

Microcontroller Based Wireless Controlled Pick & Place Robot

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Abstract— This thesis focuses on implementation and control of a pick & place robot using radio frequency transmitter and receiver system. The control of this robot is achieved by PIC16f877A microcontroller. The main duty of microcontroller is to generate pulse which are applied to the DC motors for completing the desired task. In this study three DC motors are used in which two are utilized to control the movement of robot and one is used to control the gripper.

The operation of designed pick & place robot has been experimentally verified. Simulation and experimental results are presented and discussed.

Keywords— DC motor , PIC 16F877A, pick and place robot , RF-434.

I. INTRODUCTION

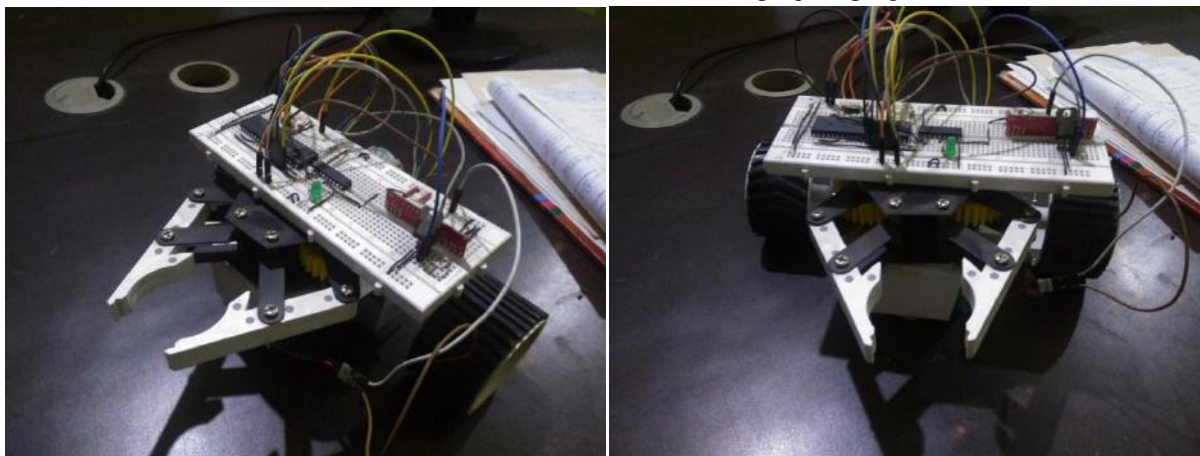
The field of robotics and machine learning originated in science fictions movies and novels. The word robot comes from the Czech word "robota" means forced labor in 1920. In 21st century, robotics is the field where machines are automated by the use of electronics , mechanical and electrical devices and controlled by different ways of communications but basically by computers and specifically

designed softwares. Robots are especially designed and build for a specific task to do some specific job.

There are three laws of robotics

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

In this work, The pick and place processes are the primary requisite for many of the industrial and house hold application where there is a need to automate the pick and place process basically comprising of picking the intended objects , possibly performing certain tasks and placing them to desired location . The automated pick and place robot mainly uses sensors and robotic arms. in this prototype robotic arm pick and place system utilizes dc motor, gripper , PIC16f877a microcontroller and software's such as Micro C for programming , PROTEUS for simulation, and PICKit 2 for dumping the program.

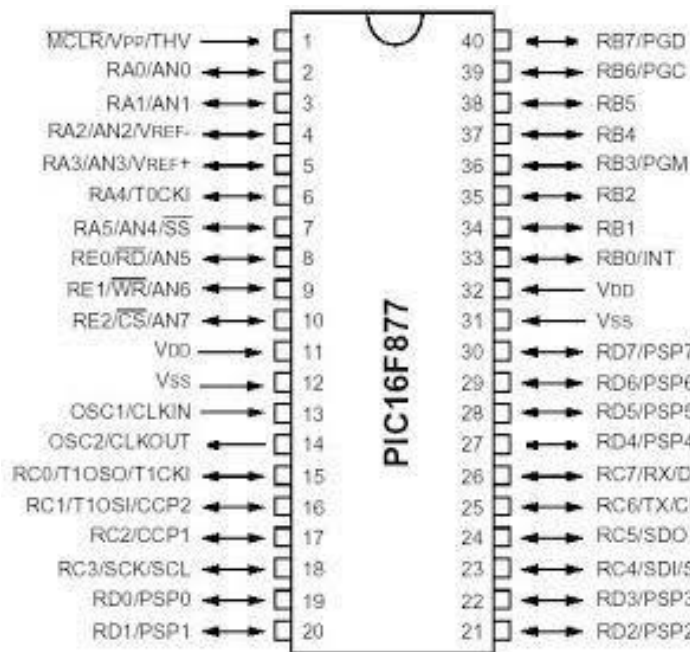


Prototype of pick & place robot.

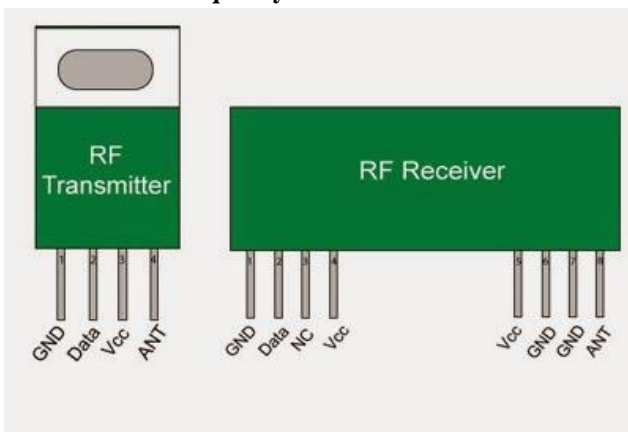
II. HARDWARE

2.1 PIC 16F877A Microcontroller

PIC 16F877A microcontroller has 40 pins and is a popular microcontroller capable of doing complex tasks. This microcontroller has 8192×14 flash program memory which consists of 368 bytes of RAM and 256 bytes of non-volatile EEPROM memory. 33 pins are dedicated for input/output pins and 8 multiplexed analog/digital converters with 10 bits resolution. This microcontroller also has specifications such as PWM generator, 3 timers, analog capture and comparator circuit, universal synchronous receiver transmitter (USART), internal and external interrupt capabilities. Figure shows the pin configuration of the PIC 16F877A microcontroller.



2.2 Radio frequency : RF- 434

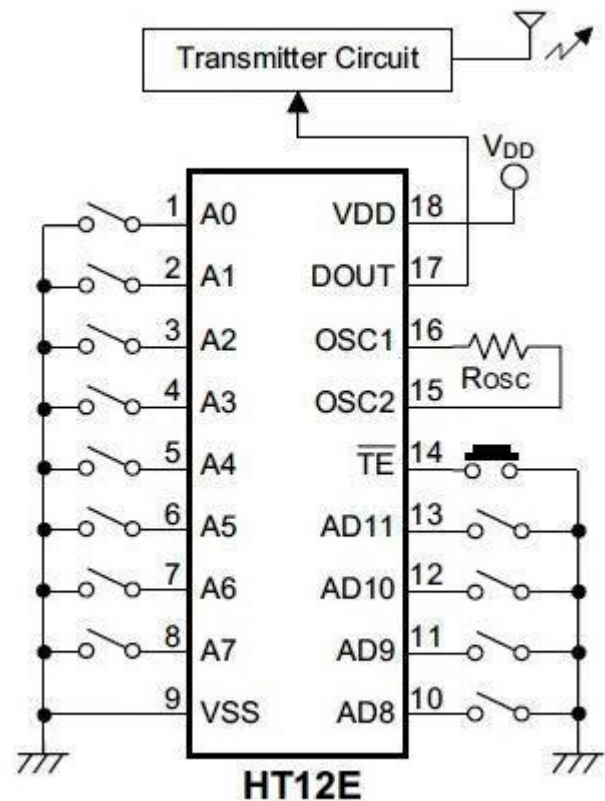


In this RF system , the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as ‘amplitude shift keying’(ASK).

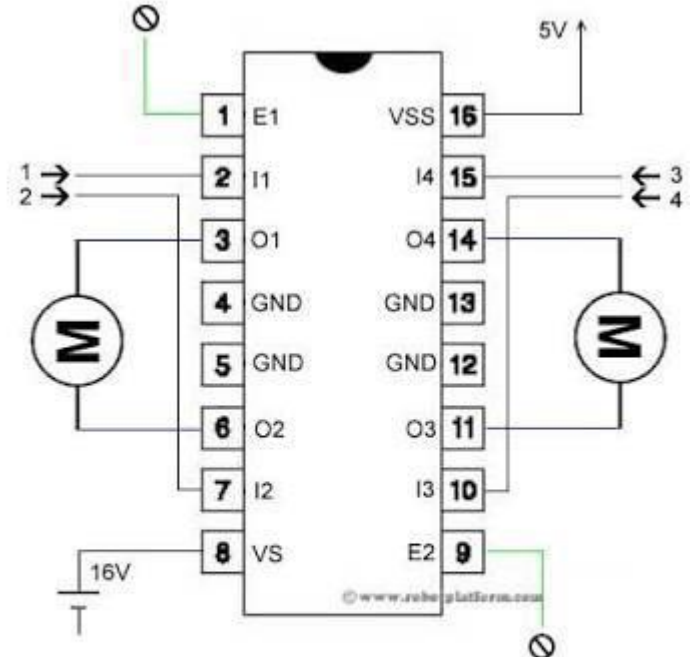
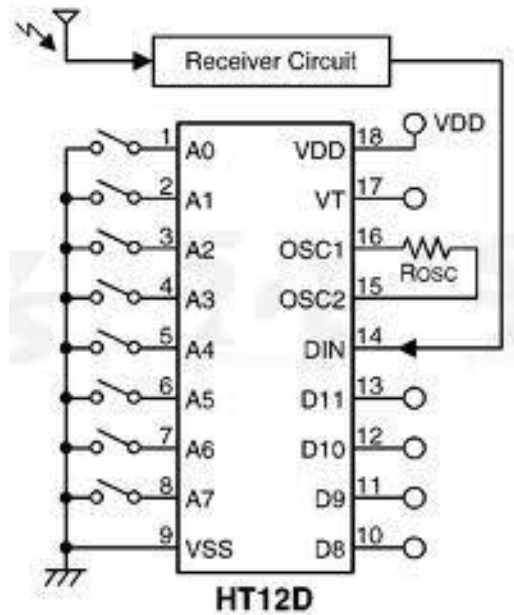
The Tx/Rx pair operates at a frequency of 434Mhz. An RF transmitter receives serial data and transmits it wirelessly through antenna connected at pin4 . The transmission occurs at the rate of 1kbps-10kbps. The transmitted data is received by the RF Rx operating at the same frequency as that of the Tx.

2.3 Encoder & decoder : HT12E & HT12D

HT12E is an encoder of 2^{12} series which converts parallel inputs into serial outputs. It encodes 12 bits parallel data into serial. These 12 bits are divided into 8 address bits and 4 data bits.



HT12D is a decoder that converts serial data into parallel. The input data code is decoded when no error or unmatched codes are found. A valid transmission is 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.

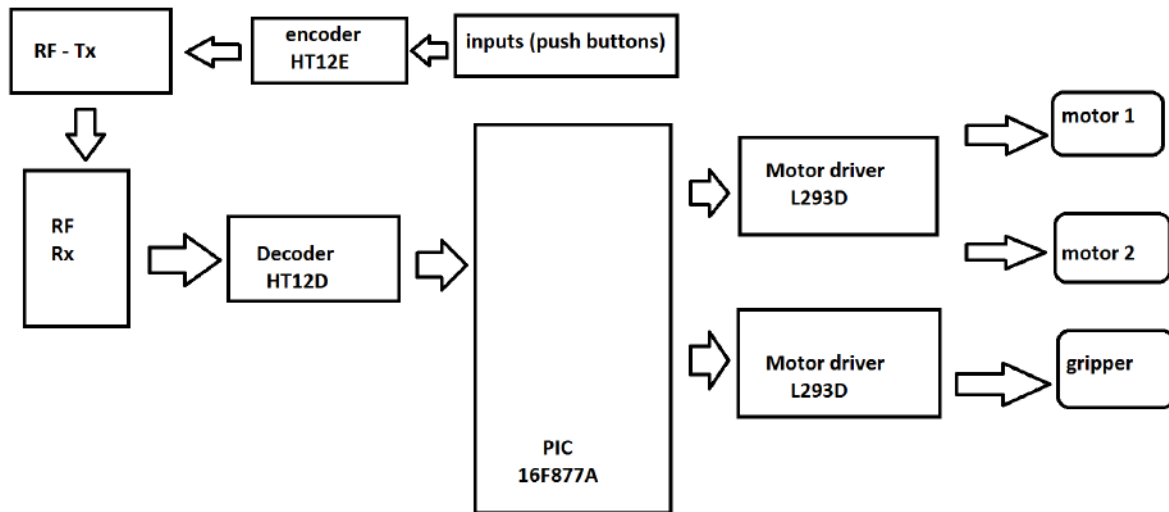


- Input from Microcontroller : 4 Inputs - I1, I2, I3, I4
- ⊖ Enable Pins : E1 & E2
- M Output to 2 Motors : O1, O2 & O3, O4
- GND Connect to microcontroller ground

2.4 Motor driver : L293D

L293D is a dual H-bridge motor driver IC that can drive two DC motors simultaneously and is available in 16 pin DIP. L293D has a current capacity of 600mA per channel and a wide supply voltage range of 4.5V to 36V DC.

III. WORKING LOGIC

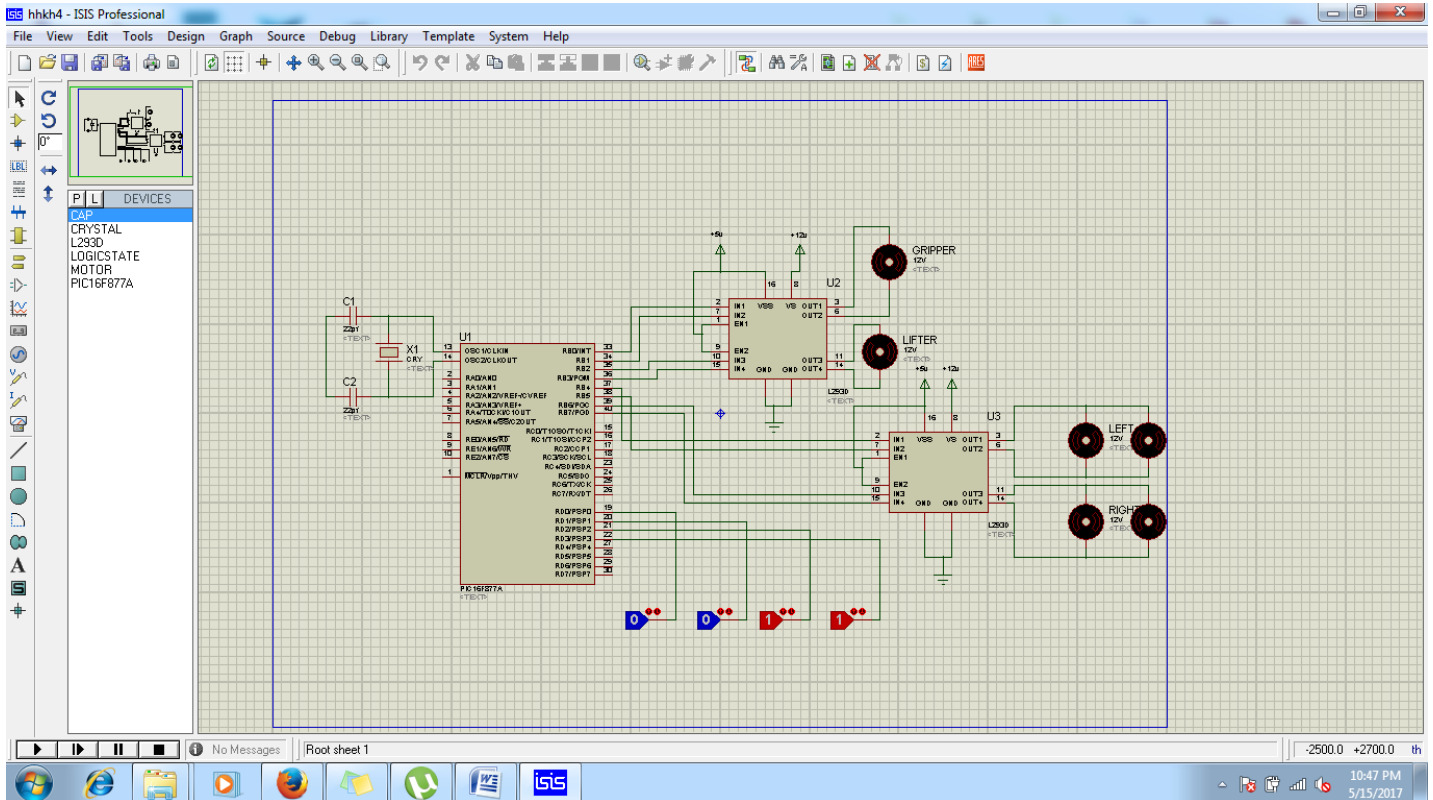


IV. SIMULATION

The **Proteus Design Suite** is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB Layout modules. The micro-controller simulation in Proteus works by applying either a hex file or

a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables it's used in a broad spectrum of project prototyping in areas such as motor control temperature control and user interface design.

The desired circuit is designed on a simulator software proteus and microcontroller is programmed in mikroC.



Proteus is used for the simulation of receiver section of the robot and logic state on PORT D of PIC16f877a work as the output from the decoder HT12D.

V. MICRO C

The mikroC PRO for PIC is a full-featured ANSI C compiler for PIC devices from Microchip®. It is the best solution for developing code for PIC devices. It features intuitive IDE, powerful compiler with advanced optimizations, lots of hardware and software libraries. The mikroC PRO for PIC is a powerful, feature-rich

development tool for PIC microcontrollers. It is designed to provide the programmer with the easiest possible solution to developing applications for embedded systems, without compromising performance or control.

The code to use the robot as PICK & PLACE:

```

void main() {
    trisd=0xff; // D port is used as inputs
    trieb=0x00; // B port as outputs
    while(1)
    {
        if( portd.f0 ==0 && portd.f1 == 1 && portd.f2==1 && portd.f3==1 ){
            portb=0x01; // gripper opens
        }
        else if( portd.f0 == 1 && portd.f1 == 0 && portd.f2==1 && portd.f3==1 ){
            portb=0x02; // gripper closes
        }
        else if( portd.f0 ==1 && portd.f1 == 0 && portd.f2==1 && portd.f3==0 )
        {
            portb=0xA0; // ROBOT MOVES FORWARD
        }
        else if( portd.f0 == 0 && portd.f1 == 1 && portd.f2==0 && portd.f3==1 )
        {
            portb=0x50; // ROBOT MOVES BACKWARD
        }
        else if( portd.f0 == 1 && portd.f1 == 1 && portd.f2==0 && portd.f3==0 )
        {
            portb=0x90; // ROBOT MOVES LEFT
        }
        else if( portd.f0 == 0 && portd.f1 == 0 && portd.f2==1 && portd.f3==1 )
        {
            portb=0x60; // ROBOT MOVES RIGHT
        }
        else{
            portb=0x00; }
    }
}

```

VI. CONCLUSION

This pick and place robot is successfully build which can be controlled with wireless technology using radio frequency RF434 from the remote and this robot follows the command and move to the desired location and perform pick and place operation of item .This types of Robots can be deployed in industries , laboratories and also used for military.

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