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Designing Smart Glove For Gesture Controlled Wireless Applications

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Abstract
This paper presents a Gesture Controlled robot which can be controlled by your hand gestures based on flex sensor and robot moves in four directions forward, backward, left and right. Including wireless camera (night vision) which is used to send audio video signal up to 30 meter, and Mostly in military application, industrial robotic Operations , construction vehicles in civil side. In this field it is quite complicated to control the robot or particular machines with remote and or switches, sometime operator may be confused so we are introducing this new concept of controlling the machine with the Different hand gestures which will simultaneously control the robot.
Keywords: *Gesture recognition, wireless camera, Robot , RF Module*

Introduction

The development of the most popular devices for hand movement acquisition, glove-based system started about 30 years ago and continues to engage a growing number of researchers. Sign language is the non-verbal form of intercommunication used by deaf and dumb people that uses gestures instead of sound to convey or to express fluidly a speaker's thoughts.

Robotics is the system which deals with construction, design and operation. Robotic research today is focused on developing system that modularity, flexibility, redundancy, fault tolerance and some other researchers are on completely automating a manufacturing process or a task, by providing sensor based to the robot arm. To save human efforts the automation playing important role in system.

In this system a gesture driven robotic vehicle is developed in which how the vehicle is moving i.e., control and handling is dependent on user gesture. This type of control is mostly used in virtual world compute games. This control make switching system more real and give more freedom to user.

Working :

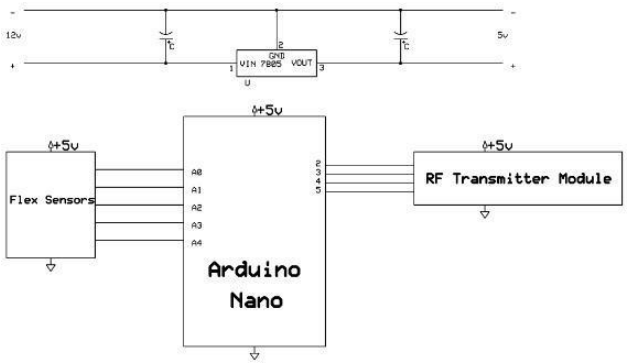


Figure Above Shows Circuit at Transmitter Side which Consist of Flex Sensors to recognise Gesture , Controller Arduino Uno to Read Gesture and Transmit respective Data and RF Transmitter Module to transmit data Wirelessly.

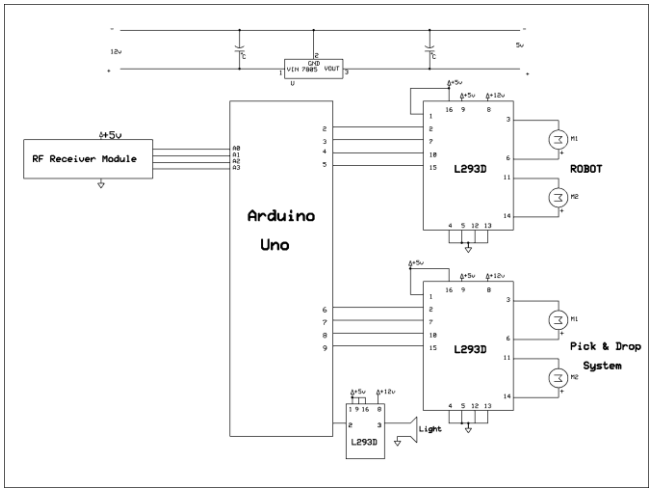


Figure Above Shows Circuit at Receiver Side which Consist of RF Receiver Module to Receive data Transmitted wirelessly from Transmitter Side , Arduino UNO to read received data and Process it to Controller Robot functionality , Driver ICs to Drive motors of Robot as well as Gripper , Robot motors to move Robot , Gripper Motors for Pick and Drop Mechanism and Light for Night Vision.

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. 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. Flex Sensors
2. Comparator
3. Arduino nano
4. Encoder (HT12E)
5. RF Transmitter
6. Voltage regulator

Flex Sensor A **flex sensor** or **bend sensor** is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. Since the resistance is directly proportional to the amount of bend.

A flex sensor is a kind of sensor which is used to measure the amount of defection otherwise bending. The designing of this sensor can be done by using materials like plastic and carbon. The carbon surface is arranged on a plastic strip as this strip is turned aside then the sensor's resistance will be changed. Thus, it is also named a bend sensor.

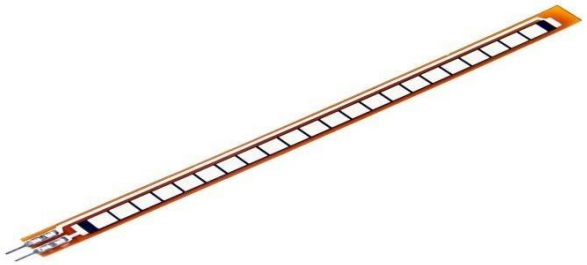


Figure 1 Flex Sensor

Comparator The pin diagram of LM358 IC comprises of 8 pins, where

- Pin-1 and pin-8 are o/p of the comparator
- Pin-2 and pin-6 are inverting i/ps
- Pin-3 and pin-5 are non inverting i/ps
- Pin-4 is GND terminal
- Pin-8 is VCC+

The LM358 IC is a great, low power and easy to use dual channel op-amp IC. It is designed and introduced by national semiconductor. It consists of two internally frequency compensated, high gain, independent op-amps. This IC is designed for specially to operate from a single power supply over a wide range of voltages. The LM358 IC is available in a chip sized package and applications of this op amp include conventional op-amp circuits, DC gain blocks and transducer amplifiers. LM358 IC is a good, standard operational amplifier and it is suitable for your needs. It can handle 3-32V DC supply & source up to 20mA per channel.

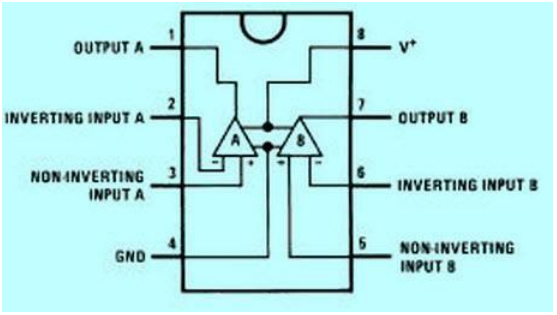


Figure 2 Comparator

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.

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.

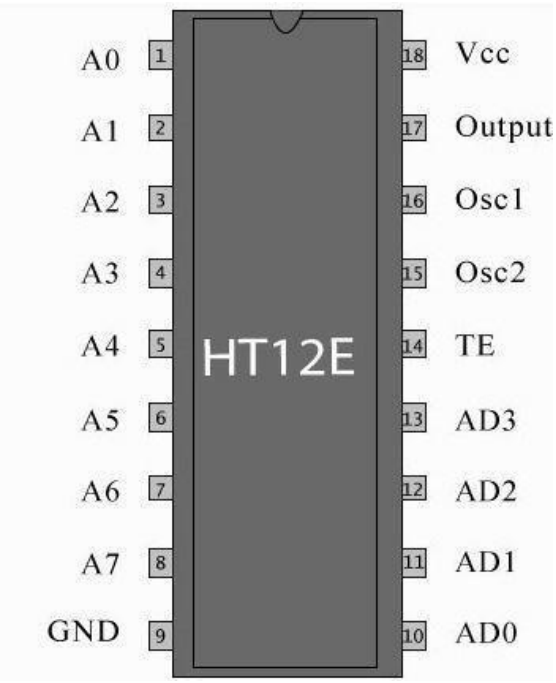


Figure 3 Encoder

RF Transmitter Module (TX)

RF transmitter module 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].

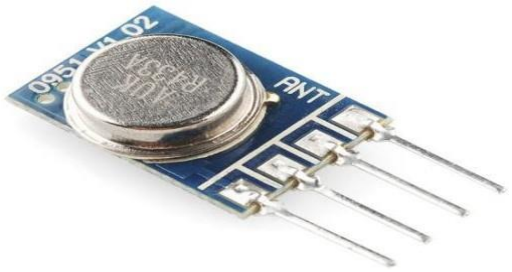


Figure 4 Transmitter module

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.

Figure 5 LM7805

Receiver Section or Robot

This part contain four module--

1. Receiver
2. Decoder (HT12D)
3. Arduino Nano
4. Motor driver

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].

Table 1 pin number and function

Pin no.	**Function**	**Name**
1	Ground (0V)	GND
2	Serial Data Output	DATA
3	Linear Output Pin;	NC
4	Supply Voltage (5V)	VCC
5	Supply Voltage (5V)	VCC
6	Ground (0V)	GND

7	Ground (0V)	GND
8	Antenna input Pin	ANT

Figure 6 Receiver module

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-D 3: Are the data output pins.

5. VT: Stand for valid transmission this output pin will be high.

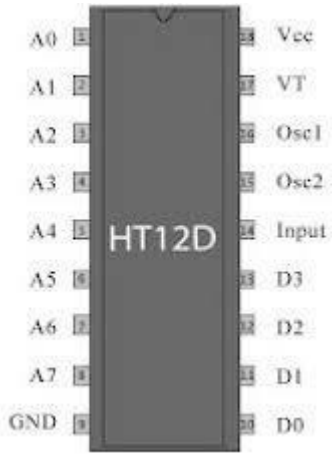


Figure 8 pin diagram of HT12D

Motor driver A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act as an interface between Arduino and the motors . The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. We will be referring the motor driver IC as L293D only. L293D has 16 pins.

- 1 - Enable 1-2, when this is HIGH the left part of the IC will work and when it is low the left part won't work.
- 2 - INPUT 1, when this pin is HIGH the current will flow though output 1
- 3 - OUTPUT 1, this pin should be connected to one of the terminal of motor
- 4,5 - GND, ground pins
- 6 - OUTPUT 2, this pin should be connected to one of the terminal of motor
- 7 - INPUT 2, when this pin is HIGH the current will flow though output 2
- 8 - VCC2, this is the voltage which will be supplied to the motor.
- 16 - VCC1, this is the power source to the IC. So, this pin should be supplied with 5 V
- 15 - INPUT 4, when this pin is HIGH the current will flow though output 4
- 14 - OUTPUT 4, this pin should be connected to one of the terminal of motor
- 13,12 - GND, ground pins
- 11 - OUTPUT 3, this pin should be connected to one of the terminal of motor
- 10 - INPUT 3, when this pin is HIGH the current will flow though output 3
- 9 - Enable 3-4, when this is HIGH the right part of the IC will work and when it is low the right part won't work.

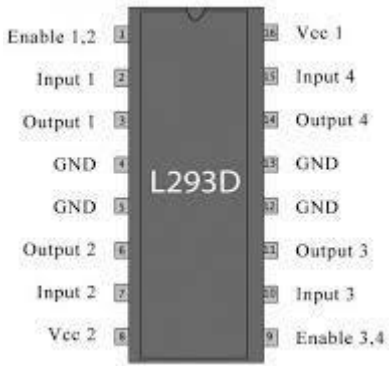


Figure 9 Motor Driver

Arduino Nano It is a Microcontroller board developed by Arduino.cc and based on Atmega328p / Atmega168.

Arduino boards are widely used in robotics, embedded systems, and electronic projects where automation is an essential part of the system.

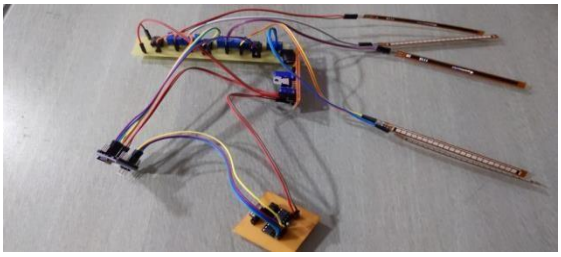
- **Arduino Nano** is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).
- It comes with exactly the same functionality as in Arduino UNO but quite in small size.
- It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.
- **Arduino Nano Pinout** contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.
- Each of these Digital & Analog Pins are assigned with multiple functions but their main function is to be configured as input or output.
- They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output.
- Functions like pinMode() and digitalWrite() are used to control the operations of digital pins while analogRead() is used to control analog pins.
- The analog pins come with a total resolution of 10bits which measure the value from zero to 5V.
- Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage.
- There is one limitation using Arduino Nano i.e. it doesn't come with DC power jack, means you can not supply external power source through a battery.
- This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support.
- Tiny size and breadboard friendly nature make this device an ideal choice for most of the applications where a size of the electronic components are of great concern.
- Flash memory is 16KB or 32KB that all depends on the Atmega board i.e Atmega168 comes with 16KB of flash memory while Atmega328 comes with a flash memory of 32KB. Flash memory is used for storing code. The 2KB of memory out of total flash memory is used for a bootloader.
- The SRAM can vary from 1KB or 2KB and EEPROM is 512 bytes or 1KB for Atmega168 and Atmega328 respectively.
- This board is quite similar to other Arduino boards available in the market, but the small size makes this board stand out from others.

Figure 10 Arduino nano

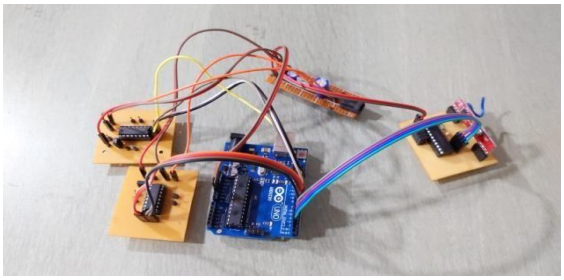
Result and Discussion

This paper describes non specific person gesture recognition System by using Flex Sensors. The recognition system consists of sensor data collection , Comparison and recognition. After receiving data from the sensing device, a comparison is done to determine every input gesture automatically. The gesture is then recognised and specific code is sent to the receiver side where controller drives robot accordingly as per the received code.

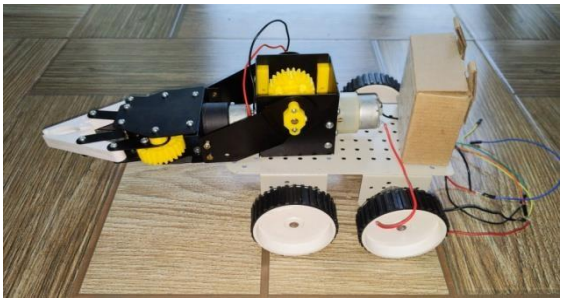
Systems at transmitter and Receiver side are as below.



Tx System



Rx System



Robot With Pick & Drop Mechanism

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