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Design And Implementation Of Accelerometer Based Wireless Gesture Controlled Rover

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Abstract- Presenting here is an accelerometer based gesture controlled rover using PIC16F877, one of the most basic microcontroller. The robot can be moved in any direction just by making simple gestures, and the systems sensitivity to gestures can be easily adjusted as per our liking.

The movement of gesture transmitter section is sensed by accelerometer and voltage level corresponds to movement of robot along X and Y axes are compared by a comparator, following which corresponding instructions are transmitted through the RF transmitter to control robot. The robot receives the instructions. The microcontroller drives motors corresponding to instructions received and displays the related message on LCD.

Keyword: Sign Language, PIC microcontroller, Hand Gesture

I. INTRODUCTION

As mentioned earlier in abstract, presenting here is a accelerometer based gesture controlled robot using PIC16F877, one of the most basic microcontroller. The robot can be moved in any direction just by making simple gestures, and the systems sensitivity to gestures can be easily adjusted as per our liking. Accelerometer is the main attraction of this system [1]. Accelerometer is an electro mechanical device that can measure acceleration of anything that is mounted on. The microcontroller used here is PIC16F877.

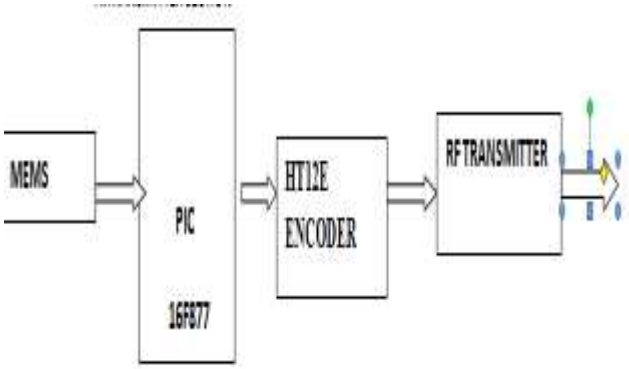
The movement of gesture transmitter section is sensed by accelerometer and voltage level corresponds to movement of robot along X and Y axes are compared by a comparator, following which corresponding instructions are transmitted through the RF transmitter to control robot [2]. The robot receives the instructions. The microcontroller drives motors corresponding to instructions received and displays the related message on LCD [3].

Fig 1. Illustration of signs that have similar hand gestures

Advantages are Unmanned robotics and gesture controlled robotic devices are being actively developed for both civilian and military use to perform a variety of dull dirty and dangerous activity [2]. In many application of controlling robotic gadget it becomes quite hard and complicated when there comes the part of controlling it with remote or many different switches. The concept of using gestures to control machine with the movement of hand which will simultaneously control the movement of robot [2], which is a benefit.Cost of production is very

cheap, Circuit is simple, Low power consumption. Disadvantages are we are using RF Transmitter; only four combination of movement is Possible. So either REVERSE or STOP condition has to be avoided. For higher application, circuit designing is very complex. If we are using a rechargeable battery hardware section is more complex. The user has a huge device on his hand which obstructs the user do normal hand movement. Since there is no force feedback, the user won't know what he is working on. But we can add feedback system in newer projects. Since there is no force feedback, the user won't know what he is working on. But we can add feedback system in newer projects Fine movement is difficult to achieve when working with bigger objects or controlling machines are bigger in size.

TRANSMITTER SECTION



RECEIVER SECTION

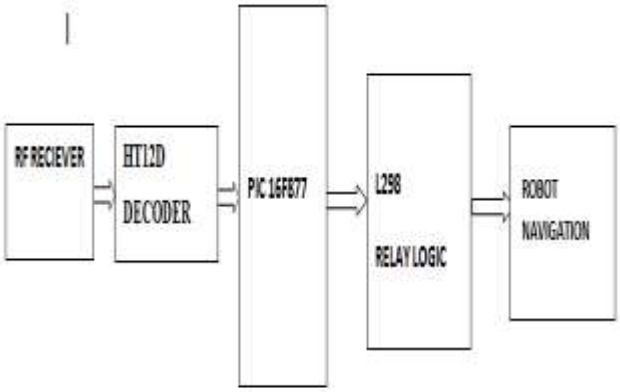


Fig 2. Block Diagram

II. PROPOSED SYSTEM

A. *Systems Description*

ACCELEROMETER (MEMS) MODULE

An Accelerometer is an electromechanical device that can measure the acceleration of anything that is mounted on [10]. The accelerometer module used here is based on ADXL335 triple-axis accelerometer from Analog devices [2]. The sensor has a full sensing range of +3g or -3g.MEMS means micro electromechanical system common name for Accelerometer. A 2 axis accelerometer module is shown below[5].

ENCODER WITH RF TRANSMITTER

This circuit utilizes the RF module (Tx/Rx) for making a wireless remote, which could be used to drive an output from a distant place illustrated in fig 2 . RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. The input signals, at the transmitter side, are taken through four switches while the outputs are monitored on a set of four LEDs corresponding to each input switch. The circuit can be used for designing Remote Appliance Control system. The outputs from the receiver can drive corresponding relays connected to any household appliance.

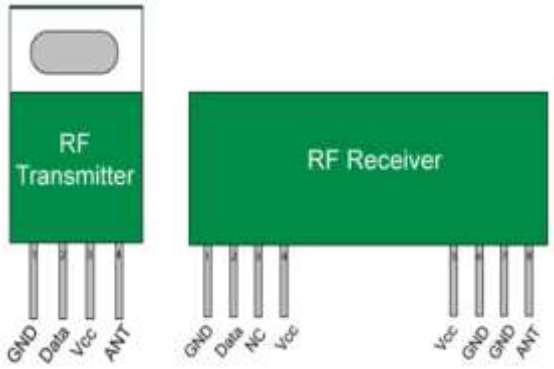


Fig3. Block Diagram of RF transmitter and receiver

This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz. The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

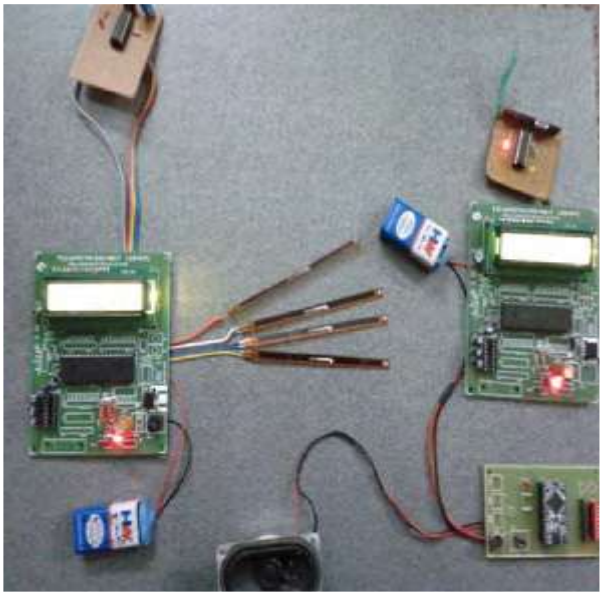


Fig 4. Block Diagram of hardware model

B. Encoder

Encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals in fig 5. The encoder HT12E encodes these parallel signals into serial bits. Transmission is enabled by providing ground to pin14 which is active low. The control signals are given at pins 10-13 of HT12E. The serial data is fed to the RF transmitter through pin17 of HT12E.Transmitter, upon receiving serial data from encoder IC (HT12E), transmits it wirelessly to the RF receiver. The receiver, upon receiving these signals, sends them to the decoder IC (HT12D) through pin2. The serial data is received at the data pin (DIN, pin14) of HT12D. The decoder then retrieves the original parallel format from the received serial data.HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

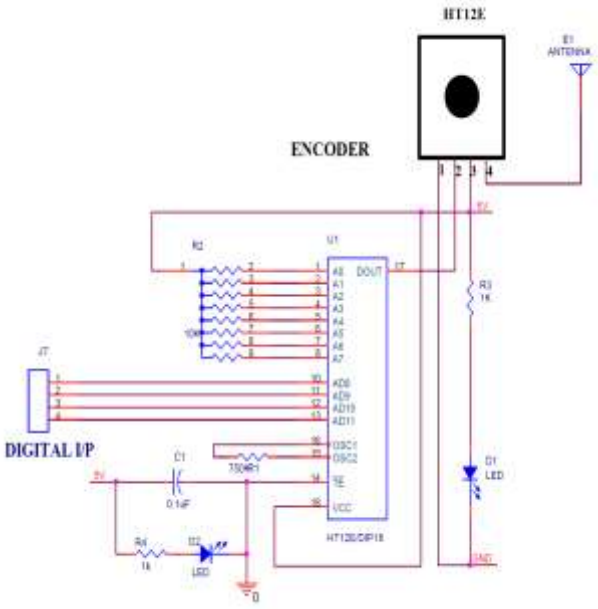
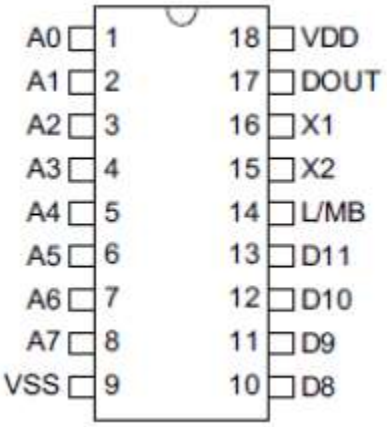


Fig 5. Circuit Diagram of encoder part

C. HT12D decoder with RF reciever

HT12D IC comes from Hol Tek Company. HT12D is a decoder integrated circuit that belongs to 212 series of decoders. This series of decoders are mainly used for remote control applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 212 series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format. In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new is received.



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output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. The input signals, at the transmitter side, are taken through four switches while the outputs are monitored on a set of four LEDs corresponding to each input switch. The circuit can be used for designing Remote Appliance Control system. The outputs from the receiver can drive corresponding relays connected to any household appliance.

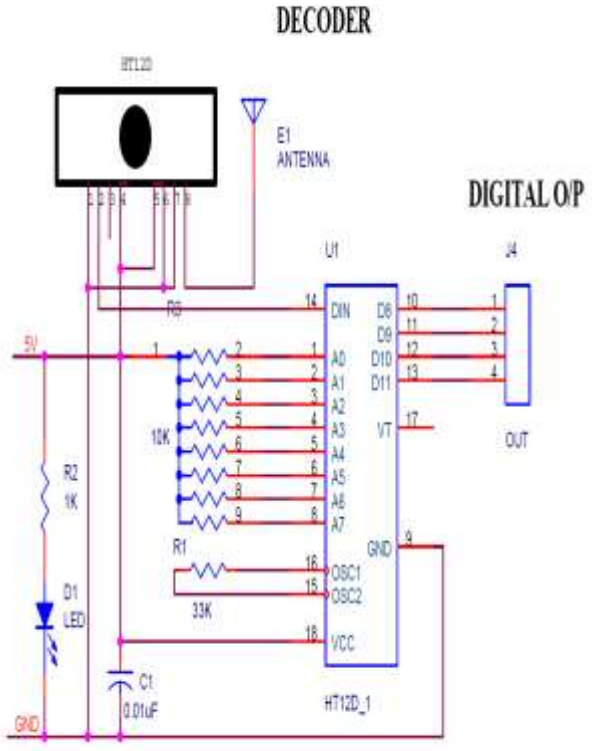

Fig 6. Circuit Diagram of decoder part

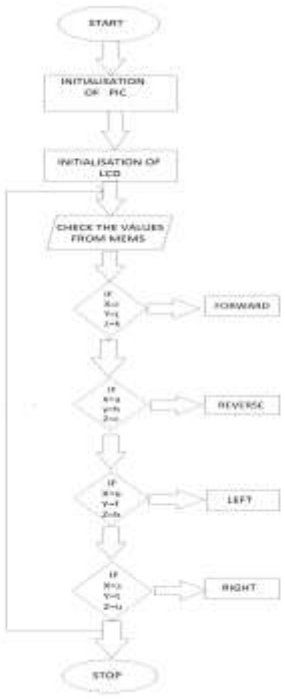

Fig 7. Flow Diagram

III. RESULT AND DISCUSSION

We completed our project "Accelerometer Based Gesture controlled Robot", which is an efficient circuit (robot), which can be moved in any direction by making simple Gestures. Since the circuit is wireless, it is very user friendly and cost effective. we used PIC16F877 microcontroller to realize the circuit because it has some additional features when compared to the basic microcontroller 8051 such as the PIC posses an in built ADC and DAC, pulse with modulation feature ,high resolution etc.

In this project, we used rechargeable battery so that the robot is very reliable. In many application of controlling robotic gadget it becomes quite hard and complicated when there comes the part of controlling it with remote or many different switches. The concept of using gestures to control machine with the movement of hand which will simultaneously control the movement of robot, which is a benefit of our project.

The figure of hardware model is shown in fig 8. It consists of a transmitter and a receiver along with a moving robot. The Transmitter section includes an accelerometer module and a comparator and an Encoder IC [HT12E] and a RF transmitter. The Receiver section includes a receiver, Decoder [HT12D], a processor [PIC 16877] and an actuator [MOTOR DRIVER IC L298 OR RELAY LOGIC].

Fig 8. Hardware

1V. CONCULSION AND FUTURE WORK

The aim of our project is to construct a Accelerometer based Gesture Controlled Robot. As its name implies it is an efficient circuit (robot),which can be moved in any direction by making simple Gestures, and the system's sensitivity to Gestures can be easily adjusted a per our liking. We have successfully completed our project. Finally, we conclude that Accelerometer Based Gesture Controlled Robot is very cheap and simple with wide applications as mentioned before.

Wireless modules consume very low power and are best suited for wireless, battery driven devices. Advanced robotic arms that are designed like the human hand itself can easily controlled using hand gestures only. Proposed utility in fields of Construction, Hazardous waste, Disposal, Medical Science, Combination of Heads Up display, Wired Gloves, Haptictactile sensors, Omni directional Tread mills may produce a feel of physical places during simulated environments. VR simulation may prove to be crucial for Military, LAW, Enforcement and Medical Surgeries.

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