Gesture Control Wheelchair For Handicap Person

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***Abstract*—A hand gesture-controlled wheelchair is a type of assistive technology designed to help people with physical disabilities who have difficulty moving around on their own. An accelerometer is used as a sensor which gives an analog signal on its movement in any of the 6 axis directions, that is positive X axis, negative X axis, positive Y axis, negative Y axis, positive Z axis, negative Z axis. In this project we have considered X, Y and Z axis for the direction. Further the input from sensor is given to encoder which sends the data wirelessly through the transmitter, then the data is received at the receiver end and the sensor data is decoded and finally given to microcontroller. Based on data received the from accelerometer the microcontroller sends the signal accordingly to relays to move the wheelchair in forward, backward, left, right directions. As a result, more and more developers and innovators have been directed towards robotic wheelchairs. A robotic wheelchair is an intelligent wheelchair that has capabilities of navigating, detecting obstacles and moving automatically by utilizing sensors and artificial intelligence. We have developed a Robotic Wheelchair for the quadriplegic patients for mobility assistance operated using the hand gesture.**

***Keywords* – Gesture Control Wheelchair, Raspberry Pi, Arduino, Accelerometer**

I. INTRODUCTION

As society continues to move towards a more inclusive and accessible world, technology has played an increasingly vital role in enabling people with disabilities to lead fuller, more independent lives. One such technology that has gained significant attention in recent years is gesture control wheelchair, which allows people with mobility impairments to control their wheelchairs using simple hand and arm movements. For individuals who are unable to use traditional joystick controllers or other forms of assistive technology, gesture control offers a ground breaking solution that can drastically improve their quality of life. This technology uses a combination of sensors and algorithms to detect and interpret hand gestures, allowing users to navigate their wheelchairs with ease and precision. The aim of this research paper is to explore the current state of gesture control wheelchair technology, its benefits and limitations, and the future directions for research and development in this field. By examining existing literature and conducting a review of available research studies, this paper will provide an in-depth analysis of the potential applications and impact of gesture control wheelchair technology on the lives of people with disabilities.

Specifically, this paper will explore the technical components and design of gesture control wheelchair systems, including the various sensors and algorithms used to detect and interpret hand gestures. It will also examine the practical implications of using gesture control wheelchairs, including the impact on users' mobility, health, and quality of life. Additionally, this paper will consider the challenges and limitations associated with this technology, including issues related to user training and interface design. Gesture control wheelchair systems are comprised of a variety of sensors that work together to detect and understand hand gestures. These sensors may include accelerometers and gyroscopes which can detect changes in orientation and motion, as well as cameras or depth sensors, which can capture images or depth data to interpret hand gestures. Algorithms are then used to process the sensor data and translate it into commands that control the wheelchair's movements. The practical implications of using gesture control wheelchairs are significant, as they offer a range of benefits over traditional joystick controllers. These benefits include increased precision and accuracy in navigation, reduced physical strain associated with joystick controllers, and a greater sense of autonomy and empowerment for users. However, there are also limitations to this technology, including the need for user training and potential challenges associated with the interface design.

II. LILTEARUE REVIEW

The aspects of this kind of problem are notably complex and vary in time. To propose an effective as well as the best solution, we have gone through several related articles. This portion also helped to propose a state-of-the-art solution by finding out the existing research gap. The main findings of the related study are presented below.

Y. Asai et al. worked on a virtual hand motion-based wheelchair [1]. In this research, they used the touch-based MR interface to capture the hand motion for the wheelchair. F. F. Alkhalid et al. worked on a voice-controlled autonomous wheelchair that includes a tracking system [2]. Predefined voice command can control the wheelchair and the GPS can track the position. This system also includes an emergency call feature. A. Rajbongshi et al. performed the extraction of the Bangla text from the Bangla text image and then converted the extracted text to speech [3]. M. G. Antonelli et al. worked on an off-road wheelchair system that will be able to protect its rider from any kind of damage [4]. According to their research, the prototype worked successfully. W. Zgallai et al. worked on a smart wheelchair that will be able to move based on EEG and spectrum and they became successful to build their prototype [5]. This device will be very helpful especially to the blind and paralyzed people, as they have the extreme difficulty of movement. P. R. Kumar et al. worked on a smart wheelchair that can be controlled by voice command [6]. This traditional wheelchair will be helpful to people who don't have control of the lower part of their body. P. Dey et al. worked on a hand gesture-based wheelchair and this project includes a solar power system to provide energy to the device [7]. They used the DC motor to control the wheelchair and Arduino Uno to provide instructions. R. Alkhatib et al. developed a machine learning-based wheelchair to support its user [8]. Here navigation was controlled by a computer vision system. I. G. Torres et al. worked on a cost-efficient wheelchair to support people as though smart wheelchairs are available but most people cannot afford it [9]. K. Joshi et al. developed a smart wheelchair that can be controlled through voice command and can be used as a line following a wheelchair [10]. S. N. Sakib et al. worked on a low-cost solar powered smart wheelchair system for disabled people and their target area was Bangladesh [11]. The main purpose of their research was to develop a system that will be cost effective so that the people of Bangladesh can use it and making it environment friendly by using solar energy. Another solar power smart wheelchair was developed by M. S. Kaiser et al. and in this project, they used EMG signal to navigate blind people [12]. M. Ghorbel et al. worked on a proposed model for the collaborative control of a smart wheelchair [13]. Z. Fan et al. worked on motion predictors for wheelchairs using Autoregressive Sparse Gaussian Process [14].

III. METHODOLOGY

Few steps are required to execute for the successful implementation of our work. The expected outcome of our work is basically five types of actions such as emergency text sending to the mobile phone, movement of the wheelchair to the forward direction, the right direction, left directions, and stop of the wheelchair movement. To obtain the expected outcome, we have proposed a methodology which is presented in Fig1. firstly, the Accelerometer will detect a change in movement of the users hand, which in turn will create a signal which will then be transmitted to the receiver side through the NRF module. On the receiver side the NRF module will pick the signal and will send the signal to the nano and then the necessary action will be performed that is forward, right, left and stop. In an emergency situation, an emergency signal is sent to the user's mobile phone. Here, Pi will activate the GSM module and request for sending an emergency text. Raspberry Pi will contain the emergency phone number, emergency text and as well as the location with the help of GPS Module. So, the raspberry pi will provide that information to the GSM. Later GSM will send text messages to mobile phones to respond immediately to the emergency of the user.

Sr. No	Component Name	Quantity
1	Raspberry Pi	1
2	Arduino Nano	2
3	NRF Model	2
4	Motor Driver	1
5	Bo Motor	4
6	GSM	1
7	Accelerometer	2
8	GPS	1

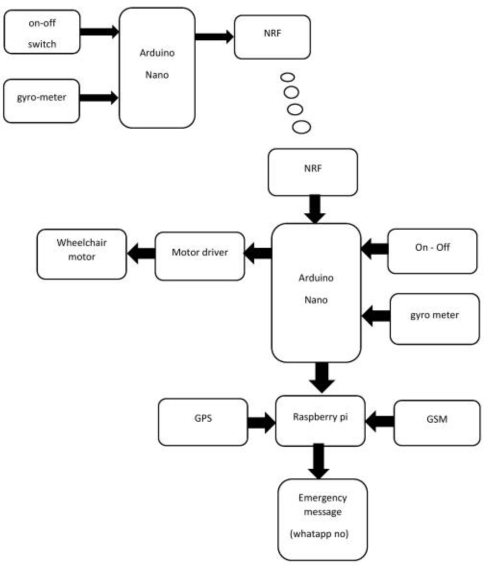

Fig.1. Block Diagram

IV. Result Analysis

There are four cases can be happened after getting the input (user's hand movement) from the user. We have done the testing of the prototype device. It executes the following four cases (Case A to Case D) perfectly during the testing.

Case A: If the tilt sensor is activated, an emergency text messages will be sent to the required mobile phones to respond immediately to the emergency of the user.

Case B: If the user moves it hand forward the wheelchair will move forward.

Case C: If the user moves his hand left, the wheelchair will consider it as a move left command. Then the wheelchair will move to the left.

Case D: If the user moves his hand right, the wheelchair will consider it as a move right command. Then the wheelchair will move to the right.

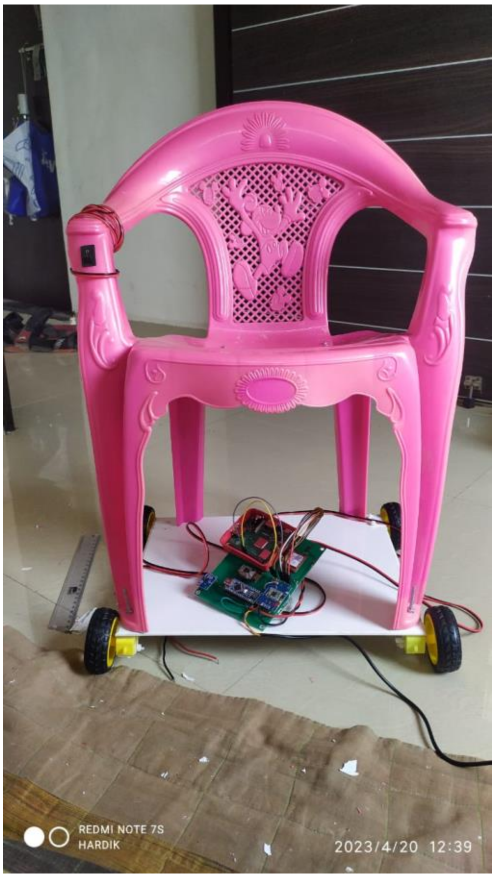

Fig.2. Final Result

V. Conclusion

In conclusion, the development of gesture-based wheelchairs for handicapped people has opened up new possibilities for improving their mobility and independence. This technology uses sensors to detect hand and arm movements, allowing the wheelchair to be controlled by gestures rather than physical contact with the chair itself. The advantages of this approach include ease of use, reduced physical strain, and increased speed and accuracy of movement. However, further research and development are necessary to refine the technology, improve its reliability and responsiveness, and make it more affordable for people who need it. Nevertheless, gesture-based wheelchairs represent a significant step forward in enhancing the quality of life of handicapped individuals, enabling them to move around more freely and participate more fully in everyday activities.

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