



WIRELESS GESTURE CONTROLLED ROBOT

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ABSTRACT

In today's world, industry and daily routine tasks are increasingly attracted to and implemented through robotic automation. Well, this study proposes a method for replacing buttons and joysticks with a more novel technology, namely, commanding the entire Robotic Arm with the user's hand movement, motion, or gesture. The goal is to alter how people think about remote controllers for manually driven robotic arms. Pick and place robots are a type of technology used in the industrial industry to execute pick and place tasks. The system is constructed in such a way that it reduces human error and intervention, resulting in more exact work. The system is designed with a simple, flexible, and minimum control technique in mind. There are numerous domains in which human intervention is problematic, yet the process in question must be operated and regulated, which leads to the application of robots. According to the literature, pick and place robots are conceived and deployed in a variety of industries, including the bottle filling industry, surveillance to identify and eliminate bombs, and so on. The goal of the project is to create a gesture-controlled robot with a robotic arm that can perform any pick-and place tasks. A radio frequency transmission is used to control the pick and place robot. For the gripper open and close, up and down, forward and backward, base clockwise and counterclockwise, the Robotic Hand has certain independent commands. Four Omni wheels support the robotic arm's displacement on the chassis. The implemented robotic arm has four degrees of freedom. Line follower, wall hugger, obstacle avoider, metal detector, and other capabilities can be added to this robot to increase its versatility.

Keywords: User Interface, Hand Gestures, Wheel

Chair Controlling, Switch Control Pan

INTRODUCTION

Touch-free user interface is an emerging type of technology in relation to gesture control. It is the process of commanding the computer/microcontroller via body motion and gesture without touching keyboard/switchboard. Touch-free user interface, in addition to gesture control are becoming widely popular as they provide the ability to interact with device without physically touching them. Existing conveyance devices/electrical machines, to move a car (forward, backward, left and right) are equipped with hardware to facilitate use/control and to provide a user interface to support user interaction. For example, Steering wheel, gear, gas pedal, bread pedal, clutch pedal. A user must physically touch the interface to engage in an action. Moreover, the interfaces (e.g., the pedals) that are designed for a given function are not always intuitive. For example, to move a car forward or backward that is not familiar with everyone.

1.2 Idea Evolved from

In the current scenario many people are not able to learn the car in a easy way and operating many controls in a car is not an easy task, which is leading to many accidents, to ease the way of moving a vehicle in a easier way.

1.3 Proposed System

The main aim of this proposed system is to develop hand gesture-based motion control panel for touch-free user interface of car to minimize risk of accidents, and which can also be scalable to any kind of applications to control its various operations using simple hand gestures so that any common man can use it easily without having any specific knowledge of its operations.

1.4 Block Diagram

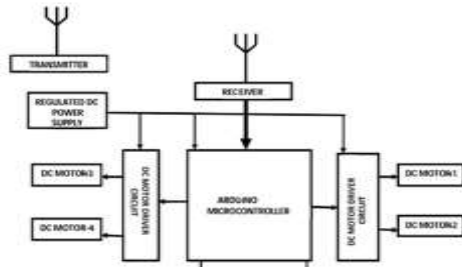


Figure 1. Block Diagram of Proposed Model

The three most essential components required are the Arduino Nano, Bluetooth Module HC-05 and the MPU6050 sensor module. From fig 1.1, we observe the block diagram which helps us picture the flow of working. When a gesture is made to the sensor, the sensor will communicate to the Arduino using the predefined codes available to us through the Arduino_MPU 6050 header file. This header files contains the data required to directly communicate in terms of the type of gesture without us ever having to define the movement to its co-relating gesture. In our working of the project, we have utilized an Bluetooth Module HC-05 module to give us an output which can be presented before connecting the “Circuit Brain” to the logic circuit of a functional elevator. As this is a Prototype we utilized motor to show the movement of the Robot.

1.5 Methodology

Users can perform hand gesture by simply moving their hand over the sensor in the required direction. The MPU 6050 Sensor reads the hand gestures. The sensor supports FORWARD, BACKWARD, LEFT and RIGHT gestures. Make sure each gesture begins outside of the range of the sensor, moves into the range of the sensor, and ends outside the range of the sensor. In this project FORWARD & BACKWARD gestures are used to set to move robot forward and backward, The LEFT gesture is to move left side direction and RIGHT is used to move robot in the right side direction . If a user made a gesture it is detected by the gesture sensor and informs Arduino to read the gesture. Arduino compares the detected gesture and set the function for it. If the detected gesture (FORWARD) indicates going in the forward direction, then set the function for it. The function will allow used to move forward. So suppose user want to move forward. To go there, simply make a hand gesture for going forward . On doing this, the control panel will capture your gesture and set the robot mechanism to go to the forward

direction. After deciding the direction user wants to, make a leftward gesture so that the robot move according to the specific direction have done by the hand gesture.

II. ARDUINO NANO AND ARDUINO UNO

2.1 Introduction To Arduino Nano

The Arduino Nano was released in 2008. In 2019, Arduino released the Arduino Nano Every, a pin-equivalent evolution of the Nano. Arduino boards are widely used in robotics, embedded systems, automation, Internet of Things(IoT) and electronics projects. These boards were initially introduced for the students and non-technical users but nowadays Arduino boards are widely used in industrial projects.

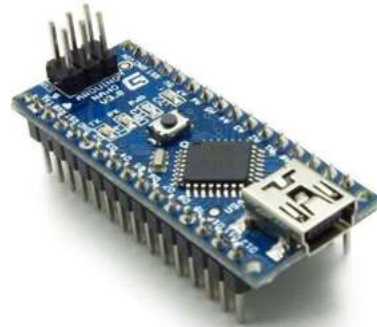


Figure 2. Arduino Nano

Arduino Nano has similar functionalities as Arduino UNO but with a different package. The Nano is inbuilt with the ATmega328P microcontroller, same as the Arduino UNO. The main difference between them is that the UNO board is presented in PDIP (Plastic Dual-In-line Package) form with 30 pins and Nano is available in TQFP (plastic quad flat pack) with 32 pins. The extra 2 pins of Arduino Nano serve for the ADC functionalities, while UNO has 6 ADC ports but Nano has 8 ADC ports. The Nano board doesn't have a DC power jack as other Arduino boards, but instead has a mini- USB port. This port is used for both programming and serial monitoring. The fascinating feature in Nano is that it will choose the strongest power source with its potential difference, and the power source selecting jumper is invalid.

Introduction To Bluetooth Module HC-05

Bluetooth Communication is a 2.4GHz frequency based RF Communication with a range of approximately 10 meters. It is one of the most popular and most frequently used low range

communication for data transfer, audio systems, handsfree, computer peripherals etc.

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network ([PAN](#)). It uses frequency-hopping spread spectrum ([FHSS](#)) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

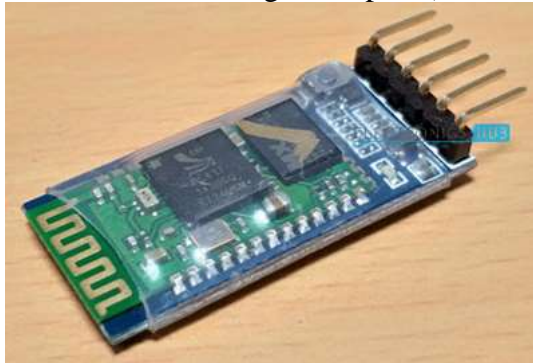


Figure 3. Bluetooth Module HC-05 Module

MPU 6050 GYROSCOPE

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.

It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.

If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output.



Figure.4 MPU 6050 Gyroscope

DC MOTOR

Dual shaft geared motors are useful in robotics applications. Shaft on both sides allows the user to use a Wheel and an Encoder simultaneously. Not only this, the user gets enough headroom for the orientation of the motor and can be used in any orientation as per the application is required.

It is a plastic based geared Dual shaft DC motor operating between a voltage range of 3V to 9V and has a torque of 0.8 Kg/cm with an RPM of 100 which is pretty decent for most of the applications. It is recommended to use this motor with more than 5V to have optimum torque in working condition.



Figure 5. DC Motor

3.1 MOTOR DRIVER

The most commonly used actuator in any electronic device/machine will be motor next to solenoids, pneumatics, and hydraulics. These DC machines can be found everywhere, from a simple vibration motor inside a phone to complex stepper motor in CNC machines. A Motor Driver or Motor Controller is required to control a motor using a microcontroller or processor. Motor Driver comes in a variety of shapes and sizes, depending on the type of motor and control required. We will focus only on DC Motor and how to control a DC motor using motor with the most popular H-bridge Topology. this technique will help us drive small or large DC motor and also control its direction.

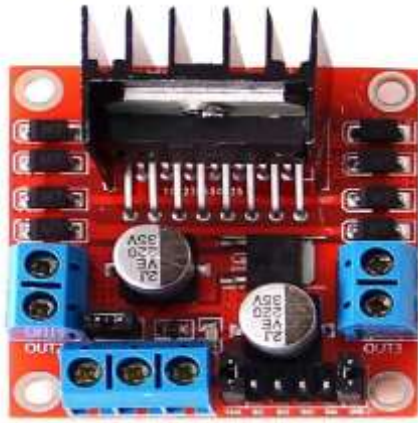


Figure 6. Motor Driver

3.2 CAR CHASSIS

The chassis or frame is the main support component in a car's structure. It bears the forces experienced by a car while it's standing still or moving at high speeds.



Figure 7. CAR CHASSIS

3.3 Circuit Design Of Proposed System Transmitter

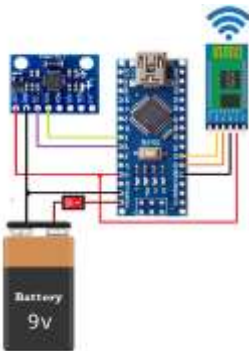


Figure.8 Circuit Diagram for Transmitter.

Receiver

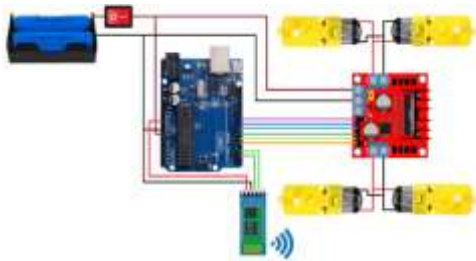


Figure.9 Circuit Diagram for Receiver

RESULT :

The project Wireless Gesture Controlled Robot with Arduino is successfully designed tested and a demo unit is fabricated.

Since it is a prototype module the facility is provided for only an individual consumer. Whereas for the real applications, there may be so many consumers. The complete project has been designed using Arduino language. This project revealed that building a relatively low cost, high security system which is aimed to control through sensor. As mentioned earlier, the project has been carried out several times and the aim of this thesis is to familiarize the get knowledge with fundamentals of Arduino and Android to build anything possible.

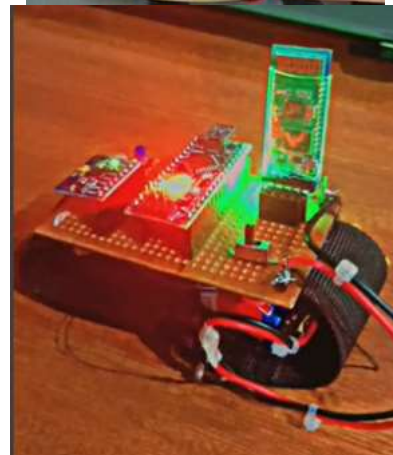
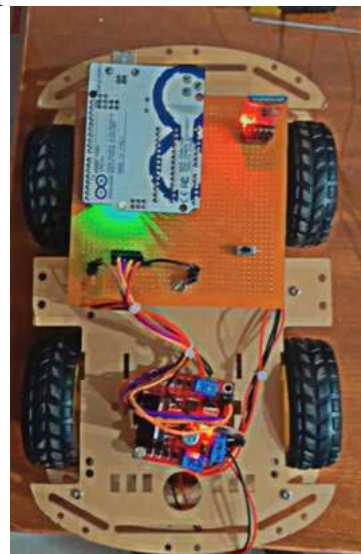


Figure.10 Prototype Picture with power Supply



Figure.11 Prototype Picture

4.1 Advantages

- User friendly
- Single equipment = multiple applications
- When extended further in the hardware section, numerous applications can be added
- Easy to operate
- Can be used in military operation and Hospitality Purposes.

4.2 Disadvantages

- Communication Error's.
- As it take single input at a time, waiting time for others is more.
- Unwanted gestures make be taken as inputs.

4.3 Applications

- Wireless controlled robots are very useful in many applications like remote surveillance, military etc.
- Hand gesture controlled robot can be used by physically challenged in wheelchairs.
- Hand gesture controlled industrial grade robotic arms can be developed.

So far you came to know about Hand Gesture Controlled Robot that completely moves according to moments of your hand (sign of input to the device). If you are looking for a similar low-budget device then Robot vacuum cleaners best suit you as it has a greater functionality in cleaning your home.

CONCLUSION & FUTURE WORK

5.1 Conclusion

Gesture based user interface is an interesting and interactive user interface. It has gained lot of scope in Electronics automation. One of the many advantages of using hand gesture recognition system is that the user can interact from a distance which was not possible in the case keyboard and mouse input methods. Thus there by installing a gesture recognition system, it increases the

longevity as it need not be touched. This eliminates major drawbacks like seen in touch screen kiosks where the screen gets worn out in short time period and has to be replaced often.

Materials and processing/ classification techniques will make the next generation of this devices cheaper, more powerful, versatile and more ubiquitous. The gesture controlled robot system gives an alternative way of controlling robots. Gesture control being a more natural way of controlling devices makes control of robots more efficient and easier.

5.2 Future Scope

In this Project we are detecting only four gestures UP, Down, Left, Right to control the operations of the Robot, but the Gesture sensor MPU 6050 can also detect some other gestures . In future we are going to design an automated wheel chair for handicapped people. This wheel chair can be operated by a wireless remote which can reduce the wiring arrangements. Instead of using acceleration motion we can use eye retina using optical sensor to move the wheel chair accordingly. We can use voice command IC's to interface our voice signal with micro controller. This system can be extended by including GSM which sends an SMS during emergency.

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