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Gestures Controlled Robot

Vaishnavi Jadhav[1], Shailaja Kadam[2], Srushti Nakate[3], Rajshree Thakur[4], Dipti Chavan[5]
[1, 2, 3, 4]*Studying in Electronics and Telecommunication Engineering Department, TKIET Warananagar*
[5]*Assistant Professor Electronics and telecommunication Department, TKIET , Warananagar, Dist -kolhapur, Maharashtra*

Abstract: ***The main abstract of the project work is to control robot with gestures using hand. There are two main components of the system: The accelerometer depends upon the gestures of the hand. Through accelerometer, a passage of data signal is received and it is processed with the help of Atmega328 microcontroller. The microcontroller gives command to the robot to move in the desired direction. The basic working principle for the robot is passage of the data signals of accelerometer readings to the Arduino board fitted on the bot. The program compiled in that Atmega328 runs according to that value, which make the bot function accordingly. While we have used three-axis accelerometer. In which, one axis will control the speed in forward or backward direction and other axis will control the turning mechanism. Accelerometer-based gesture control is studied as a supplementary or an alternative interaction modality. Gesture commands freely trainable by the user can be used for controlling external devices with handheld wireless sensor unit.***

I. INTRODUCTION

The gesture-controlled robot utilizes a hand-mounted glove with a transmission circuit assembly comprising an accelerometer, microcontroller, and RF transmitter. This assembly serves as the input device, enabling users to control the robot's movements with intuitive hand gestures. The accelerometer data is transmitted to the microcontroller onboard the bot, where it is processed to execute corresponding commands. By interpreting specific gestures as commands, users can effortlessly navigate the robot, showcasing the potential for hands-free control in various applications such as surveillance, exploration, and entertainment. This project not only exemplifies the convergence of robotics and human-computer interaction but also aims to streamline user experience by providing a natural and intuitive interface for remote control, potentially rendering conventional input devices redundant. Through the seamless integration of sensors and algorithms, the gesture-controlled robot represents a significant advancement in HMI technology, offering users a novel and immersive way to interact with machines.

II. RELATED WORKS

Sndeept and Supriya [1] proposed a gesture-controlled wheelchair system, acknowledging the global need for mobility aids, especially among the paralyzed population. Utilizing hand tilting and processing technology, their approach offers intuitive mobility, addressing challenges faced by joystick models.

Similarly, D. R. K. Purshotam Prasad [7] introduced a wheelchair control system using hand gestures and Acceleration technology. By integrating Flex and Acceleration sensors and Arduino-based devices, it provides intuitive directional control, particularly benefiting paralyzed individuals. These innovations represent significant strides in enhancing accessibility and independence for the physically disabled.

III. LITERATURE SURVEY

A. Existing System

The Existing System which the project using in that robot is having the same transmitter and the receiver section but the only difference is that it require controller to control the robot. In that case the Robot can only be controlled using the buttons or joypad.

B. Issues in Existing System

Today in this world where the Technology and Science is growing day by day the field of Robotics also needed to be upgraded. Thus it was found that there are a few issues in the existing system As the existing system can be controlled only with the Controller so the user cannot directly control the robot. Secondly the physical work is more to control the robot. Thirdly the power consumption was more as the controller requires power supply to a higher extent than the Accelerometer. Finally the expense was more as more hardware was required. These were a few Drawbacks in the existing System

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IV. DESCRIPTION OF COMPONENTS

In this project, multiple modules interface with the microcontroller: two microcontrollers for data processing, an MPU5060 accelerometer for motion detection, two NRF2401L modules for wireless communication, a battery for power, and an L293D motor driver module for controlling the robot's motors.

A. Geared Motor

The purpose of a gearbox is to increase or reduce speed. As a result, torque output will be the inverse of the speed function. If the enclosed drive is a speed reducer (speed output is less than speed input), the torque output will increase; if the drive increases speed, the torque output will decrease.



Figure-Geared Motor

B. Atmega328 Microcontroller

The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core Atmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328/328P has 32KB internal flash memory. ATmega328/328P has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). ATmega328/328P is a 28-Pin AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash-type program memory of 32KB.

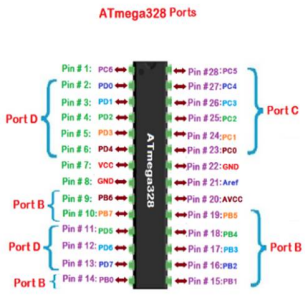


Figure- Atmega328 Microcontroller

C. NRF24L01pa

NRF24L01 transceiver module. It uses the 2.4 GHz band and it can operate with baud rates from 250 kbps up to 2 Mbps. The NRF24L01+PA+LNA module is easily attachable to any MCU. This module is designed with power amplifier and SMA Antenna. And that allows it to be used for wireless communication of up to 1000 meters (No Barrier).

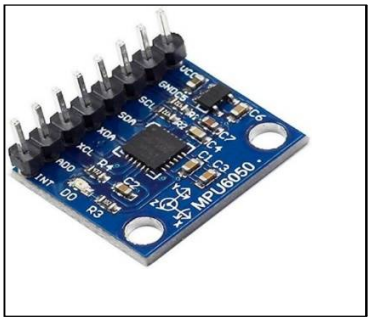


Figure-NRF2401L module

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D. MUPU6050

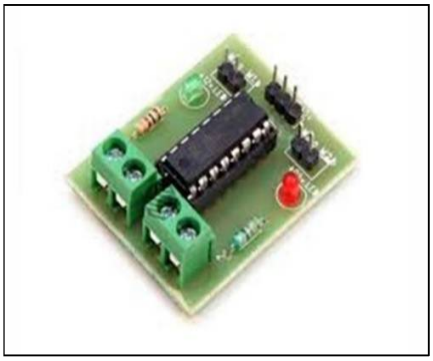
The MPU6050 is an IMU (Inertial Estimation Unit) sensor, a portion of the Micro-Electro-Mechanical Systems (MEMS) family. It highlights a 3-axis accelerometer and a 3-axis gyroscope. The MPU6050 module in addition called a magnetometer sensor. It can identify acceleration up in three measurements (X, Y, and Z) and also measure angular velocity around those axes. This motion-tracking device is often used in applications such as detecting the orientation of a device, detecting movement, and measuring angular velocity.



MUPU6050

E. L293D Motor Driver Module

L293D Motor Driver Module is a medium power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L293 motor driver IC. It can drive 4 DC motors on and off, or drive 2 DC motors with directional and speed control.



L293 Motor Driver Module

F. Battery

There is need of two Zinc Carbon batteries (refer to figure no.5) which are used to supply the DC power of 9 Volts to the circuits. Out the 2, One is used to provide power to the transmitter circuit i.e Arduino Uno, nRF2401L and MUPU6050. Second battery is used to provide the power to the receiver circuit i.e Arduino UNO, nRF2401L and motor driver.



Battery

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V. BLOCK DIAGRAM

In this block diagram, (refer to figure no. 6) Arduino is initialized and hand gesture (x and y coordinates) are collect by arduino using gyroscope and data encoded and transmitted by Transceiver. On the receiving side, data are received by transceiver, decodes it and then send it arduino for interpretation. After interpretation Arduino send the desired commands to motor driver for the movement of motors.

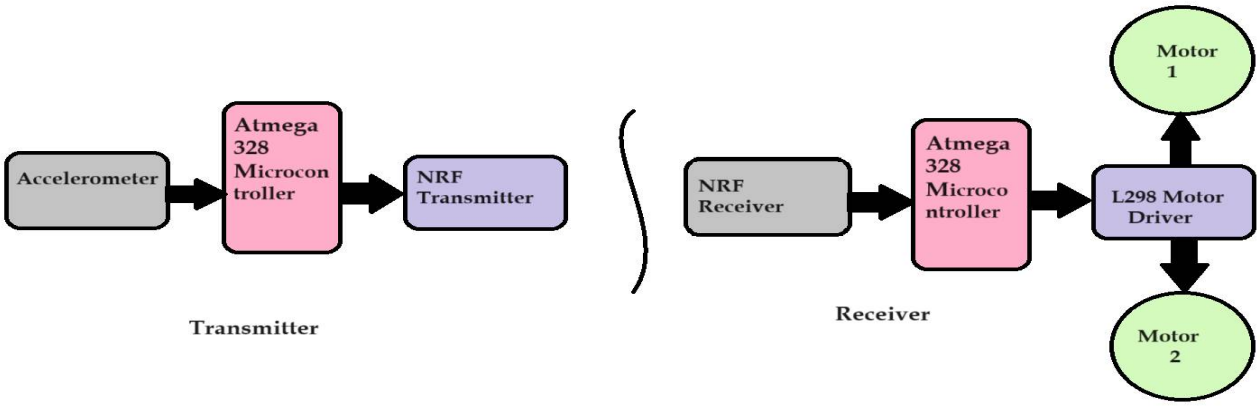
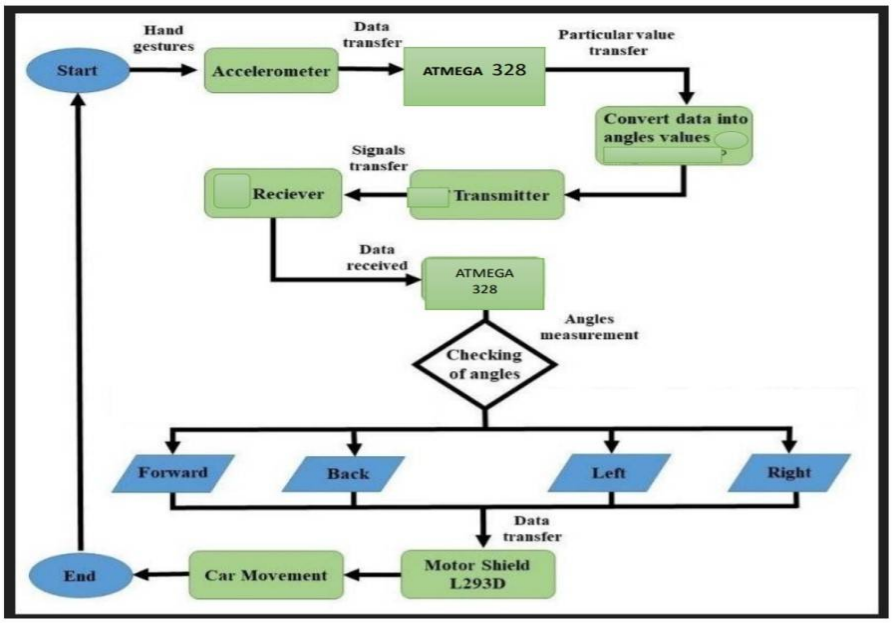


Figure- Block Diagram

VI. METHODOLOGY

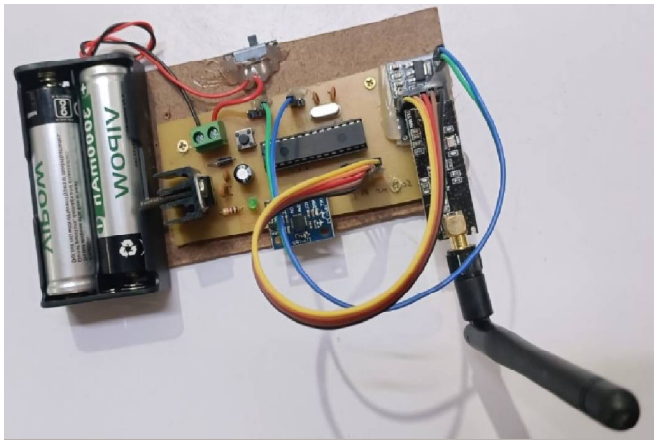
1) Ste p 1:- Start
2) Step 2:- Hand gesture guess from the accelerometer
3) Step 3:- Identified gesture (data) is transferred to 328
4) Step 4:- Microcontroller converts data into angle values, then signal passed to the transmitter.
5) Step 5:- Then that signal is transferred to the receiver (Bluetooth).
6) Step 6:-Bluetooth sends acknowledgement
7) Step 7:- According to passed signal microcontroller checks the angle .
8) Step 8:- After checking the angle motor can move in respective direction. {Left, Right, Forward, Backward}
9) Step 9:- End



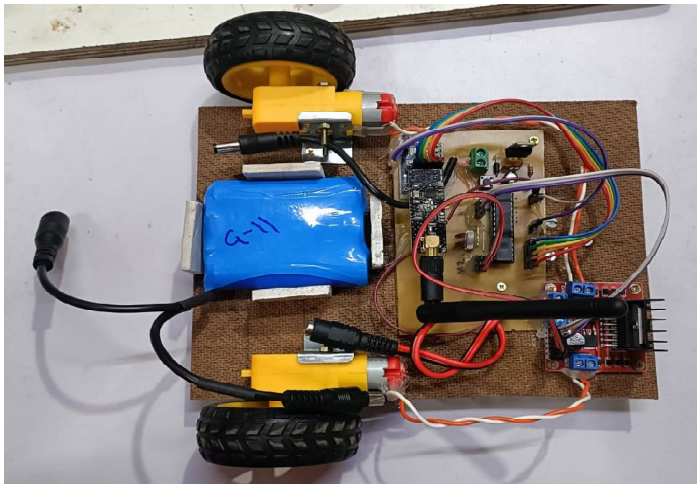
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VII. PRACTICAL IMAGES

A. Transmit Part



B. Receiving Part



VIII. CONCLUSION

In this Project, A robotic car is designed which is controlled by hand gesture using microcontroller. The transmission of data is done with nRF241L0pa which is found to be very efficient as compared to other wireless modules. This project can be beneficial where the humans are not able to perform any task but can be defined or the task with some device using hand gestures.

IX. FUTURE SCOPE

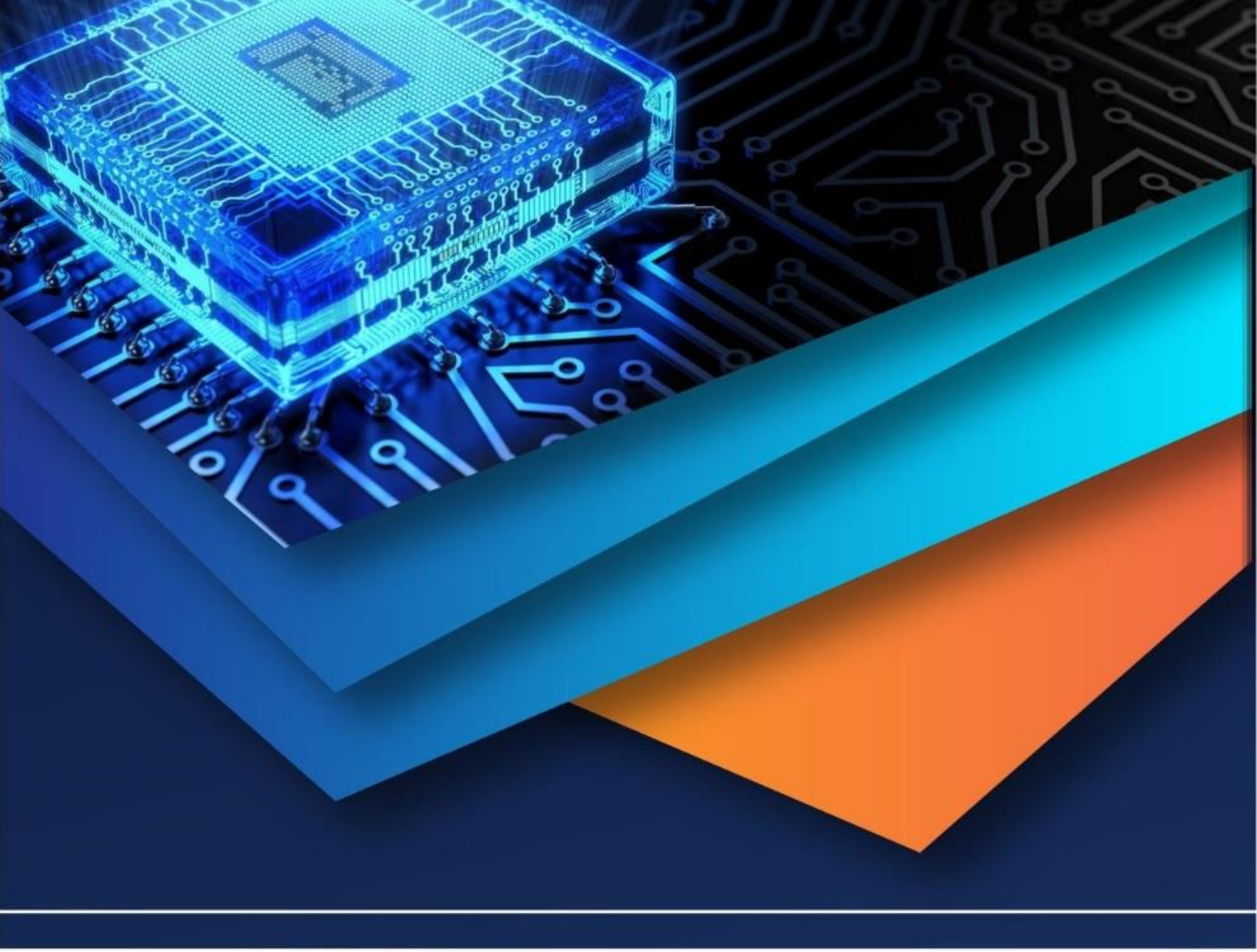
1) In the future, we will directly use a mobile phone with an accelerometer to control a car-robot. We also want to add more hand gestures (such as the curve and slash) into the interface to control the car more naturally and effectively.
2) On road driving need multi-dimensional parameter estimation to avoid risks.
3) The GSM can be embedded in to the present work to extend its feature such as sending messages during emergency

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