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Hand Gesture Control Arduino Robot

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ABSTRACT: Robots are devices that can perform tasks with or without human intervention, based on inputs from its environment. Gestures can be explained as symbolic actions performed by humans having a meaning. In this project, a robot car has been developed where the user uses these very gestures to interact with the robot car rather than the established and current technology of using remote controllers with buttons and joysticks, or mobile applications. These gestures are identified with the use of an accelerometer (ADXL345). The entire project is split into two parts: the transmitter circuit and the receiver circuit, where the former uses ADXL345 for gesture recognition, and the latter uses Motor driver (L293D) to move the car.

KEYWORDS: IMU, Arduino UNO, MPU6050, DC Motor, L293D, Bluetooth HC-05.

I. INTRODUCTION

Robotics is the field that is rapidly taking over every single discipline of human activities. The developments in this field have been going on for decades; however the 21st century particularly has seen immense growth pertaining to this field of technology. Gestures, as stated, can be explained as instinctive actions having a symbolic meaning that are used by a person to express an idea or thought. Robots are electro-mechanical (a portmanteau, reflecting technologies from the disciplines of electronic and mechanical) devices or systems that can perform any tasks without needing any human supervision or else requiring very little of it. These systems perform their tasks based on the logical operations stated in their computer programs that are loaded in their processing unit or microcontroller, taking decisions based on inputs received or read from its environment. Robots primarily fall into two categories: that of being autonomous, and the other being semi-autonomous robots. Autonomous robots are widely used in factories, at industry sites and in manufacturing units as these activities are very high speed operations requiring great accuracy. These kind of robots do not require any human assistance and as the name implies are fully self-sufficient. On the other hand, semi-autonomous robots are used where the decision cannot be made by the robots independently, such as in case of tactile controlled, voice controlled and gesture controlled device, where the inputs are touch, audio and movement dependent, thus requiring human assistance in terms of requiring input to facilitate further decision to produce the desired output.

II. METHODOLOGY

METHODOLOGY FOR HAND GESTURE RECOGNITION

The Hand held controller is a 3D inflexible body that can be turned about the three symmetrical hub. Yaw, pitch and roll are alluded to as revolution. This rotation occurs as Rotate is called yaw, the accompanying turn X-centre is called pitch and last turn about the Y-centre is called roll. Any direction can be accomplished by the forming those three essential turn. In our work, all the arranged hand movements for robot control are basic motions, every one of which contains just one of the three basic revolutions.

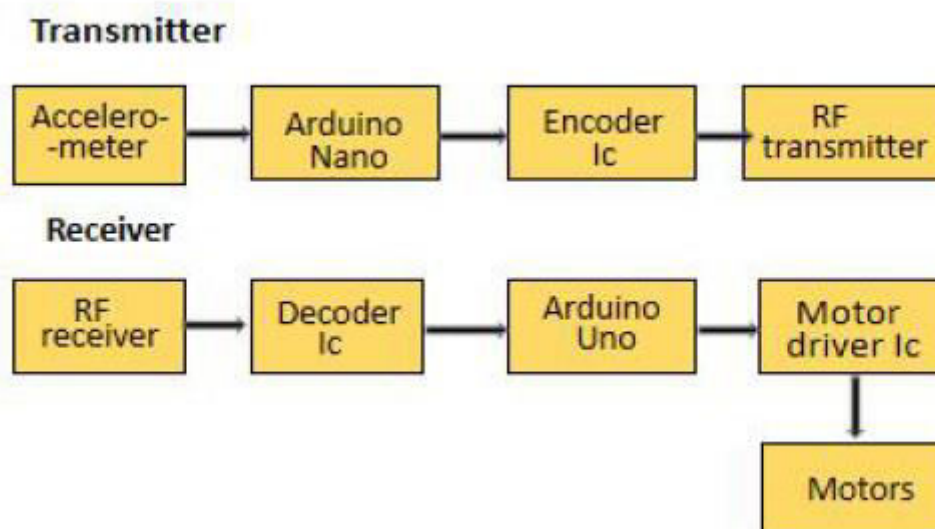
METHODOLOGY FOR COMMUNICATION SIGNALS

Transmitter and Receiver Module

The Entire project is categorized into two primary parts. The transmitter part is joined in the hand, where it can detect the human hand signal or human hand gesture. The simpler route for making robot is using micro-controller to control them. So we chose to go with microcontroller to push forward with our project. So we learned about different kinds of microcontroller before beginning our project and picked the best one for our project. Another significant segment or component that is Accelerometer, Which will detect our signals. Initially we collected lot of information as expected about accelerometer. For our project first we needed to utilize “MPU 6050” as an accelerometer however then we proceed onward to ADXL335 as a result of accessibility of the item in our market and furthermore as a result of the cost. “MPU 6050” would cost higher compared to ADXL335. we chosen another significant segment or component that is RF transmitter and receiver for our project is to send the information wireless or remotely. L293d is utilized as motor driver of the circuit in light of the fact that its adaptable and easy to utilize likewise its not costly.

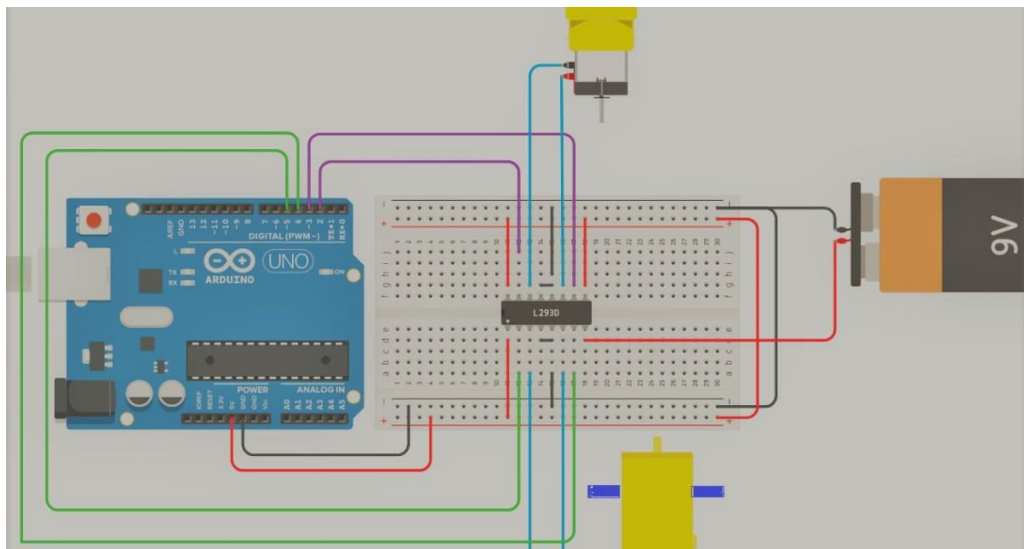
BLOCK DIAGRAM

This is a project which is based on hand motion or hand gesture technology so as to control an automated vehicle remotely. The hand gesture proposed system as shown in fig 1. At present hand movement is recognized with help of accelerometer which is than the simple data is passed to micro-controller to the transmitting side. After processing, information through accelerometer micro-controller will pass to the remote module and the signal will receiver at receiver part. What's more, from receiver side micro-controller sense it through remote module in the accepting receiving wire and pass it to the engines by means of engine driver. Than the robot wheels will began to move as directed by the user. Particularly the accelerometer moves in three different direction which is X, Y and Z axis in order to get accurate direction.





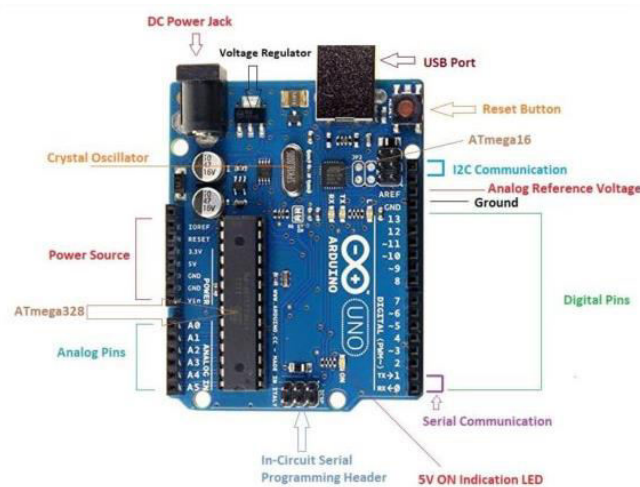
Interfacing of L293D with Arduino



III. DESCRIPTION OF COMPONENTS

Arduino Uno R3

Arduino UNO R3 variant uses Atmega328p microcontroller which comprises of different components such as voltage regulator, cation, and crystal oscillator to support the microcontroller. It has 6 analog pins and 14 digital output pins out of which 6 can be used as pulse width modulation (PWM) pins, a barrel jack or a universal serial bus (USB) port can be used to provide power to the board, an in circuit serial programming header.



Arduino Uno Technical Specifications

Microcontroller	ATmega328p - 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 - A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

DC Motors

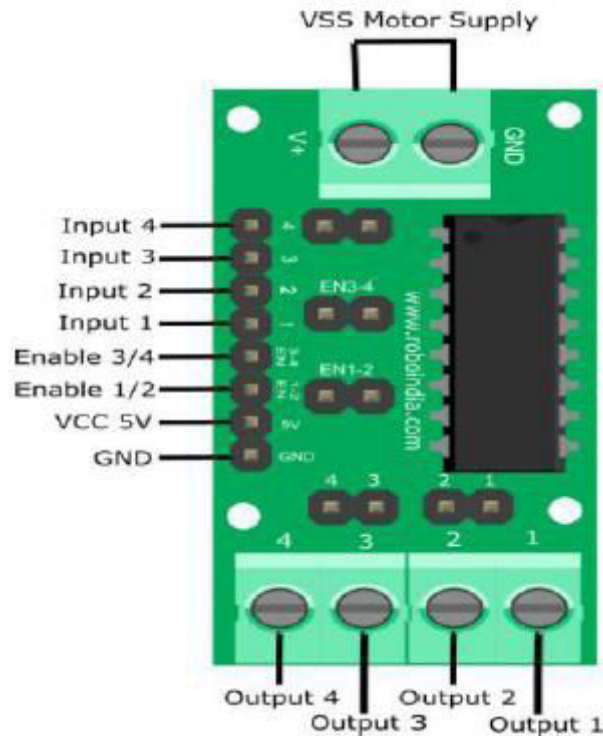
Center shaft direct current (DC) motor with gear box is a motor which has good torque and high rpm even at lower voltages and is excellent for attaching to mechanical objects such as wheels to deliver smooth rotary movements. This motor operates at 300rpm when supported by a 5V battery, which can be increased up to 500rpm provided its supply is increased to 12V



Driver Module

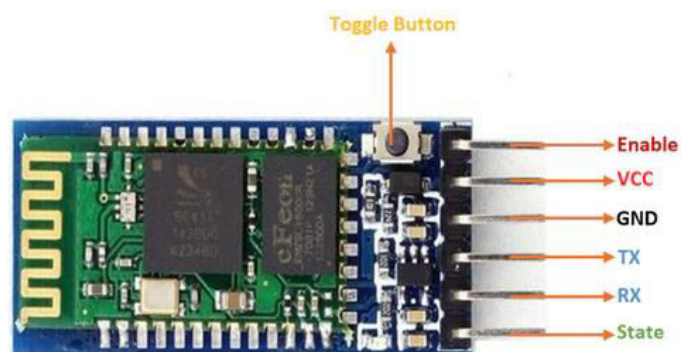
L293D is a motor driver integrated chip and as the name implies, facilitates movement of motor attached to it. It is a 16 pin IC that has the capacity to control two DC motor and the concept is based on H-bridge. However, in order to increase the battery life, we have used two motor driver ICs, attaching only one wheel per motor driver; this also

prevents overheating of the IC. For having the capacity to turn, the voltage needs to change it's direction in clock and against clockwise bearing



Bluetooth Module

The IoT enabled projects require two way communication between the microcontroller and various sensors. There are various methods you can do that, Wired Communication, WiFi, Bluetooth are some among them. The **HC-05** Bluetooth Module adds wireless communication to your project to communicate via Bluetooth to any Bluetooth enabled Laptop or Mobile Device. The module communicates at 9600 baud rate via USART protocol. It can be used in applications like communication between two microcontrollers, data logging, wireless robots, wireless sensors data acquisition and home automation.



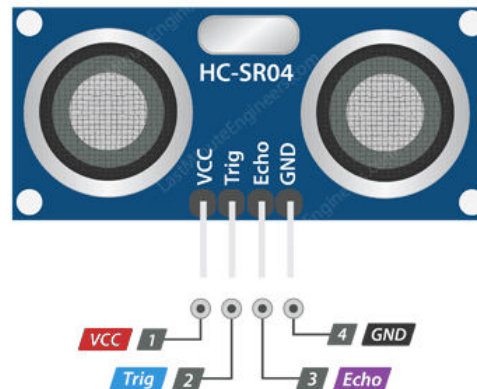
Specifications:

- Profiles: Bluetooth serial port Profile
- Dimension: 26.9mm x 13mm x 2.2 mm
- Bluetooth protocol: Bluetooth Specification v2.0+EDR

- Frequency: 2.4GHz ISM band, Range
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Sensitivity: -84dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbpsmax / 160 kbps, Synchronous: 1Mbps/1Mbps
- Emission power: 4dBm, Class 2
- Power supply: +3.3V, 50mA
- Security: Authentication and encryption
- Working temperature: -20°C to +75°C

Ultrasonic Sensor

The HC-SR04 Ultrasonic distance sensor consists of two ultrasonic transducers. The one acts as a transmitter which converts electrical signal into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them it produces an output pulse whose width can be used to determine the distance the pulse travelled.



IV. CONCLUSION

We accomplished our goal with no obstacles i.e. controlling a robot with gestures rather than remote controlled devices. Our robot is indicating legitimate reactions at whatever point we move our hand. The output from the four pre-defined hand motions to make the robot move in desired directions are: flexion for forward motion, extension for backward motion, tilt right for right turn and tilt left for left turn.

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