American International University-Bangladesh (AIUB)

Department of Computer Science and Engineering

Faculty of Science &Technology (FST)

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CSC4182 - HUMAN COMPUTER INTERACTION

Section: A

Project Title: Head Motion Controlled Wheel Chair for Disabled People

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❑ Introduction

The quality of life for physically disabled patients and handicappers should be enhanced by using practical, sophisticated, and cost-effective locomotive devices. The need for human intervention had minimized because today's technology has shifted to automation. These automated systems have fewer manual operations with high accuracy and reliability. According to the WHO's 2011 report, 75 million people need a wheelchair on a daily basis. This represents 1% of the world's population. That's twice Canada's population. There are still many people left who only can move their head, which as result prevents them from using wheelchairs. Medical devices produced to help such patients are very complicated and expensive. So, a microcontroller-based system that enables the movements of the wheelchair depending on head gestures is introduced. The system describes a wheelchair for physically disabled patients which uses head motion and a gyroscope sensor interfaced with a DC motor. A gyroscope sensor is a micro-electro-mechanical sensor (MEMS) sensor that effectively translated head movements into computer-interpreted signals. The designed wheelchair is battery-operated and can take turns in either direction (left/right/back/front) through gestures. The system can be on/off using a switch.

Project Background

Identification Of problem

Smart wheelchairs are very much helpful for disabled patients who have difficulties in driving manual wheelchairs. Patients Who had loosed their hands cannot use the manual wheelchair or motorized wheelchair with a joystick. To solve this problem we build this project. So that disabled people can move by using head gestures.

Background study

Assist prof. Dr. Auns Q. H. Al-Neami and Saba M. Ahmed proposed a project named 'Controlled Wheelchair System based on Gyroscope sensor for disabled patients' [2]. Rami Alkhatib, Maher Sabbah, and his teams also proposed a project of 'Smart Autonomous Wheelchair' in 2019. The world health organization reported 10 % of the global population (650 million people) have a disability and 10% of them need a wheelchair [3]. Recent options, made in volume for gaming and for hobbyists, offer such a possibility. Several sensors, including a 3-D camera, low-cost laser rangefinders, sonar sensors, and a low-cost inertial measurement unit, were considered for use on a smart wheelchair. On the basis of this idea, Rockey, C.A., Perko, E.M., & Newman, W.S. (2013) developed an evaluation of low-cost sensors for smart wheelchairs at the 2013 IEEE International Conference on Automation Science and Engineering (CASE) [4]. We know, moving a sensor through its environment creates signature time variations of the sensor's readings often referred to as flow cues. The results further show that the proposed control strategy can easily integrate minimal steering commands given by a user

(electric wheelchair application) or by a high-level navigation module (autonomous simultaneous localization and mapping (SLAM) applications) [5]. Based on this idea, Steckel, & Peremans proposed an 'Acoustic Flow-Based Control of a Mobile Platform Using a 3D Sonar Sensor' in 2017 [6].

- Goals

Our goal is to make a Head Gesture Controlled Wheel Chair that will provide a disabled person safe and user-friendly experience.

❑ Methodology

Methods & tools

The methods and tools used to implement the above system are discussed here with a relevant picture.

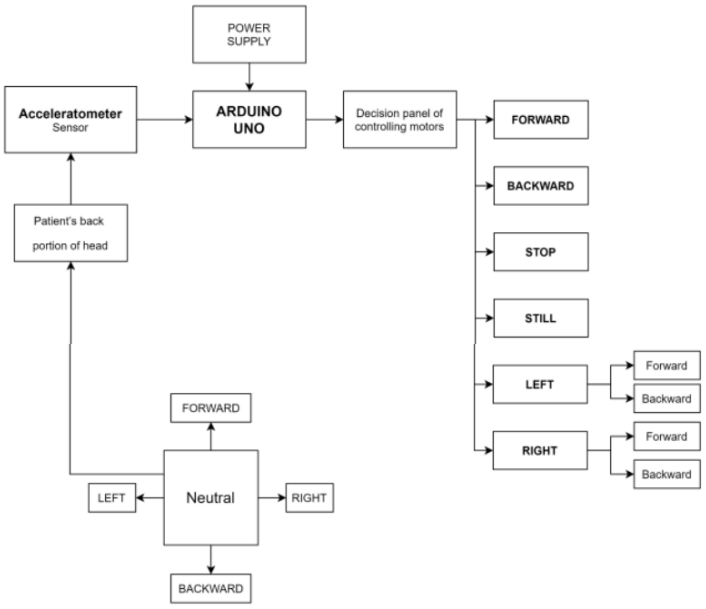

Figure 1: Block diagram for an Automated Sensor-based Head Motion Control Wheelchair.

In figure 1, we have used Arduino UNO which is connected to Bluetooth Module. Gyroscope and Power Supply. The gyroscope sensor is also connected to the patient's smartphone and it can be connected to the patients head set. If the patient moves his head forward then a wheelchair will go forward, if backward then will move to back, if moves his head to right then it will move right and if left it will do the same. The Decision Panel of controlling motors is connected to Arduino UNO and, it will move forward and backward considering the patient's movement. We have developed this project for people who are not eligible to move. By using this can easily access movement. They can move from here to there flawlessly. This is the main purpose of our project.

Implementation planning

We have created a proper plan to make our project. We have created a block diagram and listed all our components to make this project. After managing all the components, we coded our microcontrollers and sensors. After that we have created the cover of our project to make it look beautiful. Then our prototype is ready to run.

Implementation

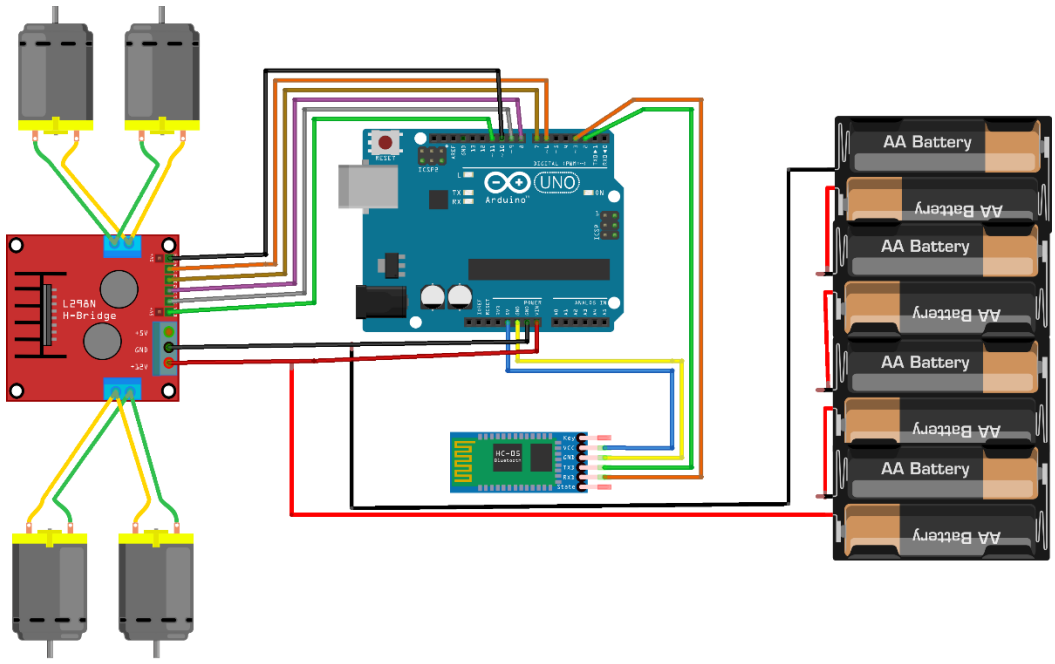

Figure: Circuit Diagram of Head Motion Controlled Wheel Chair

Here we have used four 3~6 Volt DC motors. Four wheels are connected to these motors. The motors are connected to a L298N Motor Driver. The motor driver is connected with an Arduino Uno microcontroller. A Bluetooth Module is also connected with the microcontroller. Four 18605 Li-ion rechargeable battery are connected with the microcontroller and motor driver. To connect the Bluetooth module with smart phone, we have used RemoteXY library to code the microcontroller. We have installed RemoteXY application in our phone and connected it with Bluetooth. And our project is ready to run.

❑ Result

Final visualization of Project:

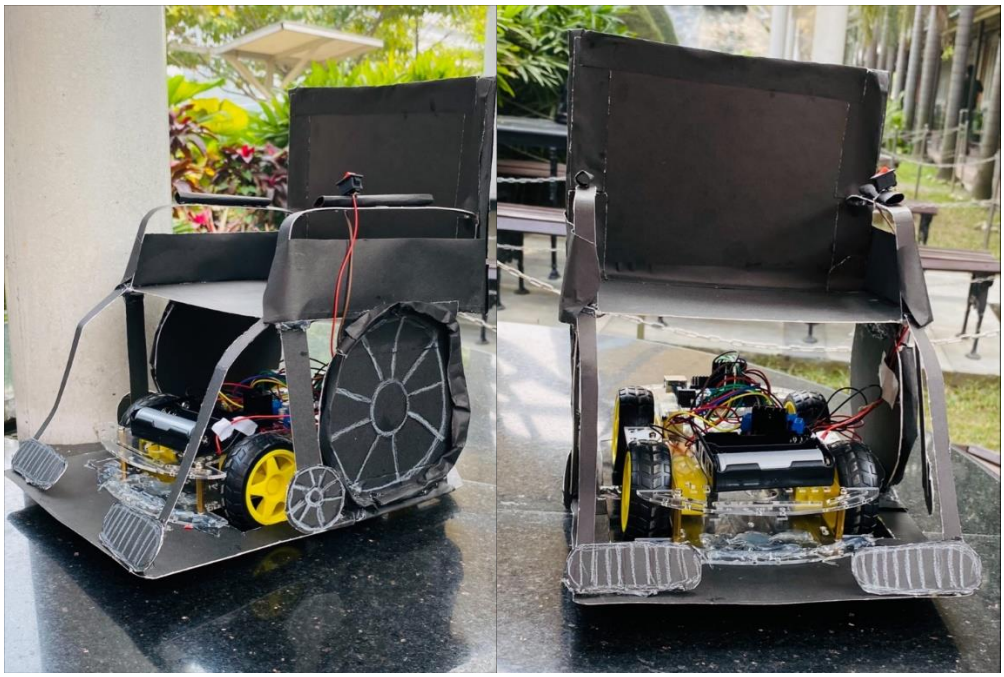

Figure: Gesture Controlled Wheel Chair

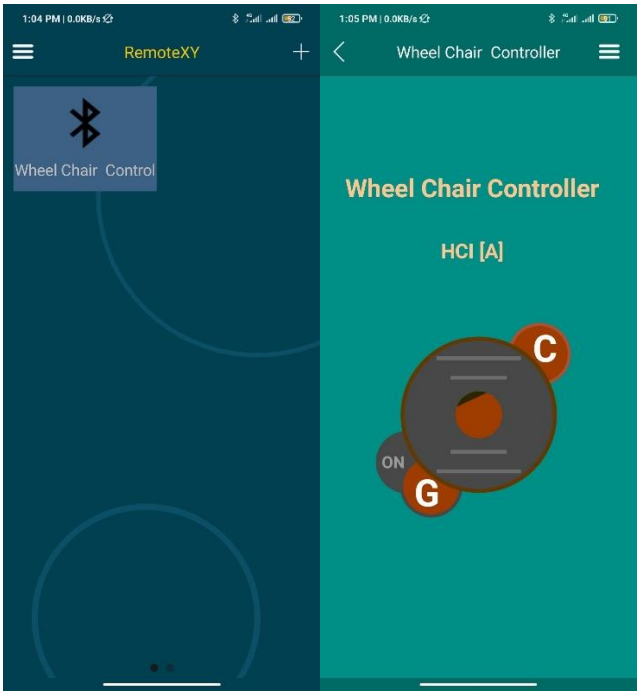

Figure: Wheel Chair Controller Application for Smart Phone

From the above pictures, it is seen that we have completed our project successfully. It works perfectly. We have achieved good controlling accuracy.

❑ Discussion

Findings

We faced many difficulties when we were making this project. The Bluetooth modules were not working correctly with a smartphone. After facing various errors, we successfully implemented the project. We learned a lot when we were building it.

❑ Conclusion

Recommendations

In the future we can add more features like emergency calling systems, which means if the individual may face any kind of trouble then automatically his/her family members get notified.

Conclusion

In this experiment, the goal was to create an automated sensor-based head motion control wheelchair for disabled patients. The direction of the motor was controlled by using the gyroscope sensor of a mobile phone. An on/off switch was used to on/off the wheelchair. We are using Arduino Uno, Bluetooth Module, Motor Driver, Wheels, Motors, Battery, Car Case, Jumper wire, and battery holder. After assembling and coding the Arduino we have run the project successfully. Therefore, the aim of this project was fulfilled. This is basically a prototype project that means when the industries will make it, they can make it at a minimal price. The main purpose of this project is to assist the incapacitated people of our society.

❑ Reference

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[3] R. Alkhatib, A. Swaidan, J. Marzouk, M. Sabbah, S. Berjaoui and M. O.Diab, "Smart Autonomous Wheelchair," 2019 3rd International Conference on Bio-engineering for Smart Technologies (BioSMART), 2019, pp. 1-5, doi: 10.1109/BIOSMART.2019.8734264.

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