Gyroscope interfaced Robot

Project Report submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology.

in

Computer Science Engineering

under the Supervision of

Dr. Vivek Sehgal

By

Tarun Arora (101209)

to

Jaypee University of Information Technology

Waknaghat, Solan – 173234, Himachal Pradesh

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established under the Act 14 of Legislative Assembly of Himachal Pradesh)

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Certificate

This is to certify that project report entitled “Gyroscope interfaced Robot”, submitted by Tarun Arora in partial fulfillment for the award of degree of Bachelor of Technology in Electronics and Communication Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

This work has not been submitted partially or fully to any other University or Institute for the award of this or any other degree or diploma.

Date: **Supervisor’s Name: Dr. Vivek Sehgal**

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DECLARATION

I hereby declare that the work reported in the B. Tech thesis entitled **Groscope interfaced robot"** submitted by "**Mr. Tarun Arora"** at Jaypee University Of Information Technology, Waknaghat is an authentic record of our work carried out under the supervision of **Dr Vivek Sehgal**. This work has not been submitted partially or wholly to any other university or institution for the award of this or any other degree or diploma.

Tarun Arora (101209)

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Acknowledgement

I would like to express our gratitude and appreciation to all those who gave us the possibility to complete this report. A special thanks to our final year project coordinator, Dr. Hemraj Saini, whose help, stimulating suggestions and encouragement, helped us to coordinate our project especially in writing this report.

Last but not least, many thanks go to the head of the project, Dr. Vivek Sehgal who have given her full effort in guiding the team in achieving the goal as well as her encouragement to maintain our progress in track. We would to appreciate the guidance given by other supervisor as well as the panels especially in our project presentation that has improved our presentation skills by their comment and tips.

Date: Name of the student: Tarun Arora

ABSTRACT

Robot's are becoming one of the major development in field of technology and robotics and are being used in many fields like defense, automobile, medical, construction etc. They are also being used to help people in form of fire fighting robots. Today we are bring you another good Robotics project on topic "Hand gesture controlled wireless robot". The main objective of this project work is to control a robot with gestures of our hand. This project is based on 2 major components viz. Microcontroller and Accelerometer which are discussed in this project report.

INTODUCTION

About Embedded System

An **embedded system** is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is *embedded* as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer(PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today.

History

One of the very first recognizably modern embedded systems was the Apollo Guidance computer, developed by Charles Stark Draper at the MIT Instrumentation Laboratory. Since these early applications in the 1960s, embedded systems have come down in price and there has been a dramatic rise in processing power and functionality. The first microprocessor for example, the intel 4004 was designed for calculators and other small systems but still required external memory and support chips. In 1978 National Engineering Manufacturers Association released a "standard" for programmable microcontrollers, including almost any computer-based controllers, such as single board computers, numerical, and event-based controllers.

As the cost of microprocessors and microcontrollers fell it became feasible to replace expensive knob-based analog components such as potentiometer and variable capacitors with up/down buttons or knobs read out by a microprocessor even in consumer products. By the early 1980s, memory, input and output system components had been integrated into the same chip as the processor forming a microcontroller. Microcontrollers find applications where a general-purpose computer would be too costly

Characteristics

Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

Hand Gesture Based Wireless Controlled Robot

The basic functionality of this robot is to operate by an accelerometer which is wireless. The operational functionality is controlled through ARDUINO controller. The project interprets human gestures and enable the human to interact with the machine. It makes use of Embedded Systems and Wireless Technology.

The accelerometer depends upon the gestures of our hand. Through accelerometer, a passage of data signal is received and it is processed with the help of microcontroller. The microcontroller gives command to the robot to move in the desired direction. The basic working principle for our robot is passage of the data signals of accelerometer readings to the controlling board fitted on the bot. The program compiled in that controller runs according to that value, which makes the bot function accordingly.

While we have used two-axis accelerometer, in which, one axis will control the speed in forward or backward direction and other axis will control the turning mechanism.

Accelerometer based gesture control is studied as a supplementary or an alternative interaction modality. Gesture commands freely trainable by the user can be used for controlling external devices with handheld wireless sensor unit (RF).

Gesture recognition is usually a subject throughout computer scientific disciplines and words engineering using the objective of interpretation people signals through exact algorithms. Gestures could originate from just about any actual movement as well as condition nevertheless typically originated from the face area as well as give. This project report also contains **microcontroller programming, sensor calibration program and circuit diagrams** etc.

Component used

ATMEGA8L

- RF Module
- Ht 12e,d
- Accelerometer module
- Relay
- Dc gear motor
- Regulator 7805
- Crystal oscillator
- Battery
- Project body frame

Component detail

- ATMEGA8L

Features

- High-performance, Low-power AVR 8-bit Microcontroller
  - 130 Powerful Instructions - Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Up to 6 MIPS Throughput at 16MHz
  - Fully Static Operation
  - On-chip 2-cycle Multiplier

- Non volatile Program and Data Memories
  - 8k Bytes of In-System Self-Programmable Flash
  - Optional Boot Code Section with Independent Lock Bits
  - 512K Bytes EEPROM
  - Programming Lock for Software Security
  - 1K Byte Internal SRAM

- Peripheral Features
  - On-chip Analog Comparator
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - Master/Slave SPI Serial Interface
  - Two 8-bit Timer/Counters with Separate Prescalar, Compare
  - One 16-bit Timer/Counter with Separate Prescaler, Compare and Capture mode
  - Real Time Counter with Separate Oscillator
  - Three PWM Channels

- 8-channel ADC in TQFP and MLF package
- 6-channel ADC in PDIP package
- Byte-oriented Two-wire Serial Interface
- Programmable Serial USART

- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Five Sleep Modes: Idle, ADCNoise Reduction, Power-save, Power-down and Standby

- I/O and Packages
  - 23 Programmable I/O Lines
  - 28-lead PDIP, 32-lead TQFP, 32-pad MLF

- Operating Voltages
  - 4.5-5.5V for ATmega8L

- Speed Grades
  - 0-16 MHz for ATmega8L

- Power Consumption
  - Active: 3.6mA
  - Idle Mode: 10mA
  - Power-down Mode: 0.5 µA

Pin Description

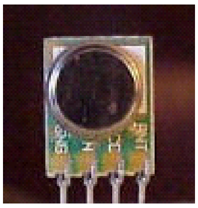
Pin Number	Description
1	(RESET) PC6
2	(RXD) PD0
3	(TXD) PD1
4	(INT0) PD2
5	(INT1) PD3
6	(XCK/T0) PD4
7	VCC
8	GND
9	(XTAL1/TOSC1) PB6
10	(XTAL2/TOSC2) PB7
11	(T1)PD5
12	(AIN0) PD6
13	(AIN1) PD7
14	(ICP1) PB0
15	(OC1A) PB1
16	(SS/OC1B) PB2
17	(MOSI/OC2) PB3
18	(MISO) PB4
19	(SCK) PB5
20	AVCC
21	AREF

22	GND
23	(ADC0) PC0
24	(ADC1) PC1
25	(ADC2) PC2
26	(ADC3) PC3
27	(ADC4/SDA) PC4
28	(ADC5/SCL) PC5

- **RF Module**

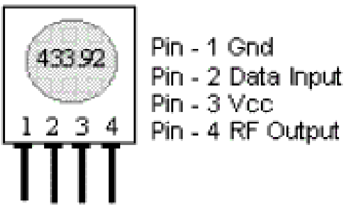
The TWS-434 and RWS-434 are extremely small, and are excellent for applications requiring short-range RF remote controls. The transmitter module is only 1/3 the size of a standard postage stamp, and can easily be placed inside a small plastic enclosure.

TWS-434: The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot, and will go through most walls.....

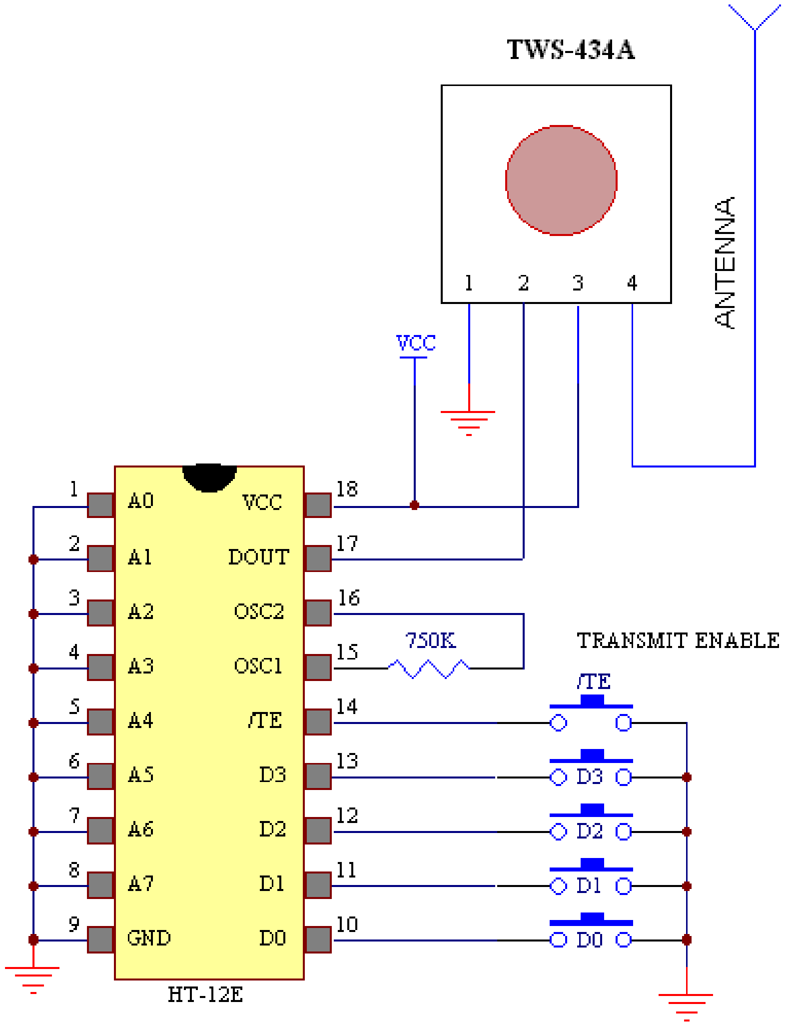


TWS-434A

The TWS-434 transmitter accepts both linear and digital inputs, can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very easy. The TWS-434 is approximately the size of a standard postage stamp.



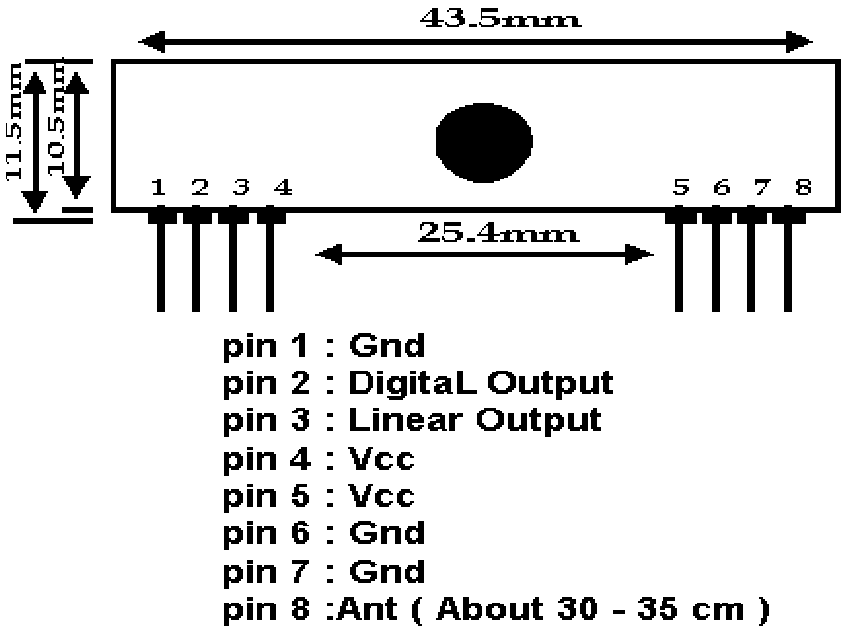
TWS-434 Pin Diagram



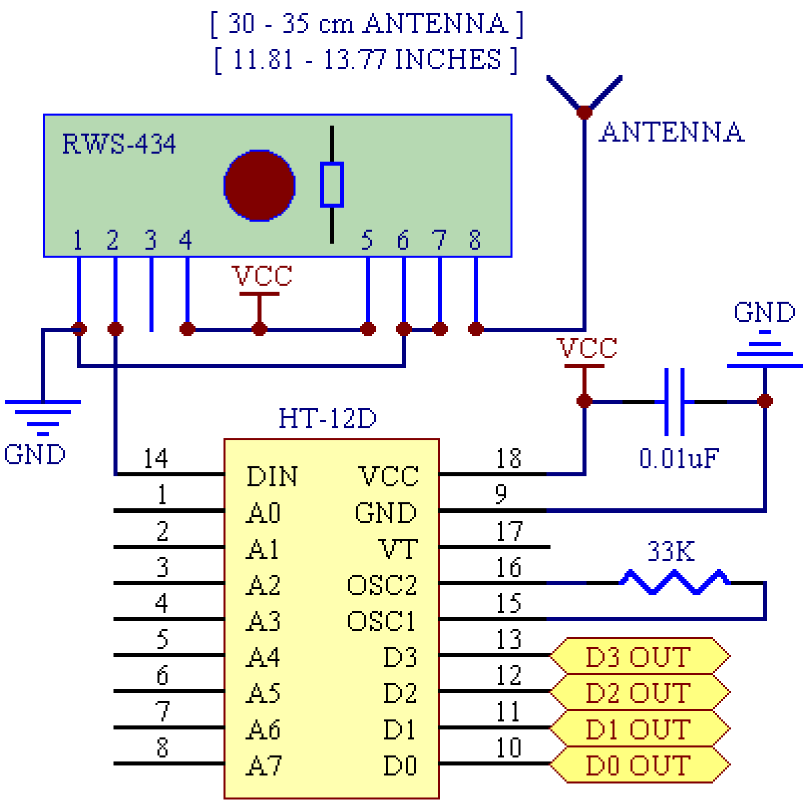
Sample Transmitter Application Circuit

RWS-434: The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The RWS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs.

RWS-434 Receiver



RWS-434 Pin Diagram

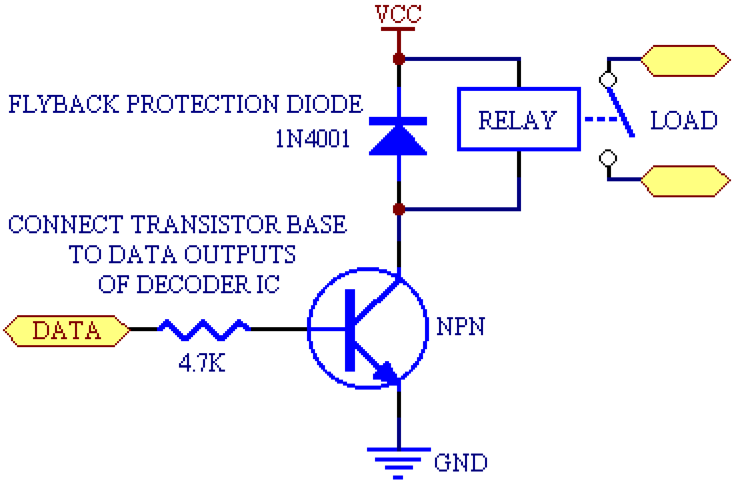


Sample Receiver Application Circuit

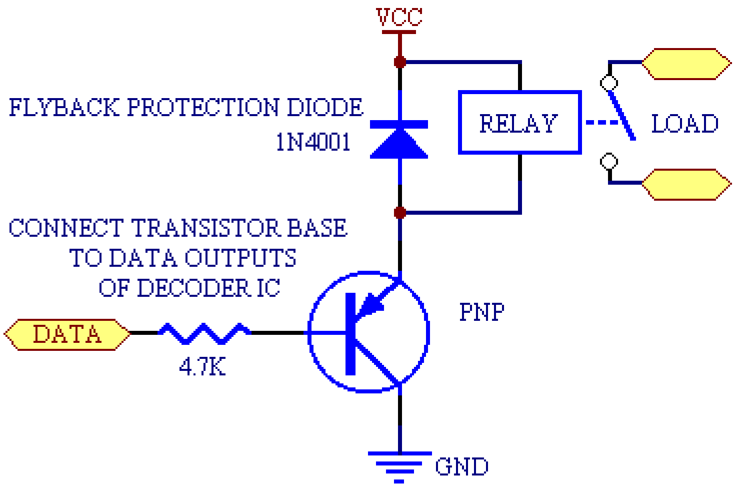
Above shows the receiver section using the HT-12D decoder IC for a 4-bit RF remote control system. The transmitter and receiver can also use the Holtek 8-bit HT-640/HT-648L remote control encoder/decoder combination for an 8-bit RF remote control system. Here are the schematics for an 8-bit RF remote control system:

Driving Relays:

Using the outputs of the HT-12D or HT-648L decoder ICs to drive relays is quite simple. Here are schematics showing how to drive relays directly from the data-output pins of the decoder.



NPN Relay Driver Circuit



PNP Relay Driver Circuit

Ht 12e,d

General Description

The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12-N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 2^{12} series of encoders. The HT12A additionally provides a 38kHz carrier for infrared systems.

Features

- Operating voltage
  - 2.4V~5V for the HT12A
  - 2.4V~12V for the HT12E
- Low power and high noise immunity CMOS technology
- Low standby current: 0.1uA (typ.) at V_{DD}=5V
- HT12A with a 38kHz carrier for infrared transmission medium
- Minimum transmission word
  - Four words for the HT12E
  - One word for the HT12A
- Built-in oscillator needs only 5% resistor
- Data code has positive polarity
- Minimal external components
- Pair with Holtek's 2^{12} series of decoders
- 18-pin DIP, 20-pin SOP package

HT12D/HT12F -- 2^{12} Series of Decoders

General Description

The 2^{12} decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2^{12}series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 2^{12} series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission.

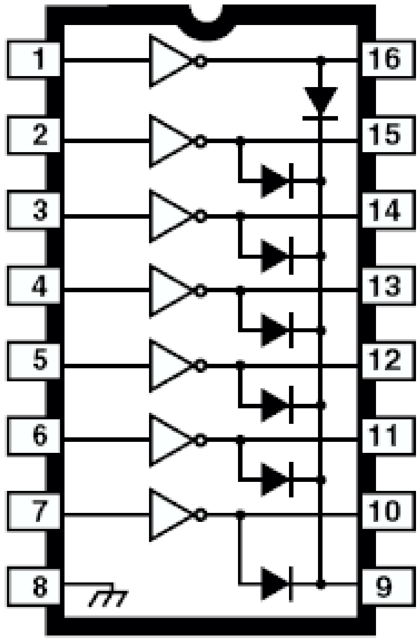
The 2^{12} series of decoders are capable of decoding informations that consist of N bits of address and 12-N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 12 bits of information
- Binary address setting
- Receired codes are checked 3 times
- Address/Data number combination
  - HT12D: 8 address bits and 4 data bits
  - HT12F: 12 address bits only
- Built-in oscillator needs only 5% resistor
- Valid transmission indicator
- Easy interface with an RF or an infrared transmission medium
- Minimal external components
- Pair with Holtek's 2^{12} series of encoders
- 18-pin DIP, 20-pin SOP package

Uln 2003

High-voltage, high-current



Ideally suited for interfacing between low-level logic circuitry and multiple peripheral power loads, the Series ULN20xxA/L high-voltage, high-current Darlington arrays feature continuous load current ratings to 500 mA for each of the seven drivers. At an appropriate duty cycle depending on ambient temperature and number of drivers turned ON
simultaneously, typical power loads totaling over 230 W (350 mA x 7, 95 V) can be controlled. Typical loads include relays, solenoids, stepping motors, magnetic print hammers, multiplexed LED and incandescent displays, and heaters. All devices feature open-collector outputs with integral clamp diodes.
The ULN2003A/L and ULN2023A/L have series input resistors selected for operation directly with 5 V TTL or CMOS. These devices will handle numerous interface needs — particularly those beyond the capabilities of standard logic buffers.
The ULN2004A/L and ULN2024A/L have series input resistors for operation directly from 6 to 15 V CMOS or PMOS logic outputs. The ULN2003A/L and ULN2004A/L are the standard Darlington arrays. The outputs are capable of sinking 500 mA and will withstand at least 50 V in the OFF state. Outputs may be paralleled for higher load current capability. The ULN2023A/L and ULN2024A/L will withstand 95 V in the OFF state. These Darlington arrays are furnished in 16-pin dual in-line plastic packages (suffix “A”) and 16-lead surface-mountable SOICs (suffix “L”). All devices are pinned with outputs opposite inputs to facilitate
ease of circuit board layout. All devices are rated for operation over the temperature range of -20°C to +85°C. Most (see matrix, next page) are also available for operation to -40°C; to order, change the prefix from “ULN” to “ULQ”.

FEATURES

- TTL, DTL, PMOS, or CMOS-Compatible Inputs
- Output Current to 500 mA
- Output Voltage to 95 V
- Transient-Protected Outputs
- Dual In-Line Plastic Package or Small-Outline IC Package

The ULN2003 has become my primary choice to controlling external components - its cheap, effective, and requires no operating voltages other than the **common ground**. Keep in mind that you will have a voltage drop of about **0.9v-1.0v** over the UL2003 when in circuit.

Note that the ULN20xxA series (dual in-line package) and ULN20xxL series (small-outline IC package) are electrically identical and share a common terminal number assignment.

ABSOLUTE MAXIMUM RATINGS
Output Voltage, VCE
(ULN200xA and ULN200xL) .... **50 V**
(ULN202xA and ULN202xL) .... **95 V**
Input Voltage, VIN .... **30 V**
Continuous Output Current,
IC .... **500 mA**
Continuous Input Current, IIN .... **25 mA**
Power Dissipation, PD
(one Darlington pair) .... **1.0 W**
(total package) .... **See Graph**
Operating Temperature Range,
TA .... **-20°C to +85°C**
Storage Temperature Range,
TS .... **-55°C to +150°C**

Accelerometer module

GY-61 3-Axis ±3 g Accelerometer

SENSOR: ADXL335

FEATURES

3-axis sensing

Small, low profile package

4 mm × 4 mm × 1.45 mm LFCSP

Low power : 350 µA (typical)

Single-supply operation: 1.8 V to 3.6 V

10,000 g shock survival

Excellent temperature stability

BW adjustment with a single capacitor per axis

RoHS/WEEE lead-free compliant

APPLICATIONS

Cost sensitive, low power, motion- and tilt-sensing

applications

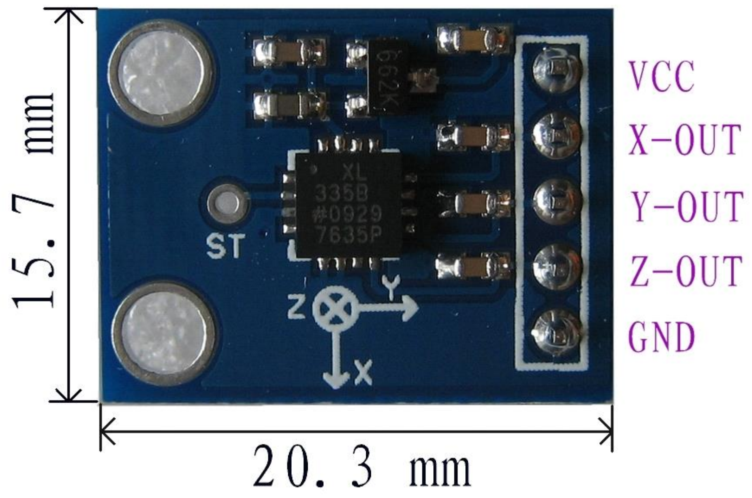
Mobile devices

Gaming systems

Disk drive protection

Image stabilization

Sports and health devices



Pin Function Descriptions

Pin	Pin name	Desscription
1	VCC	Supply Voltage.1.8-5v
2	X-OUT	X Channel Output
3	Y-OUT	Y Channel Output
4	Z-OUT	Z Channel Output
5	GND	Supply Ground
6	ST	Self-Test.

Table：

Name	Description
Operating Voltage Range	1.8~5 V
Supply Current	350uA
Interfaces	Analog
Operating Temperatu	-40°~ 85°
dimension (长*宽*高)	20.3mm×15.7mm×11.6mm

- Dc gear motor

DC GEAR MOTOR

Brand HOSIDEN motors (Japan) R.P.M: 75-100 : 12-18V. DC

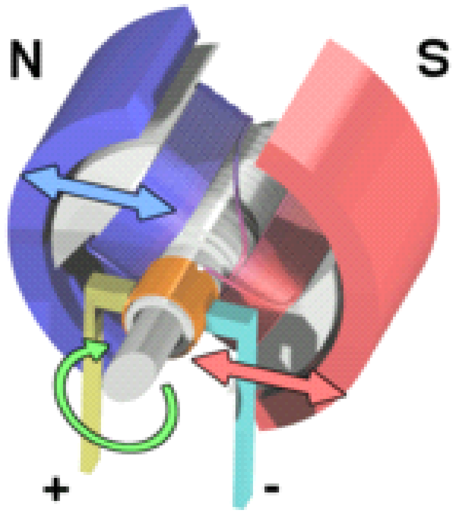
<u>DC motors</u>

One of the first electromagnetic rotary motors was invented by Michael Faraday in 1821 and consisted of a free-hanging wire dipping into a pool of mercury. A permanent magnet was placed in the middle of the pool of mercury. When a current was passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a circular magnetic field around the wire. This motor is often demonstrated in school physics classes, but brine (salt water) is sometimes used in place of the toxic mercury. This is the simplest form of a class of electric motors called homopolar motors. A later refinement is the Barlow's Wheel.

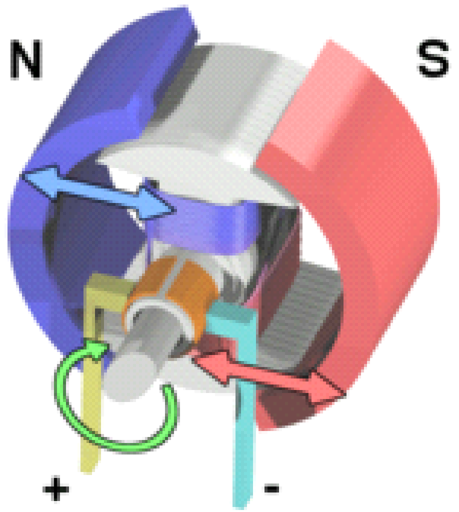
Another early electric motor design used a reciprocating plunger inside a switched solenoid; conceptually it could be viewed as an electromagnetic version of a two stroke internal combustion engine.

The modern DC motor was invented by accident in 1873, when Zénobe Gramme connected a spinning dynamo to a second similar unit, driving it as a motor.

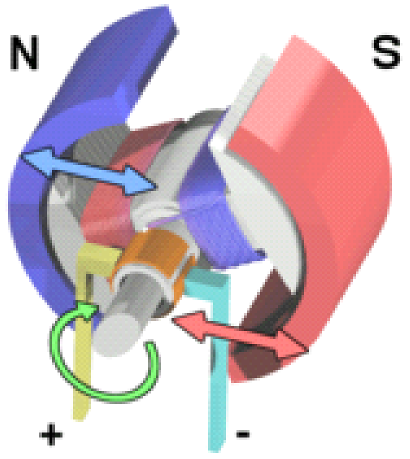
The classic DC motor has a rotating armature in the form of an electromagnet. A rotary switch called a commutator reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutator reverses the polarity of the armature electromagnet. During that instant of switching polarity, inertia keeps the classical motor going in the proper direction. (See the diagrams below.)



A simple DC electric motor. When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn toward the right, causing rotation.



The armature continues to rotate.



When the armature becomes horizontally aligned, the commutator reverses the direction of current through the coil, reversing the magnetic field. The process then repeats.

Regulator 7805

3-Terminal 1A Positive Voltage Regulator

Features

• Output Current up to 1A

• Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V

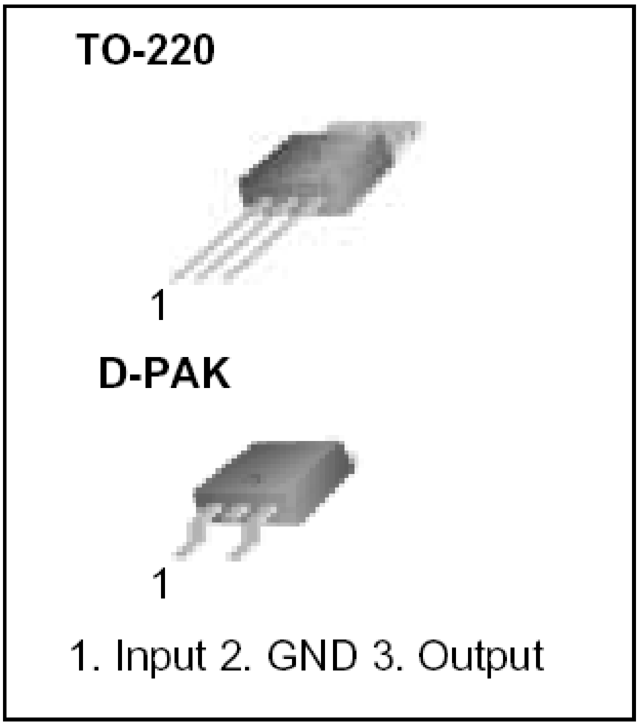
• Thermal Overload Protection

• Short Circuit Protection

• Output Transistor Safe Operating Area Protection

Description

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage



Power supply

In alternating current the electron flow is alternate, i.e. the electron flow increases to maximum in one direction, decreases back to zero. It then increases in the other direction and then decreases to zero again. Direct current flows in one direction only. Rectifier converts alternating current to flow in one direction only. When the anode of the diode is positive with respect to its cathode, it is forward biased, allowing current to flow. But when its anode is negative with respect to the cathode, it is reverse biased and does not allow current to flow. This unidirectional property of the diode is useful for rectification. A single diode arranged back-to-back might allow the electrons to flow during positive half cycles only and suppress the negative half cycles. Double diodes arranged back-to-back might act as full wave rectifiers as they may allow the electron flow during both positive and negative half cycles. Four diodes can be arranged to make a full wave bridge rectifier. Different types of filter circuits are used to smooth out the pulsations in amplitude of the output voltage from a rectifier. The property of capacitor to oppose any change in the voltage applied across them by storing energy in the electric field of the capacitor and of inductors to oppose any change in the current flowing through them by storing energy in the magnetic field of coil may be utilized. To remove pulsation of the direct current obtained from the rectifier, different types of combination of capacitor, inductors and resistors may be also be used to increase to action of filtering.

Need for Power Supply

Perhaps all of you are aware that a ‘power supply’ is a primary requirement for the ‘Test Bench’ of a home experimenter’s mini lab. A battery eliminator can eliminate or replace the batteries of solid-state electronic equipment and the equipment thus can be operated by 230v A.C. mains instead of the batteries or dry cells. Nowadays, the use of commercial battery eliminator or power supply unit has become increasingly popular as power source for household appliances like transreceivers, record player, cassette players, digital clock etc.

Code

```
#include <mega8.h>

#include <delay.h>

#define ADC_VREF_TYPE 0xE0 // Read the 8 most significant bits

                    // of the AD conversion result

unsigned char read_adc(unsigned char adc_input)

{

ADMUX=adc_input | (ADC_VREF_TYPE & 0xff);

// Delay needed for the stabilization of the ADC input voltage

delay_us(10);

        // Start the AD conversion

ADCSRA|=0x40;

// Wait for the AD conversion to complete

while ((ADCSRA & 0x10)==0);

ADCSRA|=0x10;

return ADCH;

}

void main(void)

{

unsigned int x,y,z;

PORTB=0x00;

DDRB=0xFF;

PORTC=0x00;

DDRC=0x00;
```

```
PORTD=0x00;

DDRD=0xFF;

TCCR0=0x00;

TCNT0=0x00;

TCCR1A=0x00;

TCCR1B=0x00;

TCNT1H=0x00;

TCNT1L=0x00;

ICR1H=0x00;

ICR1L=0x00;

OCR1AH=0x00;

OCR1AL=0x00;

OCR1BH=0x00;

OCR1BL=0x00;

ASSR=0x00;

TCCR2=0x00;

TCNT2=0x00;

OCR2=0x00;f

MCUCR=0x00;

TIMSK=0x00;

UCSRB=0x00;

ACSR=0x80;

SFIOR=0x00;

ADMUX=ADC_VREF_TYPE & 0xff;

ADCSRA=0x83;
```

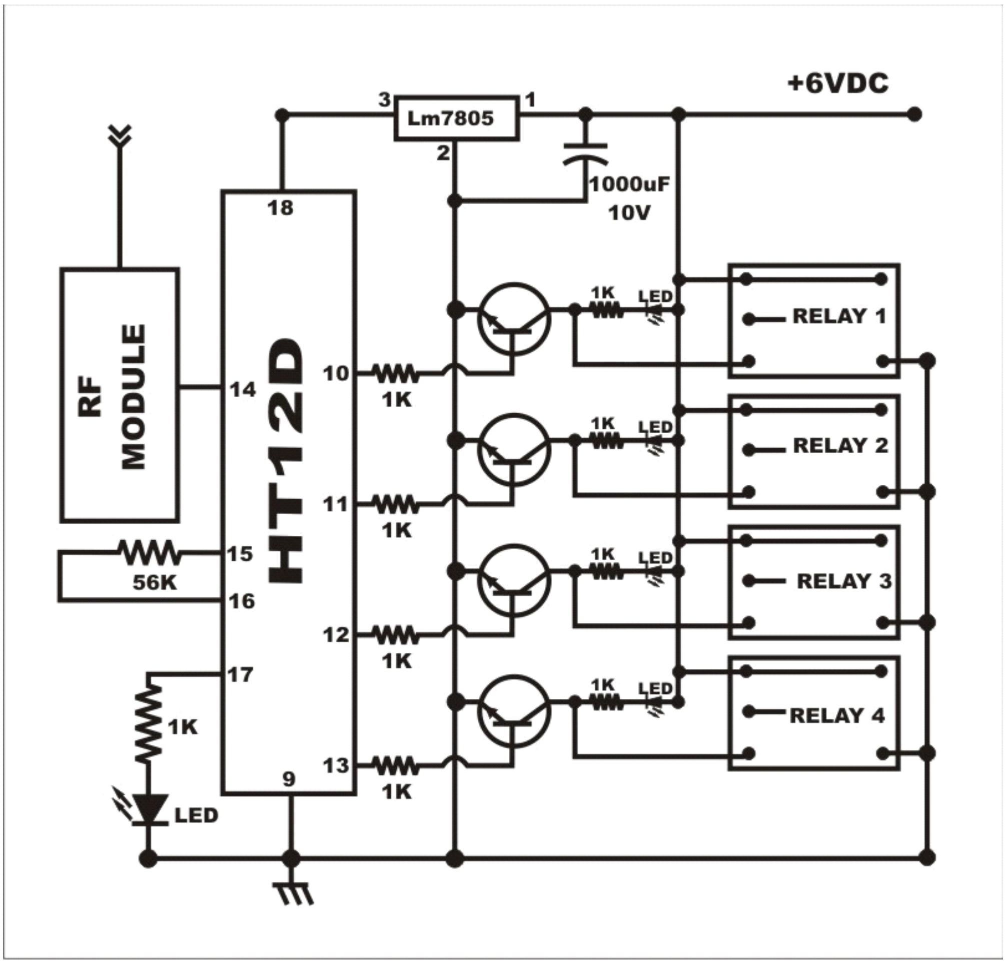
```
SPCR=0x00;

TWCR=0x00;

while (1)

      {

      // Place your code here

      x=read_adc(3);

      y=read_adc(4);

      z=read_adc(5);

        PORTB=x;

//--------------------------------------------------------------// X AXIS

//--------------------------------------------------------------     if(x>0xab)

      {



      PORTD=0x0c;

      }

            else if(x<0x9b)

      {

      PORTD=0x03;

      }

//------------------------------------------------------------ // Y AXIS

//-----------------------------------------------------------------

    else if(y>0xab)

      {

      PORTD=0x08;

      }
```

```
            else if(y<0x9b)
      {
      PORTD=0x0e;
      }
//------------------------------------------------------------
//-------------------------------------------------------------

       else
      PORTD=0xff;
      }
}

//Receiver main program

#include<reg51.h>
void main()
{
P2=0xff;
P1=0x00;
while(1)
{
if(P2==0x80)
{
P1=0xaa;
}
```

```
else if(P2==0xe0)

{

P1=0x55;

}

else if(P2==0x30)

{

P1=0xa5;

}

else if(P2==0xC0)

{

P1=0x5a;

}

else

P1=0x00;

}

}
```

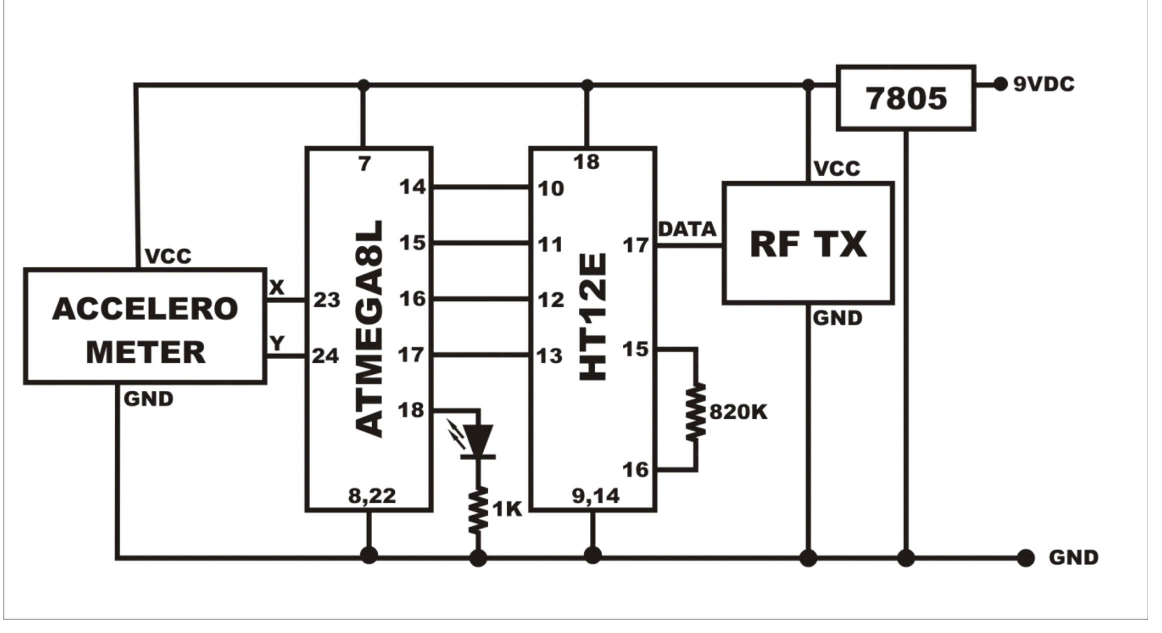
[/restrict]

Circuit



+6VDC
Lm7805
3
1
2
1000uF
10V
18
RF
MODULE
HT12D
14
10
11
12
13
15
16
17
9
56K
1K
1K
1K
1K
1K
LED
1K
LED
1K
LED
1K
LED
1K
LED
RELAY 1
RELAY 2
RELAY 3
RELAY 4

Wireless controlling circuit



Description

A **Gesture Controlled robot** is a kind of robot which can be controlled by your hand gestures not by old buttons.You just need to wear a small transmitting device in your hand which included an acceleration meter.This will transmit an appropriate command to the robot so that it can do whatever we want. The transmitting device included a ADC for analog to digital conversion and an encoder IC(HT12E) which is use to encode the four bit data and then it will transmit by an RF Transmitter module.

At the receiving end an RF Receiver module receive's the encoded data and decode it by and decoder IC(HT12D). This data is then processed by a microcontroller and finally our motor driver to control the motor's. Now its time to break the task in different module's to make the task easy and simple any project become easy or error free if it is done in different modules. As our project is already divided into two different part transmitter and receiver.

Fig a : Robot

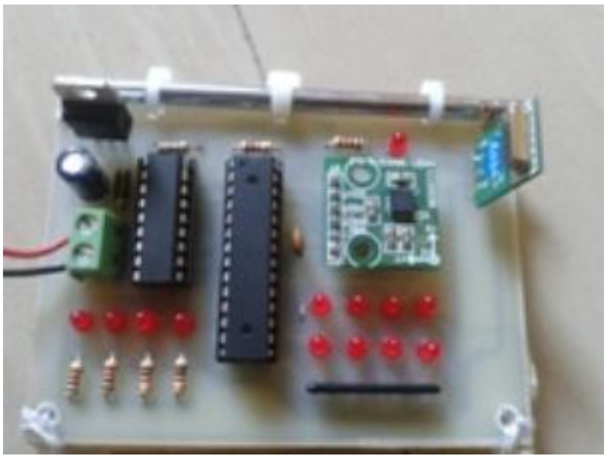


Fig b : Hand gesture sensor (transmitter)

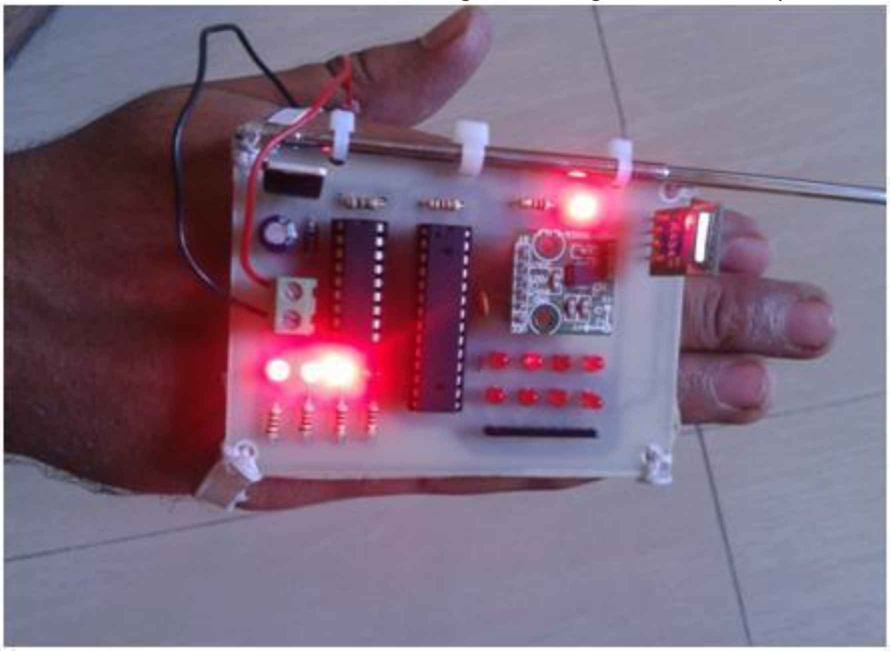


Fig c : Hand mount

Fig d : Chassey photo (Front view)

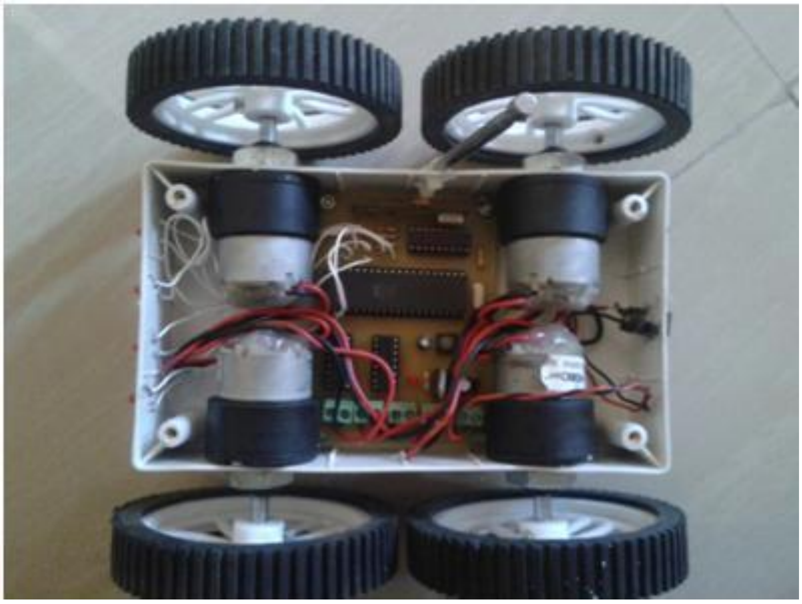


Fig d : Chassey photo (Top view open)

APPLICATIONS

- Military applications
- Industrial robots
- Medical application in surgery
- Construction working in

These are the field where sometime the operator may get confused in the switches and button itself, so a new concept is introduced to control the machine with the movement of hand which will simultaneously control the movement of robot.

REFERENCES

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