ARDUINO BASED GESTURE CONTROLLED ROBOTIC CAR

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Abstract: In recent years, robotics is a current emerging technology in the field of science. A number of universities in the world are developing new things in this field. Robotics is the new booming field, which will be of great use to society in the coming years. Though robots can be a replacement to humans, they still need to be controlled by humans itself. Robots can be wired or wireless, both having a controller device. The developed system is utilized to provide and perform laboratory task that requires manipulation of physical components. Machine based gesture recognition was developed for upper extremity of physical impairment. In this work robot can directly contact with people, so we focused on the manipulation and navigation in the environment and robotic system is used for finding the solution to the requirements. In this work, we give the command to robot for different specific actions and the commands are generated according to the gesture. The gesture movements are processing tool using image Processing.

1. INTRODUCTION

Humans interact in the physical world by the means of the five senses. However, gestures have been an important part of communication in the physical world from ancient times, even before the invention of any language. In this era of machines taking control of every complex works, interactions with machines have become more important than ever. Robots are classified into two types: Autonomous robots like Line sensing or edge sensing robots, and Remote controlled robots like Gesture controlled Robots. Since this paper deals with gesture controlled robot, the primary focus will be on the remotely controlled robots only.

Undoubtedly, the output and the functioning of machines will be more intuitive if they are communicated using human gestures. A gesture is a form of communication in a non-verbal manner by using visible body movements or actions conveying messages.

There are several ways to capture a human gesture that a machine would be able to understand. The gesture can be captured using a camera, or a data glove. Gestures can also be captured via Bluetooth or infrared waves, Acoustic, Tactile, optical or motion technological means the embedded systems designed for specific control functions can be optimized to reduce the size and cost of the device, and increase the reliability and performance. Nowadays world is getting changed tremendously, new technologies emerging to reduce human efforts and gain large amount of output in short span of time. To achieve such goals the demand for indoor as well as outdoor robots is increased. But many operators fill complicated to handle those robots. There are certain options to reduce complexity, such as use of remote control. But remote controller also consist hardware as well as signal problem, command problems etc. To avoid those problems term gesture is one of the effective options to control and handle the robots using movements of palm of hands. Gesture can be produced or perform by palm of users. Gesture is one of the most powerful virtual medium for communication between human and computer. So we have proposed hand gesture recognition system to perform various functionalities of robotic cars, such as navigation of car as per the commands given by user by using hand gesture.

II.BLOCK DIAGRAM AND MODULES DESCRIPTION

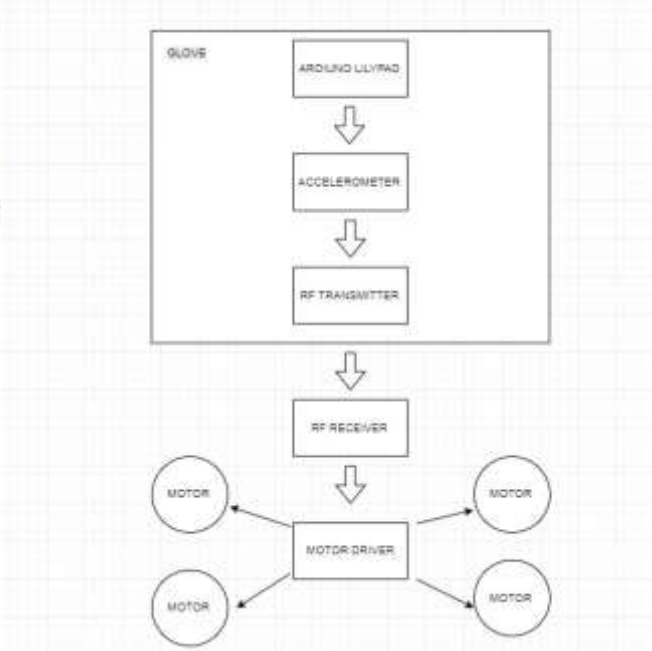

Fig: Block Diagram

A. Modules and Description

1. Accelerometer

An Accelerometer is an electromechanical device that measures acceleration forces. These forces may be static, like

the constant force of gravity pulling at your feet, or they could be dynamic – caused by moving or vibrating the accelerometer. It is a kind of sensor which record acceleration and gives an analog data while moving in X, Y, Z direction or may be X, Y direction only depending on the type of the sensor

Fig: Accelerometer of accelerometer

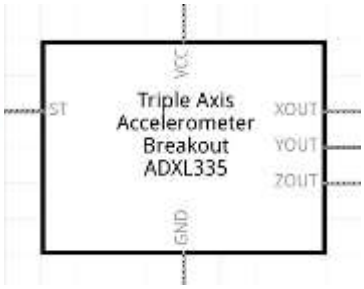

Fig: Pin Diagram

PIN NO.	SYMBOL	FUNCTION
1	ST	Set the sensitivity of the accelerometer
2	Z	Records analog data for z direction
3	Y	Records analog data for y direction
4	X	Records analog data for x direction
5	GND	Connected to ground for biasing
6	VCC	+3.3 volt is applied

Fig. Pin Description of accelerometer

2. Arduino Lilypad

The lilypad Arduino is designed for e-textile and wearable project it can be sewn to fabric and similarity mounted power supplies, sensors and actuators with conductive thread. The Lilypad Arduino is based on the ATmega328v. It was developed by Leah Buechley and Sparkfun Electronics.

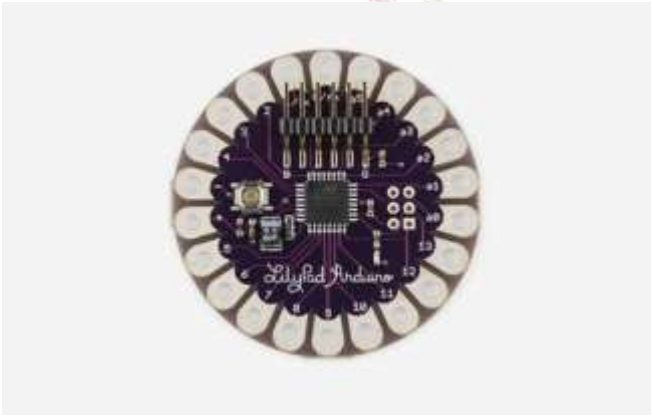

Fig: Arduino Lilypad

Fig: Arduino Pin Description

3. Encoder IC (HT12E)

HT12E is an encoder integrated circuit 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. They are paired with 2^{12} series of decoders. Simple put HT12E converts the parallel input into serial output. It encodes the 12 bit parallel data into serial for transmission throw an RF transmission .this 12 bit are divided into 8 address bits and 4 data bits.

Fig: IC (HT12E)

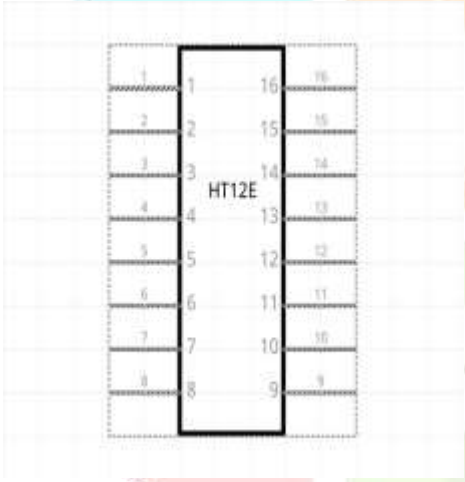

Fig: IC (HT12E) Pin Description

PIN NO.	SYMBOL	FUNCTION
1-8	A0-A7	Address pins
9	Vss	Ground pin
10-13	D0-D3	Output pin
14	TE	Enables the transmission
15-16	Osc1-Osc2	Rosc of 470K ohm is connected
17	Dout	Output for transmission
18	VCC	5V supply voltage

Fig. Pin Description of HT12E

4. Encoder IC (HT12D)

HT12D is a decoder integrated circuit 2^{12} series of decoders. The series of decoders are mainly use for remote control system application, like burglar alarm, car door controller, security system etc. it's mainly provided to interface RF and infrared circuit. They are paired with 2^{12} series of encoders. HT12D is a capable of decoding 12bit, in of which 8 are address bit and 4 are data bits. The data of 4bit latch type output pin remain unchanged until new is received.

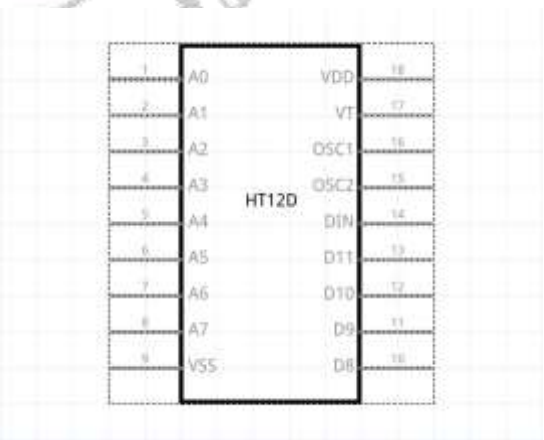

Fig: IC (HT12D)

Fig: IC (HT12D) Pin Description

PIN NO.	SYMBOL	FUNCTION
1-8	A0-A7	Address pins
9	Vss	Ground pin
10-13	D0-D3	Output pin
14	TE	Enables the transmission
15-16	Osc1-Osc2	Rosc of 470K ohm is connected
17	Dout	Output for transmission
18	VCC	5V supply voltage

Fig. Pin Description of HT12D

5. MOTOR DRIVER IC (L293D)

It is also known as H-Bridge or Actuator IC. Actuators are those devices which actually gives the movement to do a task like that of a motor. In the real world there are different types of motors available which work on different voltages. So we need a motor driver for running them through the controller. The output from the microcontroller is a low current signal. The motor driver amplifies that current which can control and drive a motor. In most cases, a transistor can act as a switch and perform this task which drives the motor in a single direction.

Fig: IC (L293D)

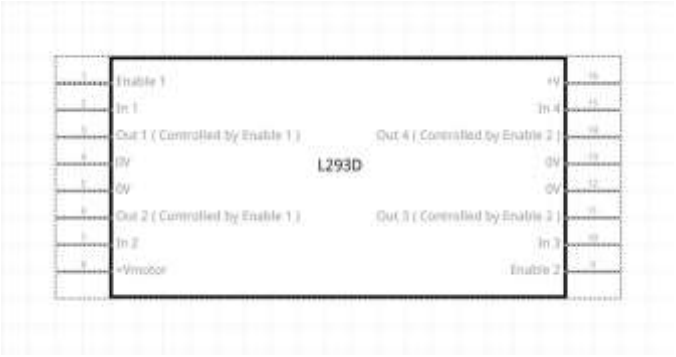

Fig: IC (L293D) Pin Description

6. RF Module (Transmitter & Receiver)

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between
30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver pair operates at a frequency of 434 MHz an RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

Fig. Pin Description of RF Transmitter

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc
5	Supply voltage; 5V	Vcc
6	Ground (0V)	Ground
7	Ground (0V)	Ground
8	Antenna input pin	ANT

Fig. Pin Description of RF Receiver

7 DC MOTORS

A machine that converts DC power into mechanical power is known as a DC motor. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.

DC motors have a revolving armature winding but non- revolving armature magnetic field and a stationary field winding or permanent magnet. Different connections of the field and armature winding provide different speed/torque regulation features. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current.

Fig: DC motor

III. IMPLEMENTATION

The accelerometer records the hand movements in the X and Y directions only and outputs constant analogue voltage

Fig: RF Module (Transmitter & Receiver)

Fig: RF Receiver **Fig: RF Transmitter**

levels. These voltages are fed to the comparator IC which compares it with the references voltages that we have set via variable resistors attached to the IC. The levels that we have set are

1.7V and 1.4V. Every voltage generated by the accelerometer is compared with these and an analogue 1 or 0 signal is given out by the comparator IC.

This analogue signal is the input to the encoder IC. The input to the encoder is parallel while the output is a serial coded waveform which is suitable for RF transmission.

A push button is attached to pin 14 of this IC which is the Transmission Enable (TE) pin. The coded data will be passed onto the RF module only when the button is pressed. This button makes sure no data is transmitted unless we want to. The RF transmitter modulates the input signal using Amplitude Shift Keying (ASK) modulation. It is the form of modulation that represents digital data as variations in the amplitude of a carrier wave.

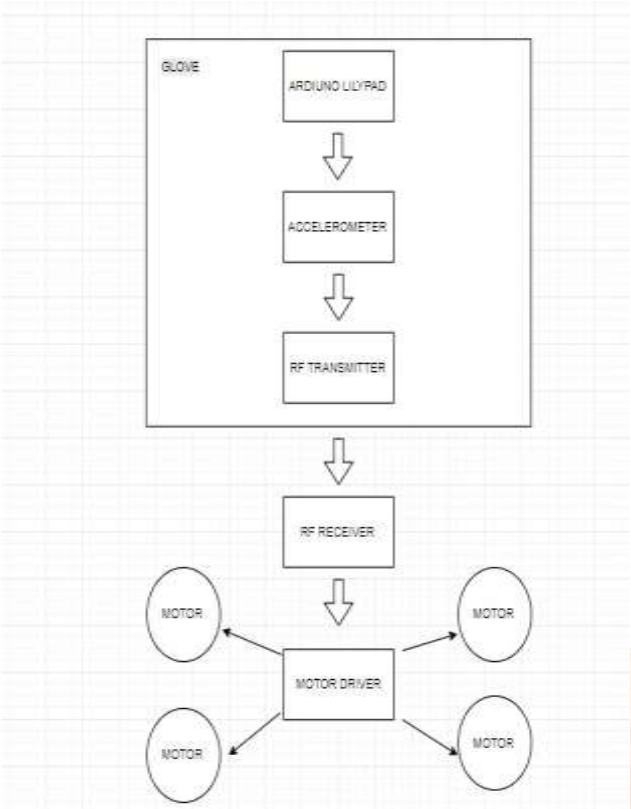

Fig: Block Diagram

The RF modules works on the frequency of 315MHz. It means that the carrier frequency of the RF module is 315MHz. The RF module enables the user transmitted signal is received by the RF receiver, demodulated and then passed onto the IC. The decoder IC decodes the coded waveform and the original data bits are recovered. The input is a serial coded modulated waveform while the output is parallel. The pin 17 of the decoder IC is the Valid Transmission (VT) pin. A led can be connected to this pin which will indicate the status of the transmission. In the case of a successful transmission, the le will blink. The parallel data from the encoder is fed to the port
1 of the microcontroller. This data is in the form of bits. The microcontroller reads these bits and takes decisions on the basis of these bits. microcontroller does is, it compares the input bits with the coded bits which are burnt program memory of the microcontroller and outputs on the basis of these bits. Port 2 of microcontroller is used as the output port. Output bits from this port are forwarded to the driver IC which drives the motors in a special configuration based on the hand movements.

IV. FUTURE SCOPE

As we are using RF for wireless transmission, the range is quite limited; nearly 50-80m. This problem can be solved by utilizing a GSM module for wireless transmission. The GSM infrastructure is installed almost all over the world. GSM will not only provide wireless connectivity but also quite a large range. An on-board camera can be installed for monitoring the robot from faraway places. All we need is a wireless camera which will broadcast and a receiver module which will provide live streaming.

V.CONCLUSION

The purpose of project is to control a toy car using accelerometer sensors attached to a hand glove. The sensors are intended to replace the remote control that is generally used to run the car. It will allow us to control the forward and backward, and left and right movements, while using the same accelerometer sensor to control the throttle of the car.

VI. REFERENCES

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