Hand Gesture Based Wireless Controlled Robot

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Abstract

This paper presents a Gesture Controlled robot which can be controlled by your hand gestures based on 3 axis accelerometer and robot move in four direction forward, backward, left and right. Including wireless camera (night vision) which is use to send audio video signal up to 30 meter, and human motion sensor working on the principle of infrared it detect 790 nanometer wavelength from human body. Mostly in military application, industrial robotic, construction vehicles in civil side. In this field is quite complicated to control the robot or particular machines with remote and or switches, sometime operator may be confused so this new concept introduce to control the machine with the movement of hand which will simultaneously control the robot.

Keywords: Gesture recognition, MEMS Accelerometer, Human motion sensor, wireless camera.

Introduction

Now days modern concept of control is introduced in field of robotic, this method of controlling remotely any robotic vehicle is like just moving your hand in any direction in air or changing your hand gesture in any axis plain, it follow your command smoothly and naturally like invisible link between your hand and moving robot. This type of control is commonly used in virtual world compute games it makes natural field to the players and adds more fun. These controls make switching system more real and give more freedom to user; they are most important in advance robotic control and monitoring system. These accelerometer based switching system is also used to operate household appliances just by changing hand or any part of body fitted with sensor. The sensitive three axis accelerometer sense the change in position of hand and give respective output, which is feed to the comparator to generate BCD output, send to the encoder which transmit these BCD signal through RF transmitter up to 100 feet in open ,these signals are received by receiver on robot change to respective command. The previous paper presents a Hand gesture recognition system using MEMS which is capable of recognizing hand gesture, based on the signal from 3-axes MEMS accelerometer. But in propose paper we also use wireless camera for live video streaming with night vision video output and human motion sensor for surveillance.

Material and Methods
**Gesture Recognition**

Gesture recognition is useful for processing information from human which is not conveyed through speech or type. As well, there are various types of gestures which can be identified by computers. *(Peasant Shaun)* Gesture recognition is a topic in computer science and language topology with the goal of interpreting human gesture via mathematical algorithm. Gesture can originate from any bodily motion or state but commonly originate from the face and hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition [1]. Gesture recognition can be termed as an approach in this direction. It is the process by which the gestures made by the user are recognized by the receiver. Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head, face, or body.

**Transmitter Section**

It consists of 5 parts:

1. Accelerometer
2. Comparator
3. Encoder (HT12E)
4. RF Transmitter
5. Voltage regulator

**Accelerometer**

Accelerometer sensors measure the difference between any linear acceleration in the accelerometer’s reference frame and the earth's gravitational field vector. We use three axis accelerometer to determine the orientation in two axis, +x axis, +y axis, -x axis, -y axis and z for free fall. When we tilled the accelerometer in x axis of y axis give an analog voltage output. Which is compare by the quad comparator and generate the four bit data and this 4 bit data send to the encoder and encoder feed this data.

The Accelerometer having 6 pins-
1- VDD- We will give the +5volt to this pin
2- GND- We simply connects this pin to the ground for biasing.
3- X- On this pin we will receive the analog data for x direction movement.
4- Y- On this pin we will receive the analog data for y direction movement.
5- Z- On this pin we will receive the analog data for z direction movement.
6- ST- this pin is use to set the sensitivity of the accelerometer 1.5g/2g/3g/4g.

<table>
<thead>
<tr>
<th>Pin no.</th>
<th>Function</th>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ground (0V)</td>
<td>GND</td>
</tr>
<tr>
<td>2.</td>
<td>Serial Data Input Pin</td>
<td>DATA</td>
</tr>
<tr>
<td>3.</td>
<td>Supply Voltage (5V)</td>
<td>VCC</td>
</tr>
<tr>
<td>4.</td>
<td>Antenna Output Pin</td>
<td>ANT</td>
</tr>
</tbody>
</table>

Figure 1 different gesture of hand
Quad Comparator

These devices consist of four independent voltage comparator that they are designed to operate from a single power supply over a wide range of voltage. The comparator use to compare the reference voltage with the sample voltage. If sample voltage is higher than or equal to it gives output here we use analog 4 variable register of 10 kilo ohm to set the difference voltage.

Table 1 pin number and their function

1. VDD and VSS: positive and negative power supply.
2. OSC1 and OSC2: Input and output pins of the internal oscillator present inside the IC.
3. TE: This pin is use to enabling the transmission.
4. A0-A7: These are input address pin used to secured transmission of this data.
5. AD0-AD3: These pins are feeding data in to the IC.
6. DOUT: The output of the encoder can be obtained through this pin and can be connected through the RF transmitter.

Encoder (HT12E)

HT12E is a 2^12 series encoder is widely use in remote control .this is capable for converting parallel data input in to serial output. This HT12E encoder generates 8 bit address and 4 bit data pin. Pin A0-A7 is use to select the address and AD0-AD3 is use to select the data. Address bit can provide 8 bit security code for secured data transmission between encoder and decoder.

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RF Transmitter Module (TX)

RF transmitter module (Hemlata) is crystal base this module transmit the RF signal at the carrier frequency of 434MHz RF signal transmit up to the distance of 30 meters. It send the data and the address feed by the encoder in ASK mode. It is crystal base to lock the carrier frequency to more precise carrier frequency[2].

Voltage regulator (LM7805)

This is positive voltage regulator IC. This IC gives constant 5v supply operates the CMOS IC. The LM7805 series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications.
1. VIN: Take the input voltage.
2. VOUT: Produce the output voltage.
3. GND: Both input and output are given to this pin.

RF Receiver Module (RX)

434 MHz crystal base RF receiver module receive (Ruize Xu) the RF information from transmitter and send the information to the decoder. The RF receiver module will receive the data which is transferred by the gesture device [3].

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<tr>
<td>2.</td>
<td>Serial Data Output Pin</td>
<td>DATA</td>
</tr>
<tr>
<td>3.</td>
<td>Linear Output Pin; Not NC</td>
<td>NC</td>
</tr>
<tr>
<td>4.</td>
<td>Supply Voltage (5V)</td>
<td>VCC</td>
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</tr>
<tr>
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Decoder (HT12D)

This is 12 bit decoder verify the 8 bit address. If address is verify VT pin goes high and decode the data and will LED glows up drive by the transistor and decode the data and give BCD output. HT12D is 2^12 series decoder for remote control application. It is commonly used for radio frequency wireless application. HT12D is simply convert serial data into parallel data... Its operating voltage can be range of 2.4v-12v.

1. VDD and VSS: Are used to provide Power to the IC, positive and negative of the power supply respectively.
2. OSC1-OSC2: These are oscillator input pin and oscillator output pin use to connect external resistor for internal oscillator of HT12D.
3. A0-A7: Are the address input pin connected to VSS.
4. D0-D3: Are the data output pins.
5. VT: Stand for valid transmission this output pin will be high.

Hex inverter

This inverter contains 6 not gate. An inverter take an input signal and reverse it; a low input signal produce a high output while a high input produce a low input. It inverts the binary 1 to 0 and 0 to 1. This is mainly use for switching compatibility and sends the output to the transistor. Transistor gives the output the collector and the output is feed to the motor driver IC through junction diode.

Motor driver (4 Wheel)

In our project we use the D.C motors which are very easy to use, but like most other motors their usefulness for robotics is very dependent on the gearing available. This is made up of the IC L2938. This IC contains 2H Bridge to control clockwise and anticlockwise movement of motors according to the input send by the decoder.
Wireless Camera

Here we use wireless very high frequency camera (Dr. Shantanu) to send audio video signal up to 30 m in open ground. Transmit a video and audio signal to a wireless security camera require at least one cable or wire for power[4]. The signal from one camera can be picked up by any receiver; you can have multiple receivers in various locations to create your wireless surveillance network.

Human Motion Sensor

Human motion sensor working on the principle of infrared. It detect \( A.alice\ lines\) 790 nm wavelength from living body of mass 35kg and send to the PLL and give the output to trigger the buzzer or relay[5],[6].

Result and Discussion

This paper describes non specific person gesture recognition System by using MEMS accelerometers. The recognition system consists of sensor data collection, segmentation and recognition. After receiving acceleration data from the sensing device, a segmentation algorithm is applied to determine the starting and end points of every input gesture automatically. The sign sequence of a gesture is extracted as the classifying feature, i.e., a gesture code. Finally, the gesture code is compared with the stored standard patterns to determine the most likely gesture. In this paper, various methodologies have been analyzed and reviewed with their merits and demerits.

References