



**IJIRCCCE**

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 6, June 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 8.165**

 9940 572 462

 6381 907 438

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# Hand Gesture-Controlled Wheelchair

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**ABSTRACT:** In today's world, physically handicapped people and elder people are depending on other people. But everyone is very busy taking care of these people. Wheelchairs are used, for those who cannot walk due to physiological, injury or any disability. This project is useful to physically disabled and elderly people with their hand gesture recognition. The basic methodology of this invention is to use two DC motors that are connected to the wheels for the movement of the wheelchair. Here we use 2 Arduino Nanos. The first Arduino nano is programmed to receive commands from MPU6050 and an encoder is used to encode the data then it transmits data through an RF transmitter to the RF receiver which receives the data and the decoded data is transmitted to the second Arduino nano, it is connected to the motor driver, to the movement of the DC motors. As per the pupil movement motor will be moved either in LEFT, RIGHT, FORWARD, and BACKWARD direction.

**KEYWORDS:** MPU6050, Hand gestured wheelchair, Motor, Motor driver.

## I. INTRODUCTION

In this modern life, indeed, recent developments in science and technology have drastically changed the way normal people live. A wheelchair is used when walking is difficult due to injury, problems related to old age, or disability. These can include spinal cord injuries, cerebral, brain injury, osteogenesis imperfecta, motor neuron disease, multiple sclerosis, muscular dystrophy, spina bifida, and more.

As we know nowadays technology is playing a vital role to complete any task in an easier manner and with consumption of less time. Recently, the number of physically handicapped people who use a wheelchair are increasing. However, two types of wheelchairs were coming into wide use. They are normal operating wheelchairs and electronic wheelchairs operated by a joystick. The normal type needs muscular strength for the operation and the latter type needs the skill. This is created to solve physically disabled people who face problems in moving a manual wheelchair. The helper gets tired by pushing the wheelchair with a patient. This wheelchair is designed for the disabled who depend on others for helping them to go from one place to another.



Under gesture control, there are several options available which include movement of the head, arm, palm, etc. Communication occurs between the patient and the wheelchair. This application will be done by using microcontrollers and an accelerometer sensor and will give patients the independence of using the wheelchair without the help of any other person [1].

## II. LITERATURE SURVEY

Diksha Goyal and Dr.S.P.S Saini: Accelerometer-based hand gesture-controlled wheelchair is dependent on sensors. If the sensor cannot move in an angled position this system cannot work. This system does not provide reliable support for a disabled or handicapped person.[2]

JK Kokate, AM Agarkar: Voice-operated wheelchair is operated with the voice command from the handicapped person and the voice command is taken from the android mobile and converted into the text and this text is given to the Microcontroller through a Bluetooth module to control the operation of DC motor. It is not suitable in a noisy environment.[3]

RK Megalingam, S Sreekanth, Akhil Raj: Wireless gesture-controlled wheelchair, presents a Bluetooth-based wheelchair that can be controlled by a finger using an Android application installed in the smart gadget. They can control the wheelchair with their fingers. This limits the navigation flexibility and autonomy of the system.[4]

MS Rani, S Chitransh, P Tyagi, P Varshney: Eye Controlled Wheel Chair involves eye movement detection and sending of control signals to the powered wheelchair. It cannot be provided in a dim environment and causes itching in the eyes.[5]

RK Megalingam, V Rangan: IR Sensor-Based Gesture Control Wheelchair for Stroke and SCI Patients. This paper presents a novel and simple hand gesture recognition method to be used in the rehabilitation of people who have mobility issues-particularly stroke patients and patients with spinal cord injury (SCI). In this method, IR sensors are used for identifying the simple gestures to control the powered wheelchair to move in any direction.[6]

Devika rani Patil, Varalakshmi: Hand Gesture Recognition for MP3 player using Image processing Technique is recognized by the image processing through Web camera. The image is taken and will be processed in a remote interface using a MATLAB controller. When capturing the image is forwarded to the MATLAB its compares to the database via the (x, y, and z) readings of particular objects. The movement of the values is noted by the accelerometer. [7]

Mufrath Mahmood & Md. Fahim Rizwan: Design of a low-cost Hand Gesture Controlled Automated Wheelchair in this microcontroller and Node MCU is used to control the wheelchair through the movement of the hand-wrist movement and also be controlled via Bluetooth technology.[8]

Rafia Hassani, Mohamed Boumehrad, Maroua Hamzi: Implementation of wheelchair controller using mouth and tongue gesture is used to detect mouth and tongue gestures from the lower face region the gesture commands are sent to the wheelchair as instruction using the Bluetooth serial port. webcam as a vision-based control unit, Bluetooth module to receive instructions comes from the vision control unit, and standard joystick used in case of emergency.[9]

## III. GESTURE-CONTROLLED WHEELCHAIR

The proposed project of Hand gesture-controlled wheelchair mainly focuses on avoiding the manpower. In this project, we propose a system to overcome physical disability challenges and assist elderly people to perform their daily life activities without others' help. An accelerometer is placed on the user's hand to sense the movements of the hand and change them into analog signals. The signals will be directed to an encoder to be sent by an RF transmitter. The hand gestures of the user will be transmitted by an Arduino microcontroller unit that is directly connected to the wheelchair to move it. The hand gestures of the user will be converted into numeric data using transmission and reception circuits. There are five commands namely, forward, backward, right, left, and stop. This wheelchair is designed for the disabled who depend on others for helping them to go from one place to another. This helps them move from one place to another without the help of anyone. They can control the wheelchair using hand gestures. This Arduino Nano, MPU6050, RF Transmitter-Receiver Pair, and L293D Motor Driver. This is controlled by the tilt of the hand. In this project, a hand gesture-controlled wheelchair is developed using MPU6050, which is a 3-axis Accelerometer and 3-axis Gyroscope sensor and the controller part is Arduino Nano. Instead of using a remote control with buttons or a joystick, the gestures of the hand are used to control the motion of the wheelchair. The project is based on wireless communication, where the data from the hand gestures is transmitted to the wheelchair over the RF link (RF Transmitter – Receiver pair). On the receiver side, the RF Receiver receives the serial data and transmits it to the Decoder IC. The Decoder IC will convert the serial data to parallel data and this parallel data is given to the motor driver IC. Based on the data, the movement of the motors is defined.

**BLOCK DIAGRAM:**

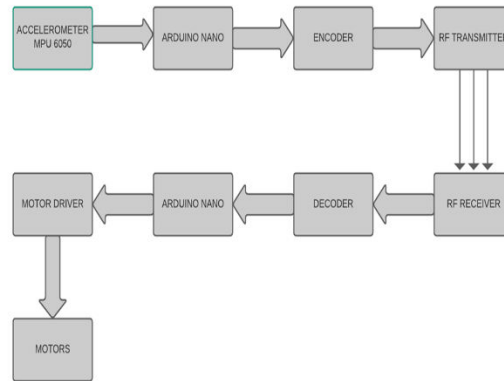


Figure 1. Block diagram of hand gesture-controlled wheelchair.

- Accelerometer
- Arduino nano
- Encoder and Decoder
- RF Transmitter and Receiver
- Motor driver
- Motors

**FLOWCHART**

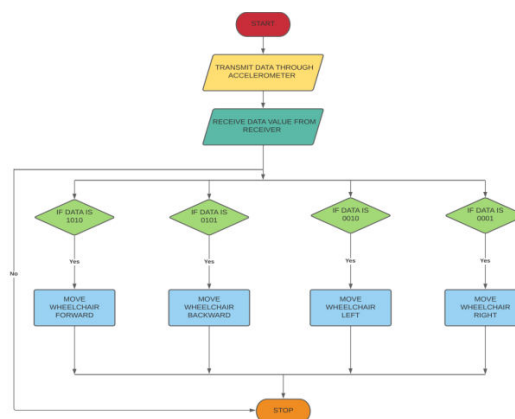


Figure 2 Flow chart of hand gesture-controlled wheelchair.

The flowchart gives a brief idea about the work: It starts the process by taking the inputs from the user and transmitting the data from the accelerometer to the RF transmitter and the RF transmitter will send the data to RF Receiver. If the received data is forward, backward, left and right commands then the motor drivers will move accordingly.



#### IV.RESULTS AND DISCUSSIONS



Figure 3. Hand gestures to move the wheelchair.



Figure 4. Transmitting Module

The communication between Arduino and MPU6050 Sensor takes place through I2C Interface.



Figure 5. Receiving Module



Decoding the Data received by the RF Receiver and sending appropriate signals to the Motor Driver IC, which will activate the Wheel Motors of the Wheelchair.

Direction of hand gesture	Right motor movements	Left motor movements
Forward	Forward	Forward
Right	Stop	Forward
Left	Forward	Stop
Backward	Backward	Backward

Table 1. Hand gesture to direct the motors

### V.CONCLUSION

We have proposed this design of a wheelchair for the physically challenged people who are facing difficulties walking so that they can easily operate the wheelchair using their hands. We designed a hand gesture-controlled wheelchair system for helping people who are facing difficulties to walk or traveling from one place to another place. The proposed design was tested with a prototype that can be operated by a single hand and it can move the wheelchair in four different directions by the position given by that hand. The gesture recognition system was clarified with several performance tests by that hand. The experiments we have done gave us the ideas to improve our design. In our future work, we intend to explore our design by performing various experimental scenarios. The goal of our project is to build a new model based on the recognition of the movements of a hand and also to provide some features for more applications. We can also add a sensor unit to the circuit so that it can detect the obstacle in its path.

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SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

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