Wireless Hand Gesture Controlled Robot

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ABSTRACT

This Paper explains hand gesture controlled robotic vehcle. Its directional movements are controlled by hand trajectories. Hand trajectories are detected with the help of 3-axis accelerometer. The RF module function is to transmit the trajectory data wirelessly .At the receiving end, decoder decodes the data & microcontroller processes the data which drives the motor to move.

I. INTRODUCTION

Gesture recognition technologies are much advanced in the today world. Nowadays, a lot of active research is taking place in the wireless field and very less in its public implementations. Lot of techniques has been devised for sensing the hand gestures & controlling robots. A technique based on glove is a popular mode of recognizing hand gestures. It uses a sensor attached to a glove that detects hand movements. The user needs to have a transmitting device on his hand which consists of a sensor, i.e., 3- axis accelerometer. Movement of the hand in a particular direction will send a command to the robot which will then move in a specified direction. The transmitting device consists of a Comparator IC for assigning proper levels to input voltages from the accelerometer & an Encoder IC whose function is to encode the four bit data & after that it will be transmitted by an RF Transmitter module.

At the receiving end, an RF Receiver module will receive the encoded data & decode the data by the help of a decoder IC. Then, microcontroller processes the data and passes it to the motor driver which rotates the motors in a special configuration to make the robot move in the same direction in which hand is moving

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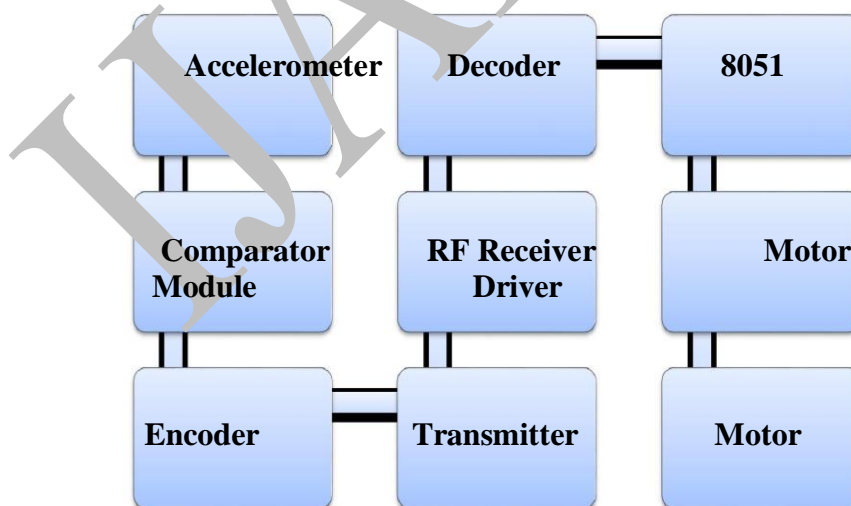
1.1   ACCELEROMETER

An Accelerometer is an electromechanical device that measures forces of acceleration. These forces may be static, like the constant gravitational force acting on our feet, or they could be dynamic – caused due to the movement or vibration of the accelerometer. It is the sensor which records acceleration and gives an analog data when moves in X, Y, Z direction.

1.2 COMPARATOR IC

The comparator IC compares the analog voltage received from the accelerometer and gives a particular voltage which may be low or high after comparing it with reference voltage. The output of comparator is quite noisy and consists of various voltage levels. This IC compares those levels and gives output in the digital voltage form of 0 and 1. This process is called signal conditioning.

1.3 ENCODER IC

PT2262 is a remote controlled encoder which is paired with PT2272 utilizing CMOS technology. It encodes data into serial coded waveform which is suitable for RF or IR modulation. PT2262 has a maximum of 12 bits of tri-state address pins thus providing up to 3^{12} address codes; thereby, it reduces any code collision and unauthorized code scanning possibilities.

1.4 RFMODULE (Rx/Tx)

Radio frequency (RF) is the frequency in the range of about 3 KHz to 300 GHz. It corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.
The RF module works on 315 MHz frequency and ranges from 50-80 meters.

1.5 DECODER IC

PT2272 is a remote controlled decoder which is paired with PT2262 utilizing CMOS Technology. It has 12 bits of tri-state address pins thus providing a maximum of 3^{12} address codes; thereby, it reduces any code collision and unauthorized code scanning possibilities. When no error or unmatched codes are found then it decodes input data.

1.6 MICROCONTROLLER

It is the brain and processing part of the robot. It receives data from the decoder and makes decisions for further operations. We used a microcontroller for our robot to give it a decision capability. That decision directs the robot to move in particular directions.

1.7 MOTOR DRIVER IC

It is known as H-Bridge and is sometimes called as Actuator IC. Actuators generate the movement   to do an operation like that of a motor. There are different types of motors available working on different voltages. So we need a motor driver for running them through the controller.The microcontroller gives a low output signal. The motor driver function is to amplify that current which controls and drives a motor. In most cases, transistor acts as a switch and performs this task thus helping to drive the motor in a single direction.

1.8 DC MOTORS

DC MOTOR converts DC power into mechanical power. 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. By changing armature voltage or by changing field current one can control speed of the motor.

1.9 DC GEAR MOTOR

A geared DC Motor has a gear assembly devoted to the motor. The speed of motor is termed as RPM and is

counted as rotations per minute. The gear assembly increases the torque by dropping the speed.Its speed can be reduced to any required figure by using the correct arrangement of gears in a gear motor .This concept of reducing the speed with the help of gears and increasing the torque is known as gear reduction.

II. IMPLEMENTATION

The accelerometer outputs constant analog voltage levels by recording the change in X and Y direction. These voltages are sent to the comparator IC which compares it with the references voltages that have been set via variable resistors attached to the IC. The levels can be set between any two voltages. Every voltage generated by the accelerometer is compared
with these set voltages and an analog 1 or 0 signal is generated by the comparator IC.
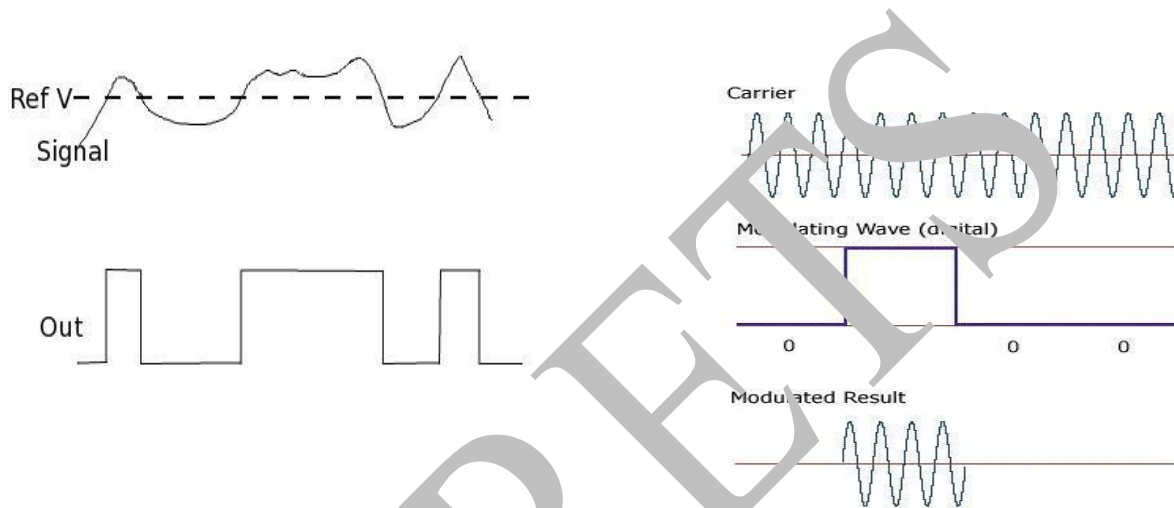
Input and Output of Comparator IC
2(a)

Modulated output of the RF module
2(b)

The analog signal so generated is fed as input to the encoder IC. Encoder converts that parallel analog signal waveform into serial analog signal waveform which is compatible for transmission. Push button which is attached with the transmitting pin enables transmission of the signal. The coded data will be passed onto the RF module only when the button is pressed. This button helps in making sure that no data is transmitted unless required.

By using Amplitude Shift Keying (ASK) modulation the RF transmitter modulates the input signal. It is the form of modulation which represents digital data as variations in the amplitude of a carrier wave. The working frequency of RF module is 315MHz. It means that the carrier frequency of the RF module is 315MHz. The RF module enables the user to have the control on the robot wirelessly and easily.

The schematic of transmitting end can be seen below:
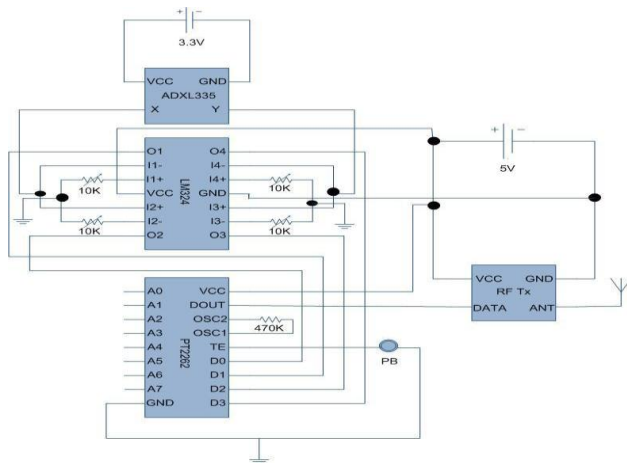
2(c) Transmitting part
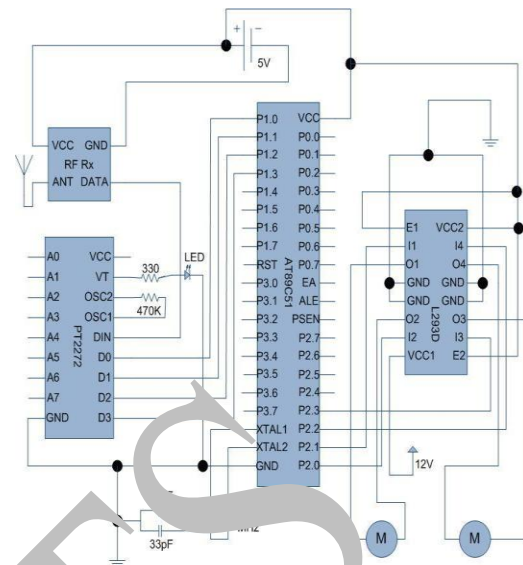
2 (d) Receiving part

The receiver receives the signal from transmitter, demodulates it and passes it to decoder IC. Original data bits are recovered by decoding the signal received by the decoder. Decoder converts the serial waveform to parallel waveform which is suitable for microcontroller use. 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 connected to this pin indicates the status of the transmission. The LED will blink in case of successful transmission.

The parallel binary data from the encoder is fed to the microcontroller. The microcontroller takes decision for further operations after analyzing these bits. Microcontroller compares the input bits with the coded bits which are burnt into the program memory of the microcontroller and gives resultant outputs. These output bits are forwarded to the motor driver IC which drives the motors in a special configuration based on the hand movements.
Motor produces no voltage at dead stop. If a voltage is applied to the motor and it begins to spin, it will act as a generator that will produce a voltage which opposes the external voltage applied to it. This is called Counter Electromotive Force (CEF) or Back Electromotive Force (Back EMF). If the motor stops moving due to excessive load then the high current so produced can burn out the motor coil windings. To prevent this, fly back diodes are used. They prevent motors from damaging by not letting back EMF increase.

IV.APPLICATIONS
A. Medical: - Gesture control can be really helpful in conducting operations.
B. Military: - Gesture controlled robots can be used for military purpose.
C. Handicap people can use this technology in their wheelchair to move from one place to another.

V.CONCLUSION
GSM Technology could be incorporated to achieve greater range as RF range is limited.IF we want to monitor the robot at far places a camera can be installed on it to keep an eye on its movement. The utility of this robot can also be used by installing a robotic arm.

VI. FUTURE DEVELOPMENT

Vibration sensors can be installed on car or your robot which will buzz when somebody will try to open it when locked. This technology is also coming in use in cars to increase the comfort of driver.

VII. REFERENCES

1. ''John T. Fedemma'' , Member IEEE, Paper on wireless controlled robotic vehicle.
2. " M .Ozaik, Robert Hier" , Application of wireless robots , in 1996-97.
3. "Accelerometer based hand gesture controlled robot" based report by Dr. Subramanium kariyappa.
4. ''Acoustic controlled robotic vehicle, International journal of engineering technology (ISSN2250- 2249, Volume 2, April 2012).
5. ''Wireless controlled system for a robotic vehicle" by Arias Esquivel, Costa Rica.
6. "Wireless controlled and monitoring of robotic arm" by R.A Kadu, Prof. VA more.
7. "Wireless sensor based robotic vehicle" by Gyula Mester.
8. "The robotic controlled using the wireless communication", a design project report at Cornell university by John Hoon.