

Wireless Controlled Robot Movement System Designed using Microcontroller

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Abstract — Wireless controlled robot which can be controlled by simple human gestures. The transmitter circuit in which sensor included, the user needs to wear this device. The robot can move forward, backward leftward & rightward through the transmitter device. The sensor will accept the movement of hand in a specific direction which will result in the motion of the robot in the respective direction. The system design is divided into two parts namely. Accelerometer part and robot part. It is basically an accelerometer based system which controls robots wirelessly using a small and low-cost, 3-axis accelerometer via RF signals. The wireless receiver module receives the wave signal transmitted by the wireless joystick transmitter module. Then the module decodes the wave signal and sends to the ATmega328P microcontroller through UART. UART is stands for Universal Asynchronous Receiver Transmitter. It is widely used as protocol for communicating with the microcontroller. Then the microcontroller sends the motor controlling signal to the L298 motor driver IC according to received wireless signal.

Keywords:- Motor, Microcontroller, Encoder, Actuator.

I. INTRODUCTION

ATmega328 is a single-chip microcontroller from Atmel and belongs to the mega AVR series. The Atmel 8-bit AVR RISC based microcontroller combines 32kB ISP flash memory with read-while-write capabilities, 1kB EEPROM, 2kB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, three flexible timers/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 10-bit A/D converter, programmable watch-dog timer with an internal oscillator and five software-selectable power-saving modes. The device operates between 1.8 and 5.5 volts. It achieves throughputs approaching one MIPS per MHz An alternative to ATmega328 is ATmega328p [1].

Some microcontrollers may use four-bit words and operate at clock rate frequencies as low as 4 kHz, for low power consumption (single-digit mill watts or

microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just Nano watts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

II. MY PROJECT

A wireless Controlled robot is a kind of robot which can be controlled by your hand gestures not by old buttons. You just need to hold 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. This is an easy [2], user-friendly way to interact with robotic systems and robots. An accelerometer is used to detect the tilting position of your hand, and a microcontroller gets different analogue values and generates command signals to control the robot. This concept can be implemented in a robotic arm used for welding or handling hazardous materials, such as in nuclear plants [3]. As our project is already divided into two different part transmitter and receiver. We will discuss both of them one by one.

III. BLOCK DIAGRAM

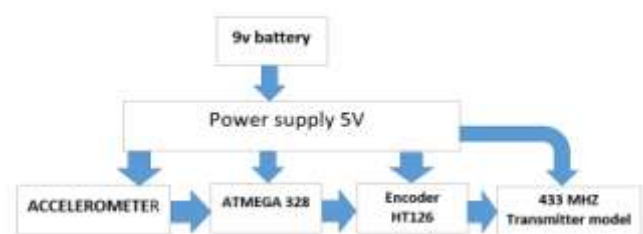


Fig.1 shows the Transmitter block diagram.

Accelerometer:-

An Accelerometer is a kind of sensor which gives an analogy data while moving in X,Y,Z direction or may be X,Y direction only depends on the type of the sensor

ATmega328:-

ATmega328 is a single-chip microcontroller from Atmel and belongs to the mega AVR series. The device operates between 1.8 and 5.5 volts [8]. It achieves throughputs approaching one MIPS per MHz An alternative to ATmega328 is ATmega328p.

Encoder (HT12E IC):-

The HT12E is an 4bit encoder which encode the input data applied on it .The pin description of the HT12E is shown in the figure.

RF Transmitter Module (TX):-

The transmitter module is working on the frequency of 433MHz and is easily available in the market at the cost of 250rs.

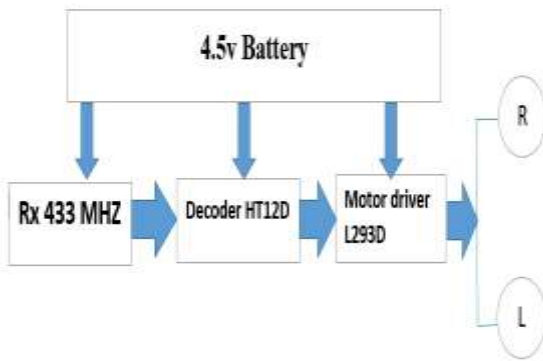


Fig.1 shows the Receiver block diagram.

RF Receiver Module (RX):-

The RF receiver module will receive the data which is transferred by the gesture device. It is also working as similar to the transmitter module.

Decoder (HT12D):-

In a very simple way we can say that an HT12D converts that serial data into parallel which is received by the RF receiver module [7]. The pin description of the HT12D is shown in the figure.

Motor driver IC (L293D):-

The Actuator's are those devices which actually gives the movement or to do a task like motor's. In the real world there are various types of motors available which works on different voltages [9]. So we need motor driver for running them through the controller. To get interface between motor and microcontroller. We use L293D motor driver IC in our circuit.

IV. CIRCUIT AND PCB LAYOUT

TRANSMITTER

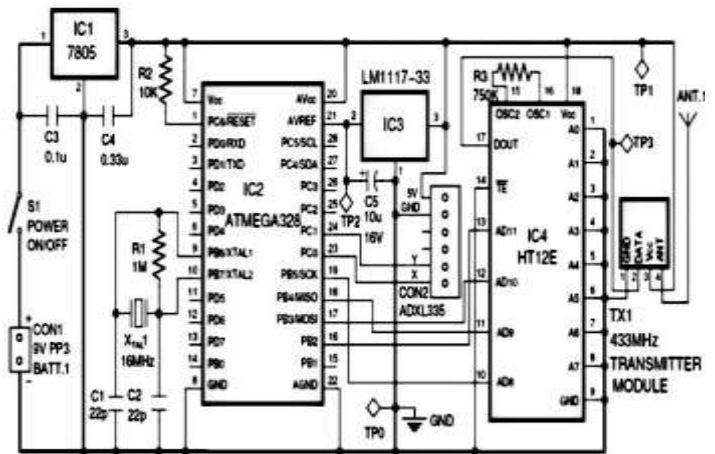


Fig.1 shows the Transmitter Circuit diagram.

The transmitter consists of ATmega328 microcontroller (IC2), ADXL335 accelerometer, HT12E encoder (IC4) and 433MHz RF transmitter module (TX1). In this circuit, two analogue outputs from ADXL335 pins (x, y) are connected with input pins (23, 24) of the microcontroller. Analogue signals are converted to digital signals through the microcontroller [4]. Digital outputs from pins 16, 17, 18 and 19 of the microcontroller are directly sent to pins 13, 12, 11 and 10 of encoder IC4. This data is encoded and transmitted via RF module TX1.

RECEIVER

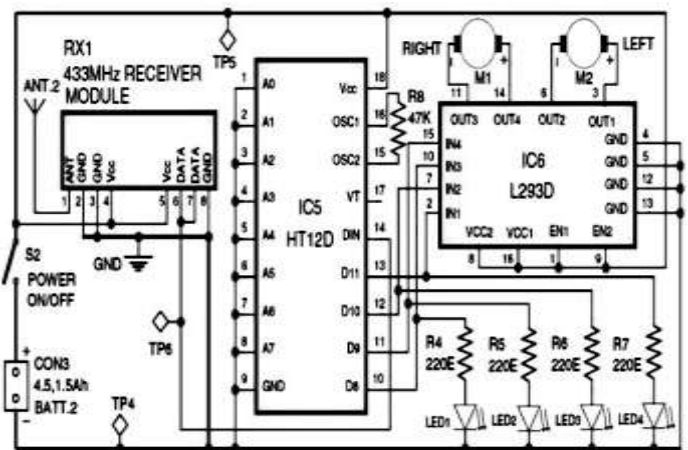


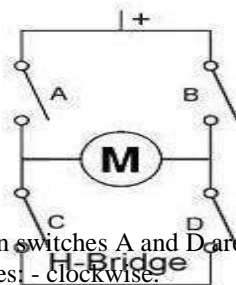
Fig.1 shows the Receiver Circuit diagram.

The receiver part consists of 433MHz RF receiver module (RX1), HT12D decoder (IC5) and L293D motor driver (IC6) to run the motors. Here, receiver module RX1 receives the transmitted signal, which is decoded by decoder IC to get the same digital outputs [5]. Four outputs of IC6 drive two motors. The robot moves as per tilt direction of the accelerometer in the transmitter. The direction of the robot movement is as per logic listed in Table I.

TABLE I
Movement of Robot and Decoder Outputs

Robot (accelerometer)	Input 1 (D11)	Input 2 (D10)	Input 3 (D9)	Input 4 (D8)
Forward (-Y)	0	1	0	1
Backward (+Y)	1	0	1	0
Right (+X)	1	0	0	1
Left (-X)	0	1	1	0

V. RESULT AND SIMULATION



- When switches A and D are on, motor rotates: - clockwise.
- When B and C are on, the motor rotates: - Anti: -clockwise.
- When a and b are on, the motor will: - stop.
- Turning off all the switches gives the motor a free: - wheel drive.
- Turning on A & C at the same time or B & D at the Same time shorts the entire circuit. So, never try to do it.

Simulation of project is performed on PROTEUS and the code was written Kiel software. Code for the microcontroller to run DC motors using the H-Bridge IC (L293D) is written. In the simulation the relevant data to the Microcontroller (ATMEGA328) is send through switches. The Microcontroller processed the data and sent the information to the Actuator IC (L293D). The Actuator IC upon receiving information showed response by driving the DC motors.

Construction and Testing

The transmitter section can be held in your palm or on the other side (refer Fig. 9). The receiver module is mounted on the robot.

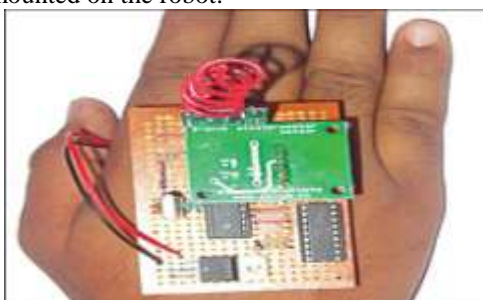


Fig 9

Mount all components on the PCBs shown here to minimise assembly errors. Fix the receiver PCB and 4.5V battery on the chassis of the robot. Fix two motors, along with wheels, at the rear side of the robot and a castor wheel on the front. After uploading the main code into the microcontroller, remove it from the Arduino Uno board and insert it into the populated transmitter PCB. Now, switch-on the power supplies in the transmitter as well as receiver circuits. Attach the transmitter circuit to your hand and move your hand forwards, backwards and sideways [6][10]. Directions of the robot movement are given in Table I. The robot will stop if you keep your palm horizontal, parallel to the Earth's surface. For troubleshooting, first verify that voltages at various test points are as per Table II.

TABLE II
Test Points

Test point	Details
TP0	0V (GND)
TP1	5V
TP2	3.3V
TP3	Train of pulses
TP4	0V (GND)
TP5	4.5V
TP6	Train of pulses

VI. CONCLUSION

The purpose of project is to control a Robot using accelerometer sensors attached to a hand. The sensors are intended to replace the remote control that is generally used to run the Robot. It will allow us to control the forward and backward, and left and right movements, while using the same accelerometer sensor to control the throttle of the Robot.

Future Scope

- The battery takes lot of space and also quit heavy. We can use the other power source in the place of batteries.
- We are using RF for wireless control, in RF the range in limited, nearly 50-80mm. we can solved this problem by using a GSM module.
- We can install camera on this circuit. For monitoring the robot from faraway places.

VII. REFERENCE

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