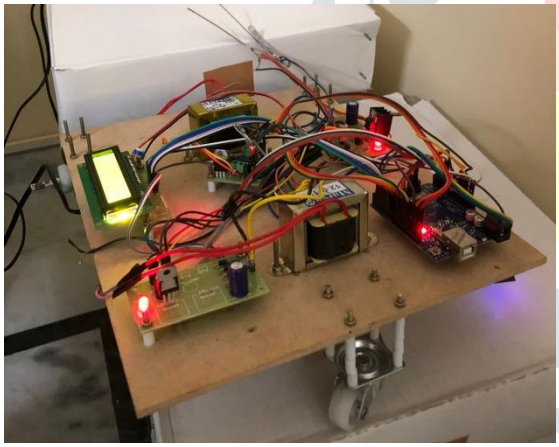
viii)Flex Sensor

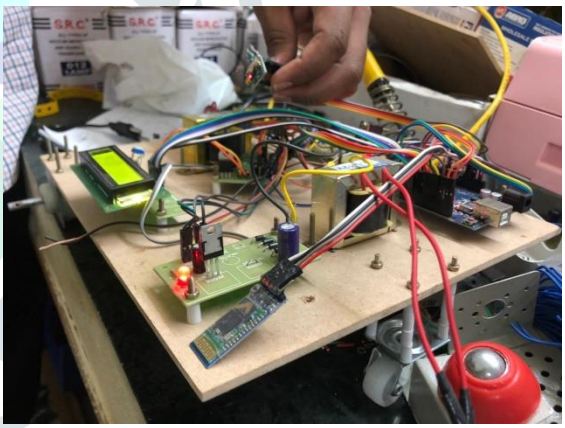


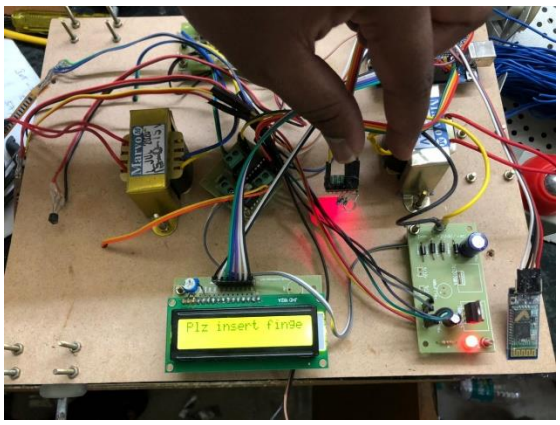
ix)Flex Sensor Circuit

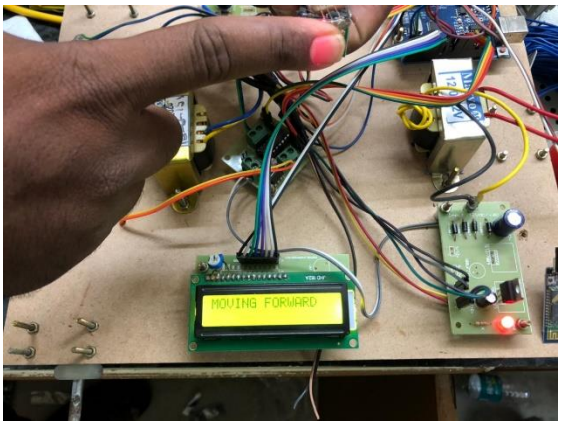


x) Arduino Circuit Diagram









PROTOTYPE WORKING MODEL

VII. APPLICATIONS & SCOPE

- The main advantages of the designed wheelchair system are, it is user friendly, especially helpful for the paralysis stroke people. It reduces the human activity, increases mobility, increases manoeuvrability, increase disabled people's ability to live independently and increase the number of disabled people in employment while providing support and security for those unable to work.
- The main areas where the wheelchair can be implemented are, hospitals, health care centers, old age home, physically handicapped individuals, home, in industries as robot to carry goods, automatic gaming toys, communication researches, control of mechanical systems sports, feedback in computer-based learning environment etc.
- New implementations can be introduced into this such as implementation of live monitoring system and a smart phone alert for providing safety. Another measure to adopt safety is implementation of the device traveling through a pre-determined path.
- Real-time Health Monitoring System with smart response capabilities eradicates the need for additional separate health observation support systems, thereby giving ease of access to operate under pre-determined and precautious situations.

VIII. CONCLUSION

The design and implementation of the Voice-Gesture Controlled Robot are presented and developed using an Arduino microcontroller. A modification to the existing system is provided and the functioning of the device is detailed. As the world keeps updating day by day, the improvisation of this system is kept has future work. The system's productivity can be increased by using additional sensors or cameras. The shortcomings of the hardware in the existing system have been reduced to a great extent and the health monitoring system is made as a single unit. It provides a way for humans to command which bridges the gap between the real and digital world in a more intuitive way.

We have implemented the voice and hand gesture-controlled wheelchair. To improve this project further,

1. We can use eye retina using an optical sensor to move the wheelchair accordingly.
2. We can use voice command IC's to interface our voice signal with a microcontroller.
3. We can send the alert message raised from the device to a defined person by adding a call log facility.
4. We can also send the data directly to our mobile or watch using the cloud services
5. The development of wheelchair for disabled which operates according to the nervous system of humans has yet to be explored.

There are various other fields in which the gesture plays a major role. Some of them are

1. They are employed in defense, security surveillance, etc.
2. Hand gesture controlled industrial-grade robotic arms can be developed.

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