

HAND MOVEMENT GESTURE WHEELCHAIR

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Abstract- A state-of-the-art assistive gadget designed to increase mobility and freedom for people with physical limitations is the hand movement gesture wheelchair. Using sophisticated gesture recognition algorithms and sensors, this wheelchair converts hand motions into the proper wheelchair control signals. Two of the numerous components of the system are a set of wearable sensors placed on the user's hand and a processing unit integrated inside the wheelchair. The sensors record the hand actions, including gestures and finger motions, and then they relay the data to the processing unit. The processing unit evaluates the received signals using gesture recognition algorithms to detect the intended commands based on predetermined gestures. The system translates the selected commands for wheelchair control into the appropriate wheelchair movements, such as forward, backward, and turning and stabbing. These instructions are then carried out by the motorised wheelchair, enabling the user to move easily and precisely through their surroundings.

Keywords- Recognition algorithms and sensors; Commands; Gestures; Algorithms;

I. INTRODUCTION:

A hand movement gesture wheelchair is a cutting-edge assistive technology that allows users with limited mobility to control their chair using hand gestures. Using sensors and a microcontroller, this state-of-the-art technology transforms the user's hand motions into commands for the wheelchair. A number of sensors, including as accelerometers, gyroscopes, and flex sensors, are included in the wheelchair's control system to capture the user's hand movements in real time. In order to accurately detect the user's hand's position, orientation, and motion, these sensors are carefully placed. By analysing the sensor data, the system can determine the user's intended actions and gestures. A microcontroller like an Arduino or an ESP32 serves as the wheelchair control system's main processing unit. It receives sensor data and interprets it in order to understand the user's hand gestures. The microcontroller has algorithms and logic that translate specific hand motions into appropriate wheelchair commands. For instance, tilting the hand forward can cause the wheelchair to move forward while twisting the hand left or right can cause the wheelchair to turn. The microprocessor interprets the user's hand gestures to determine the intended wheelchair movement, and then provides control signals to the wheelchair's motor drivers. The motor drivers, which are typically affixed to the wheelchair's motors, receive these signals and convert them into electrical impulses that power the motors. By adjusting the motors' speed and direction, the wheelchair can be made to move in reaction to user hand motions. The hand gesture wheelchair provides a straightforward and natural way for those with limited movement to manage their mobility devices. It lessens the reliance on conventional joystick controls and makes the experience more approachable and engaging. This technology gives wheelchair users additional freedom and flexibility, allowing them to manoeuvre through their surroundings more swiftly and comfortably.

II. LITERATURE REVIEW

In [1]. The research paper "Hand Gesture Controlled Wheelchair" published in the International Journal Of Creative Research Thoughts explores the fundamentals of a wheelchair that is operated by hand gestures. The sensor that tracks hand motion and controls the wheelchair is an accelerometer. The main difficulties that people with disabilities have when doing various chores to meet their basic needs have been covered in this project. Hand gesture detection technologies are becoming more and more crucial in user interfaces since they provide more convenience.

In [2]. Accelerometer, general-purpose PCB, encoder IC, RF module, decoder IC, microcontroller, motor driver, DC Motors, DC Gear motor, and other components are used in the paper titled "Design And Analysis Of Gesture Controlled Wheelchair" published in the IJARIE-ISSN(O) journal. The suspension is used to suspend the rider and bicycle, protecting them from the rough terrain. The use of bicycle suspension is advantageous in this project.

In [3]. The research paper "Hand Gesture Controlled Wheelchair" that was published in the IJRET journal suggests a wheelchair that is completely automated and requires less effort and physical strength from the disabled individual. It will be affordable, or if a person currently has a typical wheelchair, automation can be added to it using circuits. It is equally as folding as the original wheelchair, making it simple to carry from one place to another. It can support up to 100 kg of weight. Within a predetermined range, it can be controlled by the user alone or by a friend. The design of this wheelchair was primarily focused on fostering independence among the elderly and the crippled.

In [4]. The project was written up in the Journal of JESR with the title "Object A Smart Wheelchair Prototype Based On Hand Gesture Control." In this project, a smart wheelchair prototype based on hand gesture control was conceived and constructed to aid and offer improved control options to those with severe disabilities. In addition to hand gestures, the project can benefit from the use of foot, head, torso, or even eye movements. Further study will address the system braking concerns with this wheelchair.

In [5]. The research article "An Automated Wheelchair For Physically Challenged People Using Hand Gesture And Mobile App" published in the Journal of International Journal Of Springer proposes a user to utilize the wheelchair autonomously, DC motors have been used in the design of the wheelchair. Compared to pushing a manual wheelchair, it is more simpler. Rechargeable

batteries, which can be utilized for two to three hours when fully charged, provide power for the DC motors. For elderly and disabled patients, they have created a clever automatic wheelchair. The two main control systems for this wheelchair are the gesture control system and the Bluetooth control system using a mobile application called the Bluetooth RC controller. With the use of a gesture recognition system, the wheelchair can be operated by hand gestures in this system. The accelerometer sensor, which is inexpensive and can provide the hand's direction, is what the gesture recognition system relies on to identify gestures. For elderly and disabled people, this study offered a wheelchair that is simple to maneuver and that they may use independently and with little effort.

III. METHODOLOGY

Project management methodology offers a clear roadmap outlining the steps required to finish a project successfully. These project approaches or strategies all offer a specified governance structure, process norms, test activities, processes, and deliverables. Project management methodology is needed to standardise, structure, and arrange work processes. This encourages a consistent focus across all initiatives, gives us the chance to repeat successful strategies and learn from our mistakes, and results in a process of continuous improvement.

ESP32 transmitter: The ESP32 transmitter detects hand motions and sends the necessary signals to the receiver module. It is possible to programme the gadget to analyse hand gestures using accelerometer sensor data and read data from the sensor. The ESP32 transmitter and receiver modules will wirelessly exchange the gesture data.

Accelerometer sensor: An accelerometer sensor is used to track the movement and position of the hand. It computes the acceleration forces that are applied to the sensor at various angles. The ESP32 transmitter will read information from the accelerometer sensor to determine the user's hand motions.

ESP32 receiver: The ESP32 receiver module receives the gesture data that the ESP32 transmitter has transmitted. It can be connected to the motor driver module and use the information it interprets to properly control how the wheelchair moves.

Motor driver: The motor driver module is in charge of managing the wheelchair's motors based on information about the gestures it has received. It receives signals from the ESP32 receiver module and then transmits the necessary power and control signals to drive the motors in the desired direction and at the desired speed.

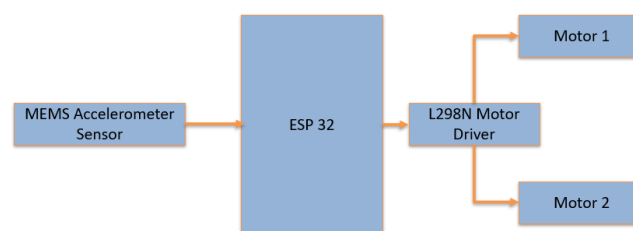


Figure 1.1:Block Diagram of the Project

IV. WORKING PRINCIPLE

The hand's direction and velocity are determined by the accelerometer sensor, which also provides acceleration data. The ESP32 transmitter reads the accelerometer data and interprets it as hand motions. The hand gestures, which can be predefined, can be used to indicate start, stop, turn, and other commands, as well as up, down, left, and right hand movements. The ESP32 transmitter transmits gesture data wirelessly to the ESP32 receiver module.

The ESP32 receiver receives the gesture data and processes it to determine how the wheelchair should move. Based on how the motions are perceived, the ESP32 receiver transmits control signals to the motor driver module. The wheelchair can move in the desired direction and at the appropriate speed thanks to the motor driver module, which receives control signals and controls the wheelchair's motors accordingly. By detecting hand movements and wirelessly transmitting them to the receiver module, which then controls the motors via the motor driver, the wheelchair can be manoeuvred by the user using this set-up.

V. PROPOSED SYSTEM

Remember that implementing such a system would require expertise in hardware design, sensor integration, programming, and user experience. Prioritising safety should also include making sure the system is dependable and safe for both the user and others. The system would need to undergo thorough testing, validation, and adherence to relevant regulations before being made available for usage in the real world. The following elements make up the hand movement gesture wheelchair system that is being proposed. The proposed system for Hand movement gesture wheelchair consists of the following components:

•**Sensors:** The wheelchair would be equipped with a variety of sensors to record hand actions. It is possible to utilise gyroscopes, accelerometers, motion sensors, or even dedicated gloves with finger-movement sensors. These sensors would provide information about the hand motions to the microcontroller.

•**Microcontroller:** A microcontroller, such as the ESP 32, would analyse the information it gets from the sensors to comprehend the hand gestures. The microcontroller would be programmed with algorithms to recognise specific motions and convert them into commands for the wheelchair.

•**Wireless Technology:** The microcontroller would interface to the wheelchair's control system using Bluetooth or Wi-Fi. The wheelchair would receive the conveyed motions as commands.

•**IoT Connectivity:** As part of an IoT-based system, a wheelchair might be connected to the internet, allowing for remote data logging, monitoring, and control. Utilising features like wheelchair usage tracking, remote assistance, or IoT device or service integration may be made feasible through this link.

•**Power Source:** The wheelchair system would require a dependable power source, such as batteries or a power supply, to ensure continuous operation. The power source should be designed to give the wheelchair the required power and support continuous use.

VI. CONCLUSION

Finally, the construction of a hand gesture wheelchair using an ESP32 microcontroller, accelerometer sensor, and motor driver has been successful. The project's objective was to create a different wheelchair navigation control system that would enable users to steer the wheelchair with simple hand gestures.

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