Wireless Gesture Controlled Car

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Problem Statement –

The traditional wired buttons-controlled robot becomes very bulgy, and it also limits the distance the robot goes. The wireless hand / gesture controlled robot will function by a wearable hand glove from which the movements of the hand can be used as the input for the movement of the robot. The basic idea of our project is to develop a system (Robot) which can recognize the Human Interaction with it to accomplish the certain tasks assigned to it. In our project we will design a remote control which will contain the sensors to capture the movement of the hand and convert the raw mechanical data into electrical form.

Objective -

To build a wireless gesture-controlled car that can be moved accordingly with appropriate hand gestures which uses radio frequencies for controlled movements.

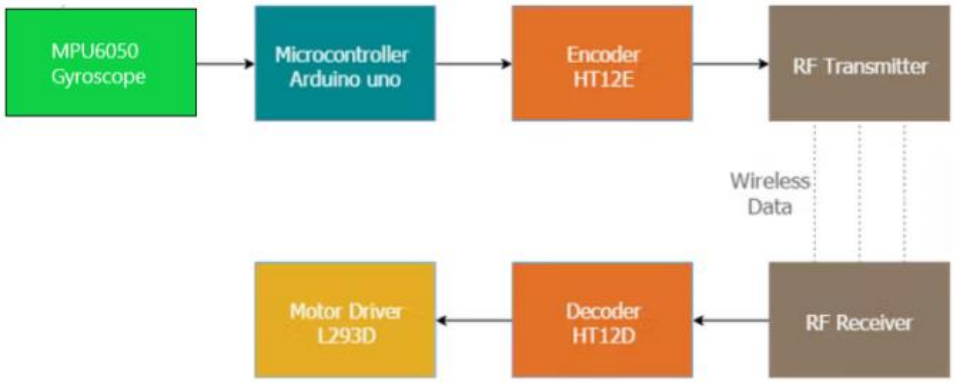
Introduction -

Most remote devices use a special device interface (joystick) to control the main module. In our project, we are trying to make a remote control which uses simple gesture movements to control the main device. Our project uses an accelerometer to detect gesture movement and communicate it to the main module using RF transmission. The main device decodes the communicated data which is sent by the remote control and appropriately rotates the DC motors to generate movement.

Components Used –

a. **Arduino UNO** – it converts the analog signal sent by the MPU6050 gyroscope into digital data that is sent to the encoder
b. **HT-12E encoder IC** – encodes and sends the command signal to the transmitter module
c. **HT-12D decoder IC** – receives the analog signal from receiver module and converts the signal into digital data which is then given to the motor driver IC to drive the motor movement
d. **433 MHz Tx and Rx** – the transmitter and receiver module transmit and receive signals respectively using radio frequencies
e. **MPU6050 accelerometer/gyroscope sensor -** it is a type of sensor, and it **gives an analog data while moving in the direction of X, Y and Z**. These directions depend on the type of sensor. This sensor consists of arrow directions, if we tilt the sensor in one direction, then the data at that particular pin will change in the form of analog.
f. 47 KΩ resistor
g. 1 MΩ resistor
h. **9 V battery** – to supply power to the receiver circuit
i. **L293D motor driver IC** - it allows DC motor to run in both forward and backward directions. It consists of up to 16 pins
j. **5V DC motors (2)** – used to drive the car by rotating the wheels according to the gestures in the required direction
k. **Wheels and Chaise** – used to hold and move the receiver circuit

Block Diagram -



CONCEPT

The principal idea of the project is to detect the angle of tilt of the hand and move the car accordingly.

WORKING

The working principle of the car is presented with the block diagram. There are two parts in which one is transmitter section and another one is the receiver section. In the transmitter section, an accelerometer is connected to the Arduino UNO. The value of accelerometer output connected to the Arduino UNO changes with the gestures. The transmitted values are then encoded using the encoder and transmitted using the RF transmission modules connected to it. The receiver section consists of various parts such as RF receiver module, decoder, motor driver and motors. The decoder is used to decode the received values at the receiving end. The movement of the wheels are controlled using motor driver IC and the connected DC motors.

Angle Measurement

MPU6050 sensor has a built-in gyroscope that works on the principle of measuring angular rotation using The Coriolis Effect. The angle is then communicated to the Arduino using I2C communication.

The gyroscope contains four fixed mass that continuously move in inward and outward periodic motion in a horizontal motion. Any type of rotation of the gyroscope changes this motion in the plane. The angular rotation is detected by measuring this change in periodic motion.

Transmission

According to the angle detected, data to rotate appropriate wheels is sent to the encoder. The encoded data is transmitted to the decoder on the car using 433 MHz RF transmitter.

Arduino UNO is the choice of Arduino as it is very convenient to use. This makes it ideal for making a handheld controller.

A threshold of -25º is chosen to move the car in forward direction, 40º is chosen to move the car in backward direction, -40º is chosen to move the car leftwards and -120º is chosen to move the car rightwards, that is we need to tilt the hand more than the mentioned angle in the respective direction for the car to move in that direction. This angle is chosen using a hit and trial method.

The HT-12E encoder has 4 data pins each of which is active low. These four data pins are used to control the 4 direction control pins of the motor driver. The first and third data pins control the left wheel and the second and fourth data pins control the right wheel. The following data is transmitted for the given directions:

a. 0011 : Forward
b. 1100 : Backward
c. 0100 : Right
d. 1000 : Left

Reception

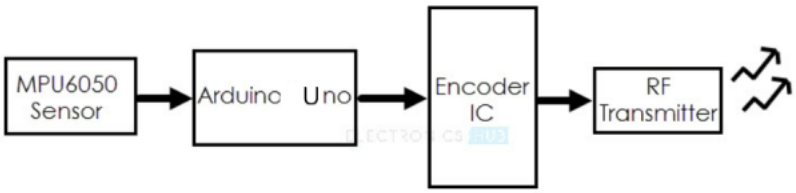
The data is received using the 433 MHz receiver on the car and sent to the HT-12D decoder IC. The decoded data is used to set the direction control pins of the motor driver to rotate the wheels using DC motors.

The receiver part is divided mainly into four parts which are described as Receiver module, Decoder, Motor driver IC, and DC motors. The Analog signal from the transmitter is received by the receiver module and then sent to the decoder by the help of ‘DATA’ pin. The decoder converts the Analog signal into the digital signal and then sends it to the motor driver IC. We have used L293D motor driver IC which has two H-bridge driver circuit which helps in moving two motors in a clockwise and anticlockwise direction. Movement of the motor

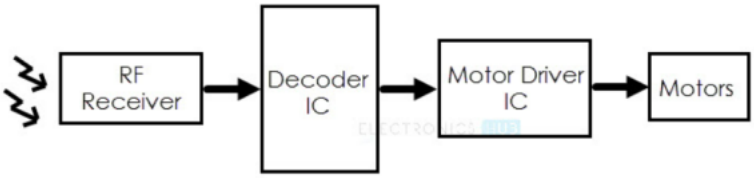
is decided according to the inputs which are provided in the input table. The receiver section input is connected to a 9-volt source.

CIRCUIT DIAGRAMS -

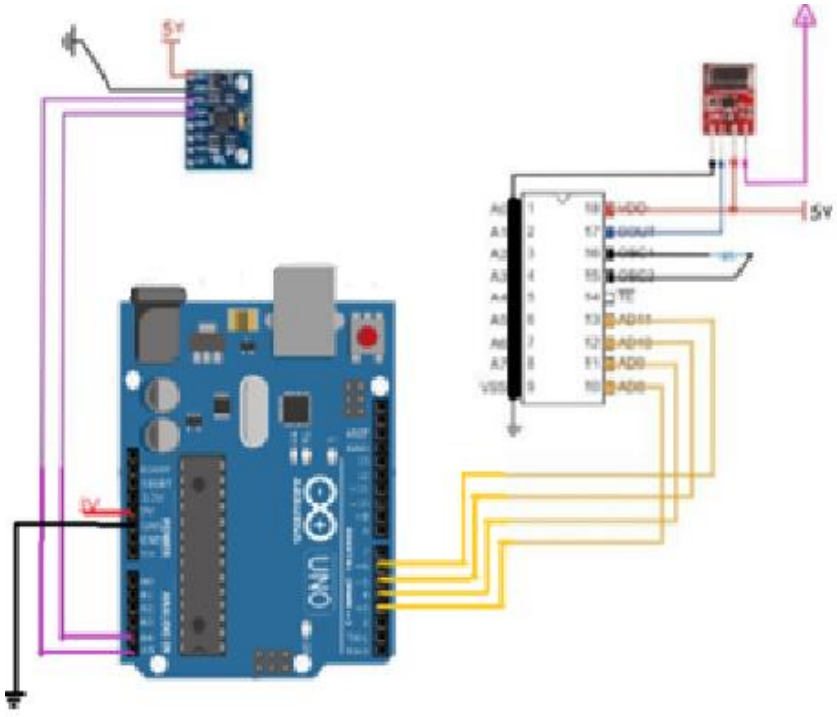
Transmitter Block Diagram



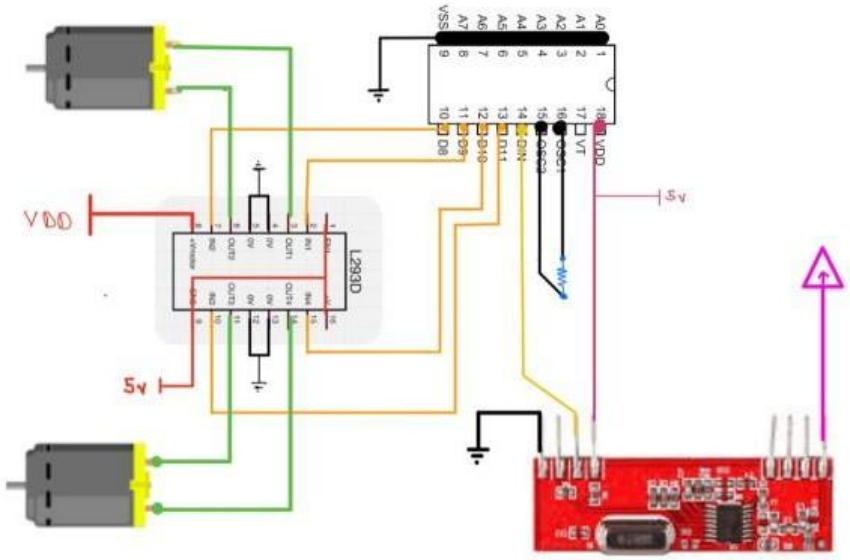
Receiver Block Diagram



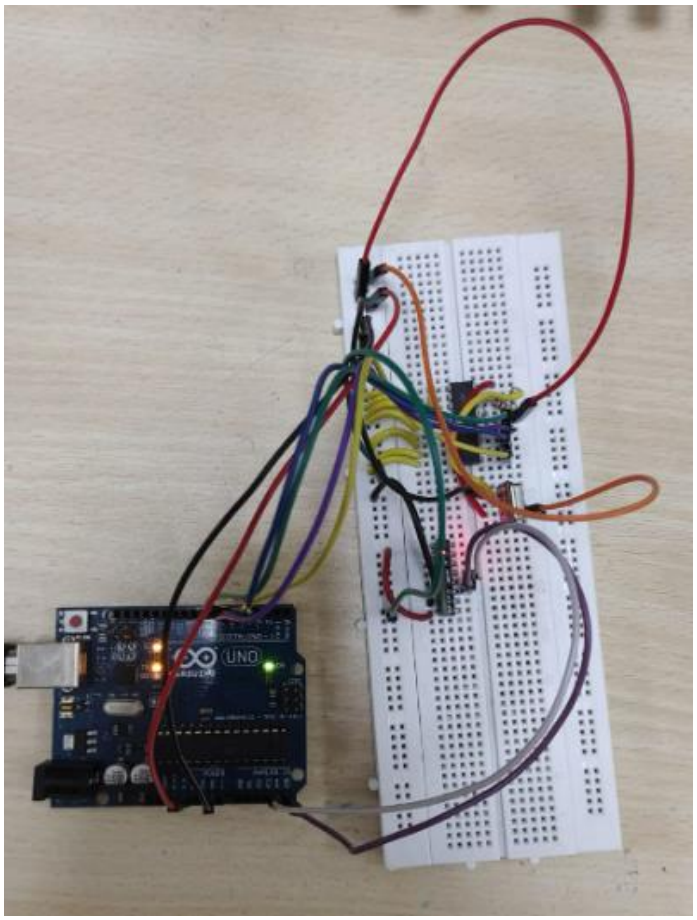
Encoder and Transmitter (On the controller)



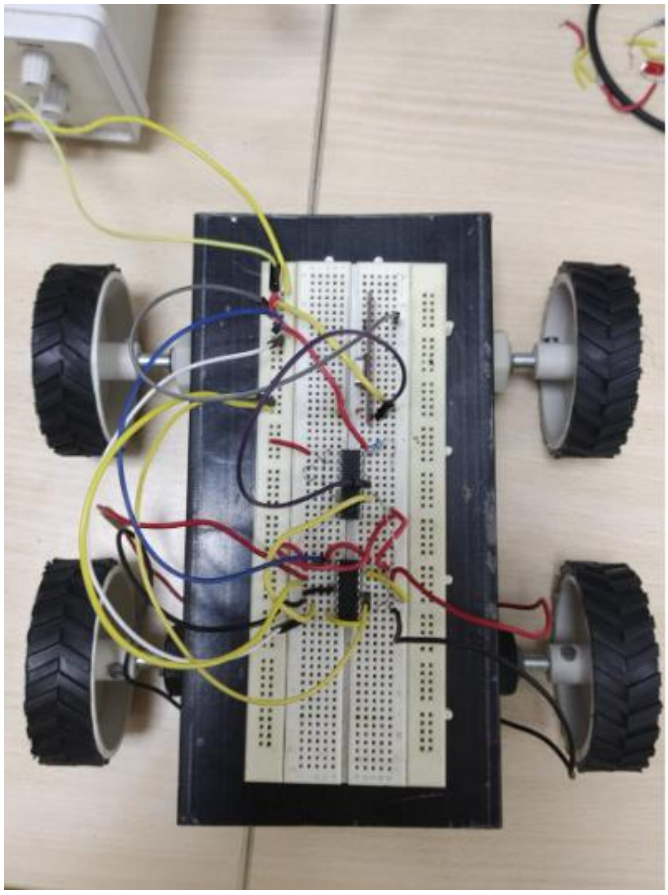
Receiver and Decoder (On the car)



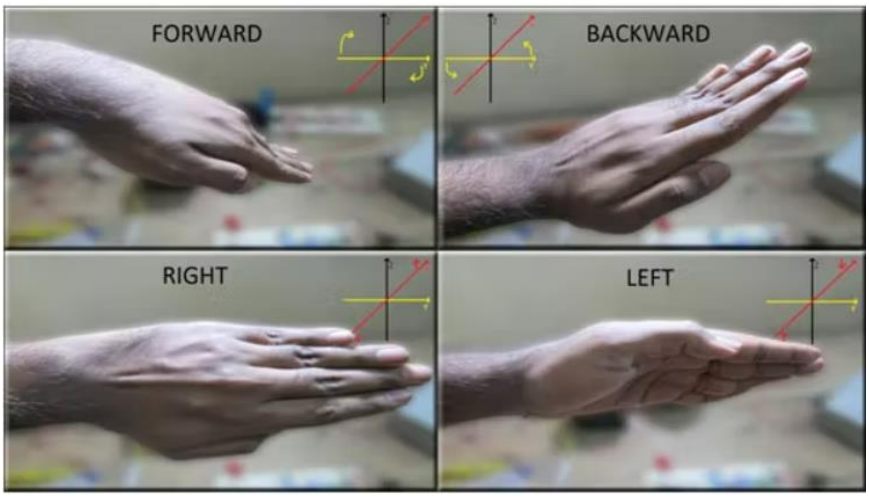
Controller



Car



GESTURES



FURTHER IMPROVEMENTS

a. The car can be equipped with a camera
b. Instead of RF, a different method of communication can be introduced like Wi-Fi or over the internet which can increase the range of the transmitter.
c. More intuitive gesture controls can be encoded to give control (backward left and right, rotate 360°) over the car.

APPLICATIONS

a. This proof of concept can be applied on wheelchairs and other devices following handicapped people to control a range of devices.
b. Manipulating virtual environments using limb movements.
c. This model can be used to get information from places where it is difficult for humans to reach. The car equipped with camera and light can be easily moved to different places to extract information or

to do some tasks.

d. Wireless Controlled Robots are very useful in many applications like Remote Surveillance military applications, Bomb Diffusion Robots, etc.

e. Hand gesture controlled industrial grade robotic arms can be developed

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Video of the project -

https://drive.google.com/file/d/1AmQeluJ7LNiGMdMoVVYBTFl-iJ12PbMt/view?usp=sharing