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Finger Movement Controlled Automatic Wheelchair

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ABSTRACT: This project describes a wheelchair for physically disabled people. Our goal is to designanddevelopasystemthatallowstheusertorobustlyinteractwiththewheelchair at different levels of the control and sensing. A dependent-user recognition using Head movements and infrared sensor integrated with wheelchair. Wheelchair which can be driven using acceleration sensor and Head Movements with the possibility of avoiding obstacles. Our project Automatic wheelchair basically works on the principle of acceleration, one acceleration sensor, provides two axis, acceleration sensors whose output varies according to acceleration appliedtoit, by applying simple formula we calculate the amount of tilt output of tilt will decide to move in which direction. Sensor gives x- axisy-axis o/p independently which is fed to ADC then C depending on the pulse width it decides to move or not. On chair Obstacle sensors will be installed. Total 4 sensors will be installed for detection of wall/obstacle in the forward, backward, left right direction. We are trying to build a controlled wheelchair; the system will understand and obeys natural language motion commands such as Take aright.

I. INTRODUCTION

The needs of many individuals with disabilities can be satisfied with traditional manual or powered wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs. There is extensive research on computer-controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention. This project describes a wheelchair for physically disabled people. Our goal is to design and develop a system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing. On chair Obstacle sensors will be installed. Total 4 sensors will be installed for detection of wall/obstacle in the forward, backward, left & right direction. We are trying to build a controlled wheelchair; the system will understand and obeys natural language motion commands such as"Take a right." Various technologies are used for developing such a system.

The aim of this project is to use wheelchair automatically for moving forward, back- ward, Left & Right. The overall framework of this project is to restore autonomy to severely disabled people by helping them use independently a power wheelchair. A wheelchair is an electric wheelchair fitted with acceleration sensors, obstacle sensorand computer to help less able drivers achieve some independent mobility. By just tilting acceleration sensor wheelchair can be moved in four directions. The obstacle sensor can help the rider control the wheelchair by taking over some of the responsibility for steering and avoiding objects until he or she is able to handle the job. The amount of work that the rider chooses to do and how much control is taken by the chair isdecided by the rider and his or hercare.

1.1 Motivation

The life style of the physically challenged people to a great extent. In recent times there have been a wide range of assistive and guidance systems available in Wheelchair to make their life less complicated. In recent times there have been various control systems developing specialized for people with various disorders and disabilities. The systems that are developed are highly competitive in replacing the old traditional systems.

1.2 Problem Definition and Objective

There are many assistive systems using visual aids like Smart Wheelchair systems, Using Joystick and much more. There are even systems based on voice recognition too. The basic assisting using voice control is to detect basic commands using joystick or tactile screen. These applications are quite popular among people with limited upper body motility. There are certain drawbacks in these systems. They cannot be used by people system that involves the movement of Head in directing the wheel chair. The system enables the patient to have command over the Wheelchair its direction of movement and will also sense the user about the obstacles in the path to avoid collision. This wheelchair helps the user to move in environments with ramps and doorways of little space. This work is based on previous research in wheelchairs must be highly interactive to enable the system to work most efficiently.

1.3 Project Scope and Limitation

Project Scope:

Automated wheelchairs that are equipped with sensors & data processing unit are termed as Smart Wheelchair. Our goal is to design and develop a system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing.

Limitation:

1. The impediment looked by debilitated individuals forces critical monetary and social expense
2. Although influence wheelchairs do have a few hindrances, a significant number of them can be transformed into focal points with additional cash or extra high- lights. Regularly a power wheelchair won't crease up or break apart. Most people who need to movement might not have a van or bigger vehicle to store the power wheelchair; in this way they should make different arrangements. You may need to buy an extra manual wheelchair for outings. Another choice is spend more cash on a power wheelchair and buy one that folds ups or will dismantle decently effectively. The crease up power wheelchairs is accessible in many stores; notwithstanding, they can cost a considerable amount more than customary power wheelchair.
3. Even since power wheelchairs have expanded in prevalence, there are as yet many handicapped, harmed, or elderly people who can't buy a power wheelchair. The main motivation behind why a person who might want to buy a power wheelchair can't is because of money related reasons. Prior to acquiring a power wheelchair or totally discounting one, it is vital to talk with protection or Medicare agents. Numerous people don't know about the way that if a wheelchair is prompted by a specialist, it might be completely or halfway secured.

1.4. Applications

2. It very well may be utilized in healing facilities and centers for the impeded people.
3. It can likewise be utilized for elderly people with incapacities.

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II. LITERATURE SURVEY

[1]. Borgolte, R. Hoelper, H. Hoyer, H. Heck, W. Humann, J. Nezda, I.Craig,R. Valleggi and A. M. Sabatini, "Intelligent control of a semi-autonomous omni- directional wheelchair". In Proceedings of the 3rd International Symposium on Intelligent Robotic Systems '95 (SIRS '95) , July 10-14, 1995, Pisa, Italy, pp. 113-120.

A new smart, sensor-assisted wheelchair system for the vocational rehabilitation of people with severe and multiple handicap has been developed in the research project OMNI within the CEC TIDE programme. The project finished in December 1996. The objective of the project was the development of an advanced wheelchair with omnidirectional maneuverability and navigational intelligence that is well suited for vocational rehabilitation. It provides an opportunity ofintuitive wheelchair control to people with severe physical or multiple (incl. mental) handicap. Cramped offices are made accessible by the small outline, high mobility and navigational support of the chair. The user's safety and driving accuracy are guaranteed by a novel sensor system and navigation modules. A wide range ofcontroldevicescanbeusedwiththeadaptablehuman-machineinterfacewhich also controls environmental devices. Within this project, the user focused principle has strongly been followed (this includes the involvement of users from the preparatory work to the evaluation of theresults).

[2]. S. Yokota, H. Hashimoto, Y. Ohyama and J. She, "Electric wheelchair controlled by human body motion", Journal of Robotics and Mechatronics, 2010, Vol. 22, No. 4, pp 439-446.

This paper classifies human body movements when an electric wheelchair was controlled using a Human Body Motion Interface (HBMI) by a Self-Organizing MAP (SOM) and proposes control based on classification results. The Human Body Motion Interface (HBMI) uses body movement following voluntary motion. This study focuses on electric wheelchair control as an application of the HBMI. The viability of the HBMI was confirmed using Center of Weight (C.O.W.) from pressure distribution information on backrest in the wheelchair to control it. If body movement concentrated on a single point at C.O.W. in pressure distribution, a problem occurred because the system would recognize even different body- movement patterns as the same movement. We call body movement taking the same C.O.W. even if it has a different body-movement pattern movement confusion. We solve the movement confusion problem and enhance wheelchair control, classifying body movement using the SOM and reflecting this classification result to improve wheelchair control. Experimental results showed that movement confusion is solved and wheelchair control improved.

[3]. V.I. Pavlovic, R. Sharma, and T.S. Huang, "Visual interpretation of hand gestures for human-computer interaction: A review", IEEE Transactions on Pattern Analysis and Machine Intelligence, July 1997, vol. 19, pp.677-695.

The use of hand gestures provides an attractive alternative to cumbersome inter- facedevicesforhuman-computerinteraction(HCI).Inparticular,visualinterpretation of hand gestures can help in achieving the ease and naturalness desired for HCI. This has motivated a very active research area concerned withcomputer vision-basedanalysisandinterpretationofhandgestures.Wesurveytheliterature on visual interpretation of hand gestures in the context of its role in HCI. Thisdiscussion is organized on the basis of the method used for modeling, analyzing, and recognizing gestures. Important differences in the gesture interpretation approaches arise depending on whether a 3D model of the human hand or an image appearance model of the human hand is used. 3D hand models offer a way of more elaborate modeling of hand gestures but lead to computational hurdles that have not been overcome given the real-time requirements ofHCI.

[4]. C.A. McLaurin and P. Axelson, "Wheelchair standards: an overview", Journal of Rehabilitation Research and Development (Clinical Supplement), 1990, 27(2): pp. 100-103.

This issue features an interesting case report on preventable burns in an individual with tetraplegia (1). This injury was secondary to wheelchair malfunction and a lack of backup to the equipment failure. This case underscores the need to ensure that safety features are addressed as technology is applied to rehabilitation and clinical care. As wheelchairs proliferate and become more sophisticated, it is crucial that safety standards for design and use also evolve. Standards need to be comprehensive.

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[5]. J.D. Nisbet, I.R. Loudon and J.P. Odor, "The CALL Center smart wheelchair".

In Proceedings of 1st International Workshop on Robotic Applications to Medical and Health Care, 1988, Ottawa, Canada. People with physical disability or subjected to other injuries who cannot walk will use wheelchairs. In today‘s world, development is so enhanced that it assures to develop a smart wheel chair. This paper presents a smart wheelchair which is developed to monitor the movement of wheelchair based on speech using regional languages for physically disabled people. To monitor this wheel chair inbuilt speech functions of regional languages are used. This system allows the user to robustly interact with the wheelchair at different levels of the control and sensing.

[6]. 608Rakhi A. Kalantri, D.K. Chitre "Automatic Wheelchair using Gesture Recog- nition", International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 9, March 2013

The needs of many individuals with disabilities can be satisfied with traditional manual or powered wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs. There is extensive research on computer- controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention. This project describes a wheelchair for physically disabled people. Our goal is to design and develop a system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing

III. SYSTEM DESIGN

SystemArchitecture

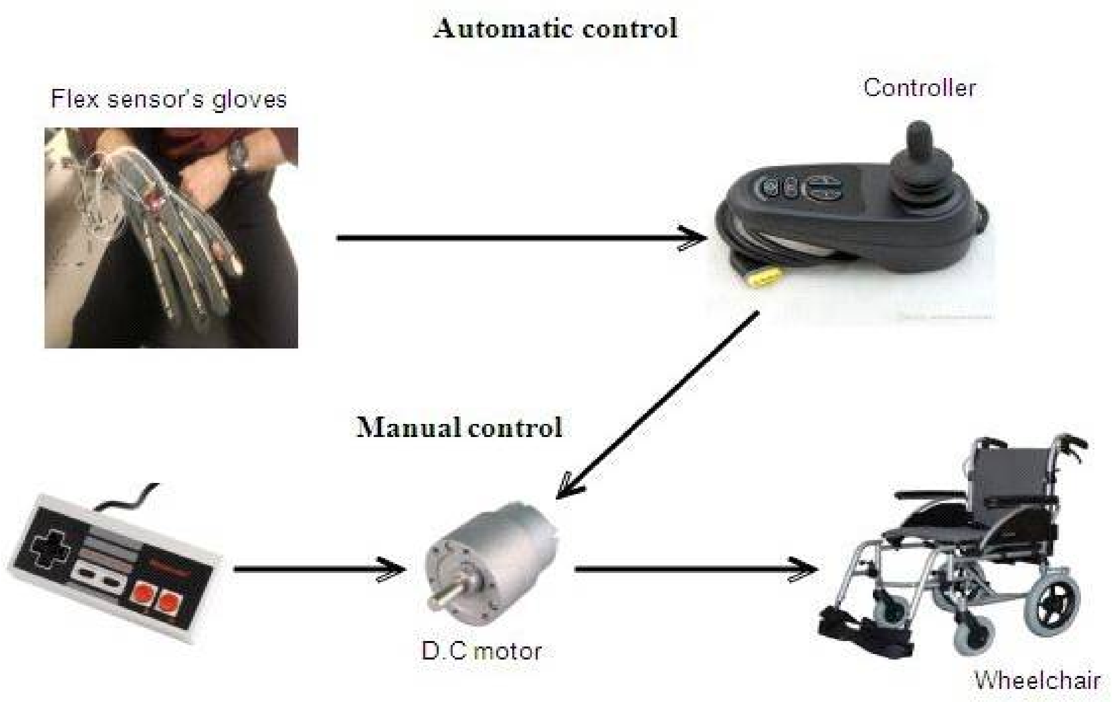

Fig 1: system architecture

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Working principle:

Our project handicap wheelchair basically works on the principle of acceleration, one acceleration sensor, provides two axes, acceleration sensors whose output is analogs, varies according to acceleration applied to it, by applying simple formula we calculate the amount of tilt output of tilt will decide tomove in which direction. Sensor gives x-axis y-axis o/p independently which is fed to ADC then C depending on the pulse width it decides to move or not. On chairObstacle sensors will be installed. Total 4 sensors will be installed for detection of wall/obstacle in the forward, backward, left rightdirection.

Project will work like this,

When person tilt his head in forward direction above 20degree angle chair will move in forwarddirection.

1. Ifpersontilthisheadinbackwarddirectionabove20degreeanglechairwillmove in backwarddirection.
2. Ifpersontilthisheadinleftdirectionabove20degreeanglechairwillmoveinleft direction.
3. If person tilt his head in right direction above 20degree angle chair will move in rightdirection.
4. If person tilt his head at 45degree forward priority will be given to forwarddirection.

IV. PROJECT IMPLEMENTATION

4.1. Arduino Uno

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

Fig 2: Arduino Uno

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Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

4.2. Flex Sensor

Fig 3: Arduino Uno

This flex sensor is a variable resistor like no other. The resistance of the flex sensor increases as the body of the component bends. Sensors like these were used in the Nintendo Power Glove. They can also be used as door sensors, robot whisker sensors, or a primary component in creating sentient stuffed animals.

4.3. DC Motor

A **DC motor** is any of a class of rotary electrical machines that converts direct current 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 flow in part of the motor.

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Fig 4: Arduino Uno

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

4.4. Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.

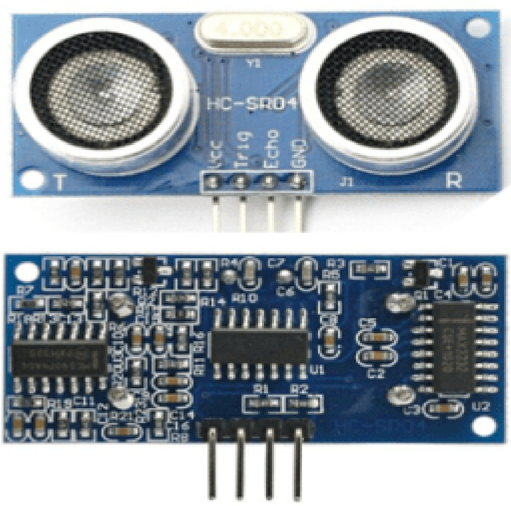

Fig 5: Arduino Uno

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Pins

- VCC: +5VDC
- Trig : Trigger (INPUT)
- Echo: Echo (OUTPUT)
- GND: GND

4.5. NodeMCU For IoT

ESP8266 Wi-Fi Module:

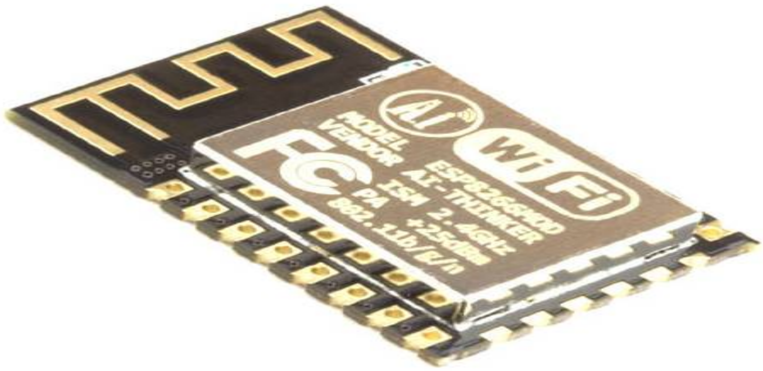

Fig 6: Arduino Uno

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements.Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.ESP-12E is a miniature Wi-Fi module present in the market and is used for establishing a wireless network connection for microcontroller or processor. The core of ESP-12E is ESP8266EX, which is a high integration wireless SoC (System on Chip). It features ability to embed Wi-Fi capabilities to systems or to function as a standalone application. It is a low cost solution for developing IoT applications.

V. RESULTS

5.1. Outcomes

The averaging we do at each interval helps to account for any noise or glitches that the flex sensors are sometimes prone to. The accuracy of the glove is also somewhat limited by the size of the person's hands. The accuracy of each flex sensor is limited beyond a certain point. Smaller hands will result in a larger degree of bend. As a result, the difference between slightly different signs with a lot of flex might be too small for users with small hands.

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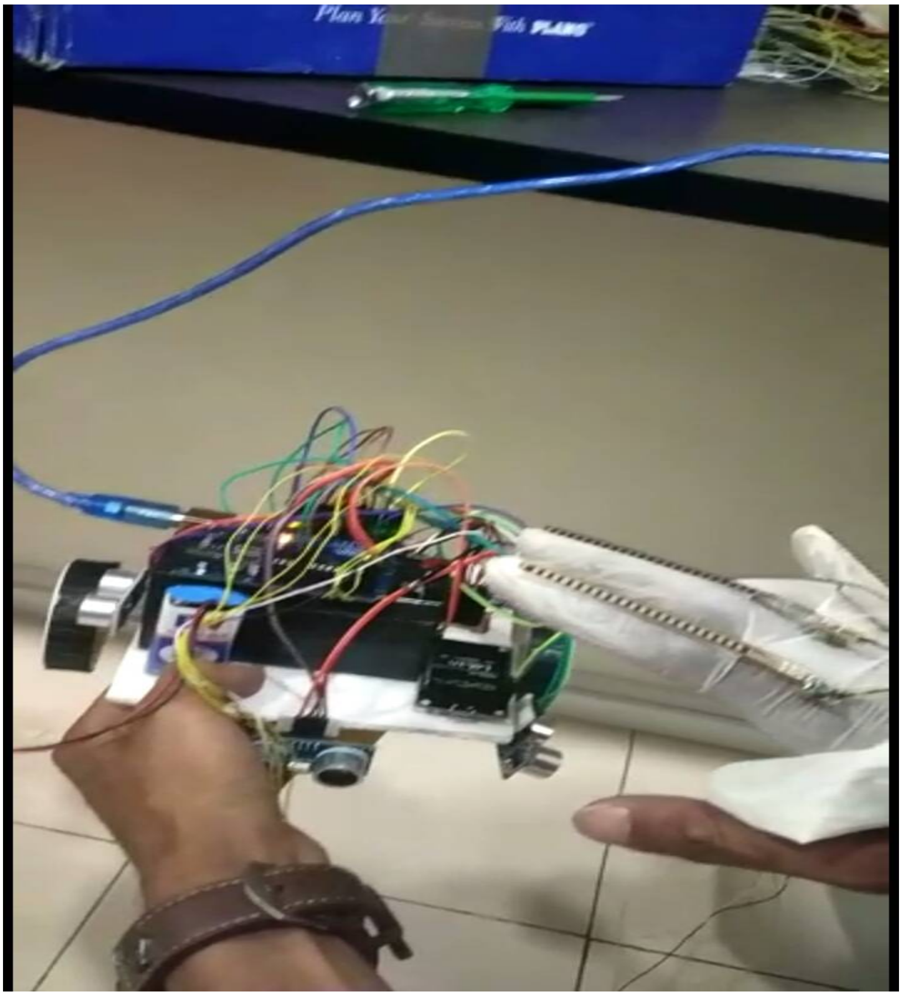
The device uses a low voltage environment, and extremely low frequency communication. The sensors are well attached, and there are no sharp edges. As a result, we don't see any large safety issues associated with the glove. Furthermore, since all communication is done via cables, our device does not interfere with other designs. The glove can be used by anyone who fits into it, they would only have to train on it and generate new datasets if they wish for a higher prediction accuracy than the standard or to incorporate new signs.

5.2. Screen Shots



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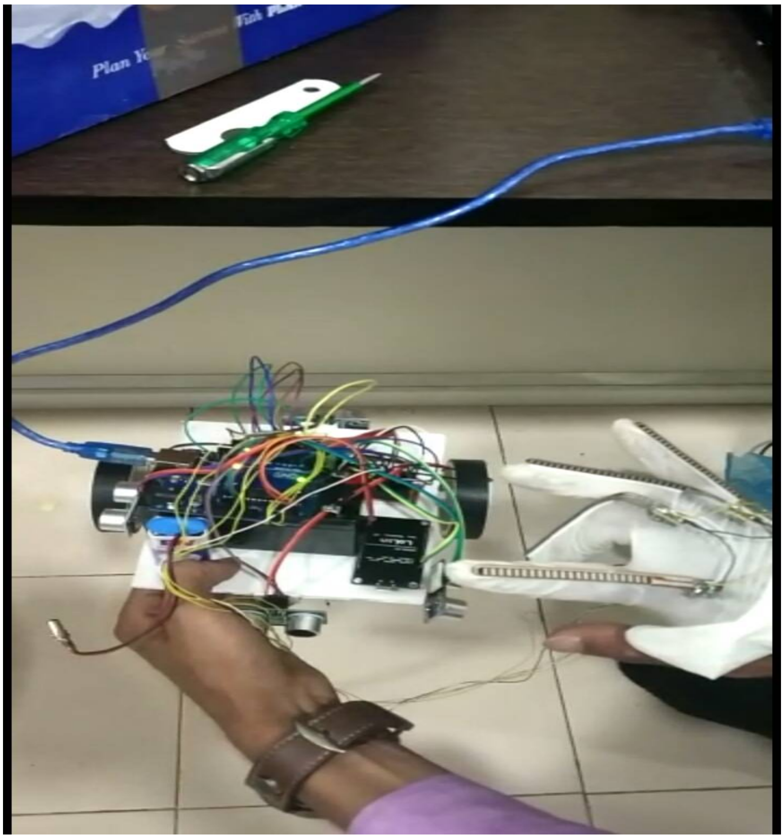

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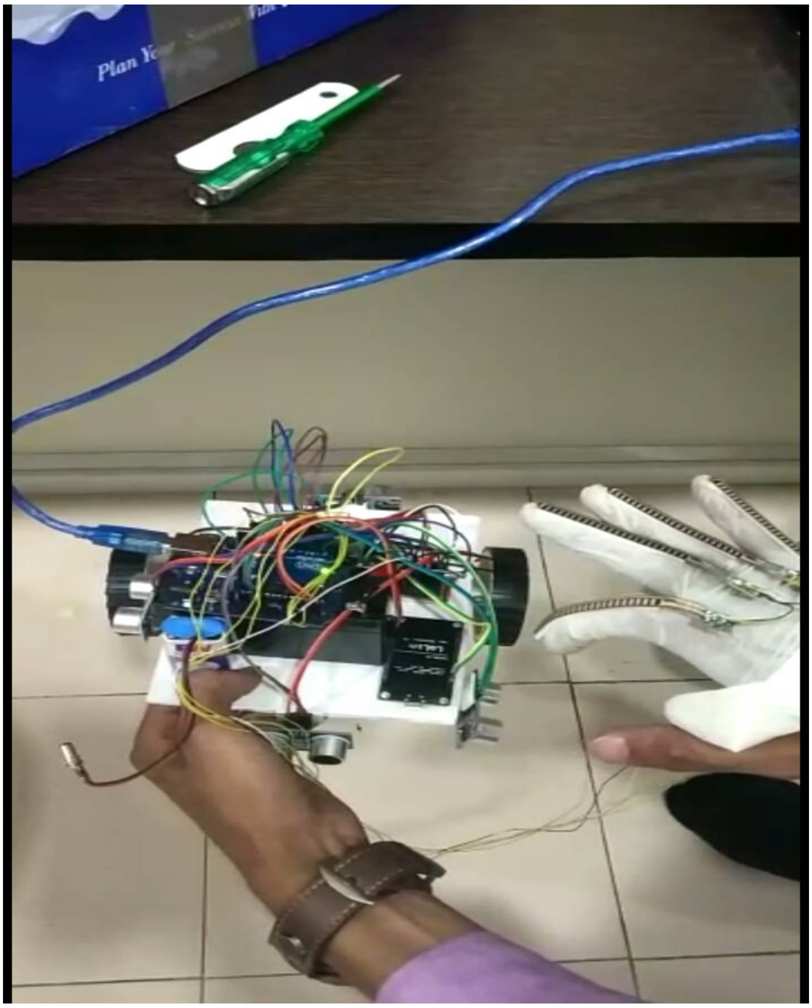

VI. CONCLUSION AND FUTURE WORK

Conclusion

The project presents a Gesture Control Robotic Arm Using Flex Sensor with seven de- grees of freedom. The robotic arm was made of low cost materials that were readily available. The model of the robotic arm was constructed and the functionality was tested. The robotic arm can be controlled over the internet by using Ethernet connectivity and a camera for visual feedback.

Future Work

In future, we can us the advanced technologies for fast gesture recognition. we can also use facial expressions for the movement of the wheelchair, so that in case the person is disabled with hands then also they can use the technology.

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