



Fire Sensing and Control Robot

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ABSTRACT : The project is designed to develop a fire fighting robot using RF technology for remote operation. The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to throw water. An 8051 series of microcontroller is used for the desired operation. At the transmitting end using push buttons, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end three motors are interfaced to the microcontroller where two of them are used for the movement of the vehicle and the remaining one to position the arm of the robot. The RF transmitter acts as a RF remote control that has the advantage of adequate range (up to 200 meters) with proper antenna, while the receiver decodes before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. A water tank along with water pump is mounted on the robot body and its operation is carried out from the microcontroller output through appropriate signal from the transmitting end. The whole operation is controlled by an 8051 series microcontroller. A motor driver IC is interfaced to the microcontroller through which the controller drives the motors..

I. INTRODUCTION

Here is an fire extinguisher vehicle with water jet spray using wireless RF modules. The RF remote control has the advantage of adequate range (up to 200 metres with proper antennae) besides being omnidirectional. On the other hand, an IR remote would function over a limited range of about 5 metres and the remote transmitter has to be oriented towards the receiver module quite precisely. However, the cost involved in using RF modules is much higher than of IR components and as such, we have included the replacement alternative of RF modules with their IR counterparts for using the IR remote control.

When the robot faces a fire then it extinguishes fire with the help of pump motor connected to a water tank mounted on its body. RF transmitter module works as a remote to control the motion of the robot either to move it forward or backward and the motion of the water pipe up and down of the robot through which it throws water to extinguish the fire. On the robot RF receiver module is placed that receives commands from the transmitter and acts accordingly. In this robot as the fire sensor senses the fire, it sends the signal to microcontroller; since the signal of the sensor is very weak the amplifier is used so that it can amplify the signal and sends it to microcontroller. As soon as microcontroller receives the signal a buzzer sounds, the buzzer sound is to intimate the occurrence of fire accident.

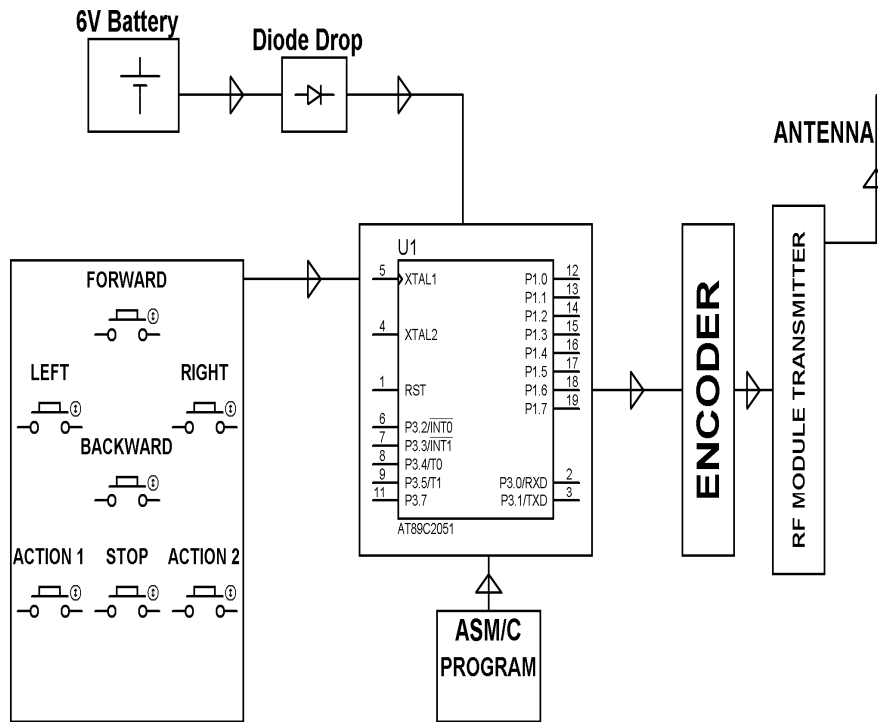
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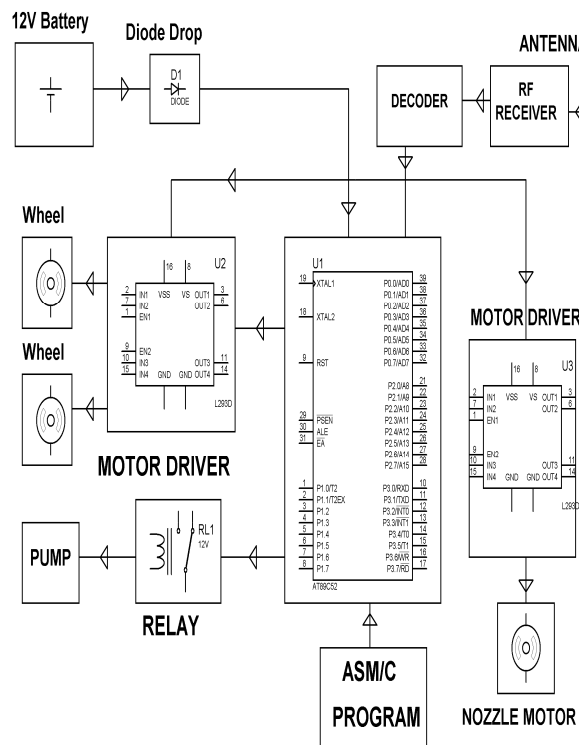
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Block diagram

Transmitter:



Receiver





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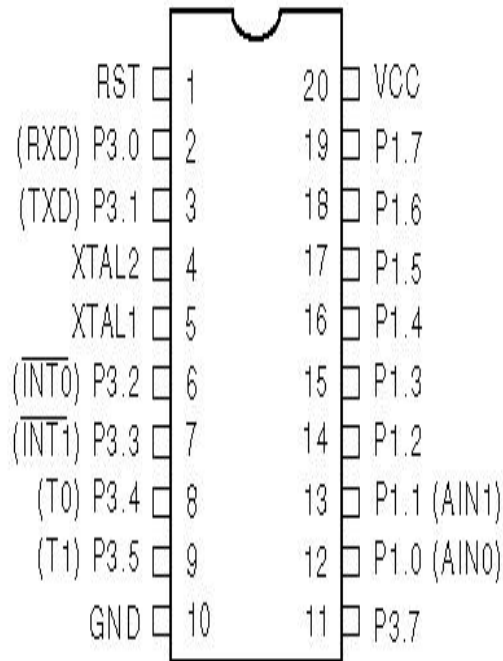
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Features of MC 2051

- ▶ The 2051 is a 20 pin version of the 8051.
- ▶ Fully Static Operation: 0 Hz to 24 MHz
- ▶ Two-level Program Memory Lock
- ▶ 128 x 8-bit Internal RAM
- ▶ 15 Programmable I/O Lines
- ▶ Two 16-bit Timer/Counters
- ▶ Six Interrupt Sources
- ▶ Programmable Serial UART Channel
- ▶ Direct LED Drive Outputs
- ▶ On-chip Analog Comparator
- ▶ Low-power Idle and Power-down Modes

2051 Pin-out



Features of MC 8052

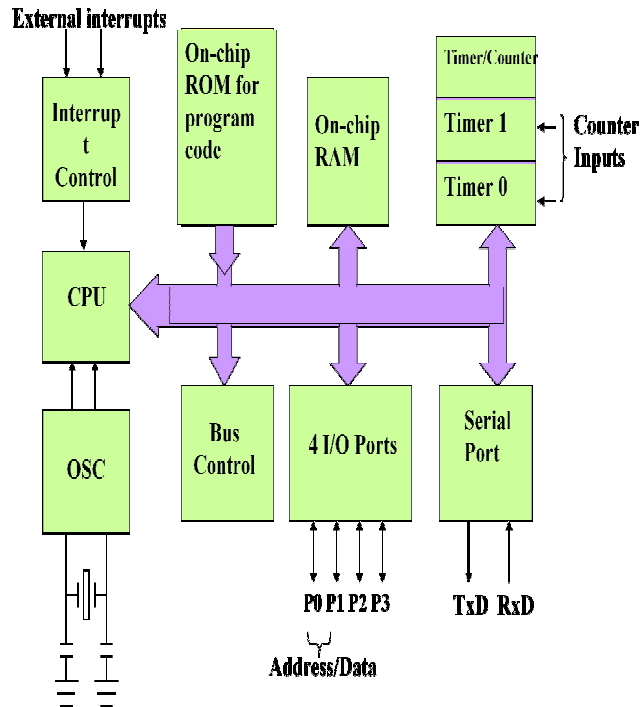
- ▶ 8K Bytes of In-System Programmable (ISP) Flash Memory
- ▶ 4.0V to 5.5V Operating Range
- ▶ Fully Static Operation: 0 Hz to 33 MHz
- ▶ 256 x 8-bit Internal RAM
- ▶ 32 Programmable I/O Lines
- ▶ Three 16-bit Timer/Counters
- ▶ Eight Interrupt Sources
- ▶ Full Duplex UART Serial Channel

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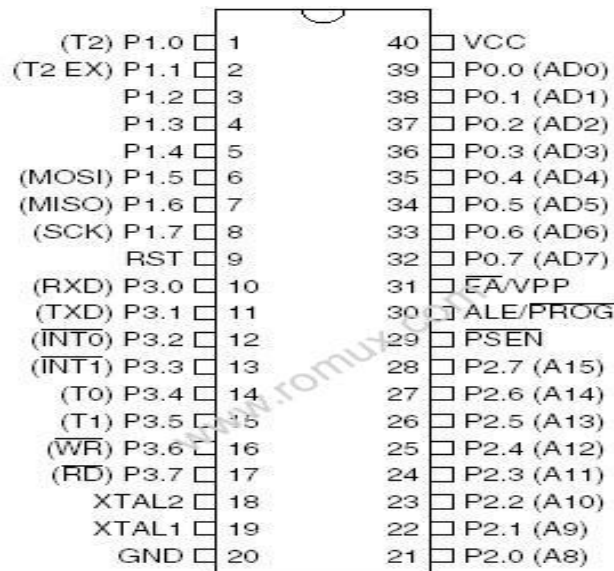
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Block diagram of MC



Pin out of 8052

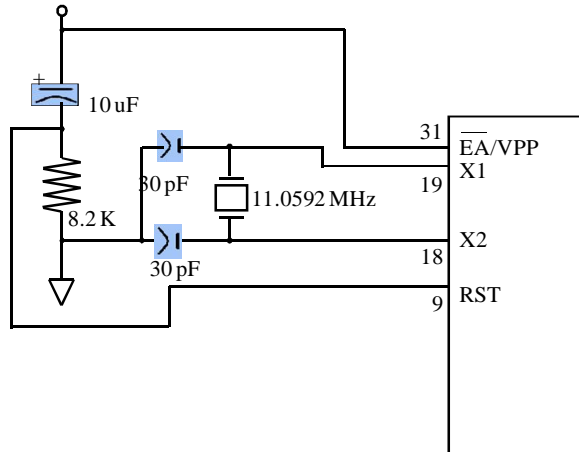


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Power on Reset circuit



RF remote control

- ▶ The circuit uses HT 12E, HT 12D encoder and decoder.
- ▶ 433MHz ASK transmitter and receiver is used for the remote control.

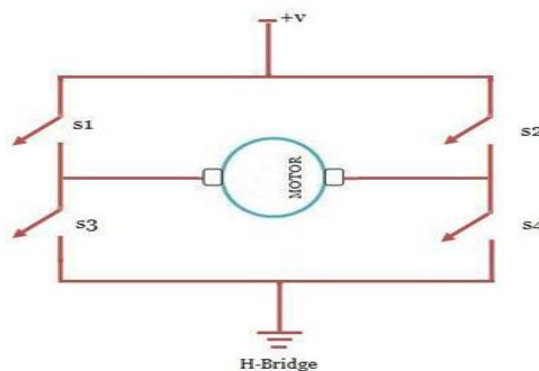
Features of RF

- ▶ Range in open space(Standard Conditions) : 100 Meters
- ▶ RX Receiver Frequency : 433 MHz
- ▶ RX Typical Sensitivity : 105 Dbm
- ▶ RX Supply Current : 3.5 mA
- ▶ RX IF Frequency : 1MHz
- ▶ Low Power Consumption
- ▶ Easy For Application
- ▶ RX Operating Voltage : 5V
- ▶ TX Frequency Range : 433.92 MHz
- ▶ TX Supply Voltage : 3V ~ 6V
- ▶ TX Out Put Power : 4 ~ 12 Dbm

RF Encoder & Decoder

- ▶ The HT 12E Encoder ICs are series of CMOS LSIs for Remote Control system applications. They are capable of Encoding 12 bit of information which consists of N address bits and 12-N data bits.
- ▶ The HT 12D ICs are series of CMOS LSIs for remote control system applications.
- ▶ This ICs are paired with each other. For proper operation a pair of encoder/decoder with the same number of address and data format should be selected.
- ▶ The Decoder receive the serial address and data from its corresponding decoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data.

MOTOR driver L293D



- ▶ L293D is a dual H-bridge motor driver integrated circuit (IC).

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▶ Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal.

▶ This higher current signal is used to drive the motors.

▶ L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

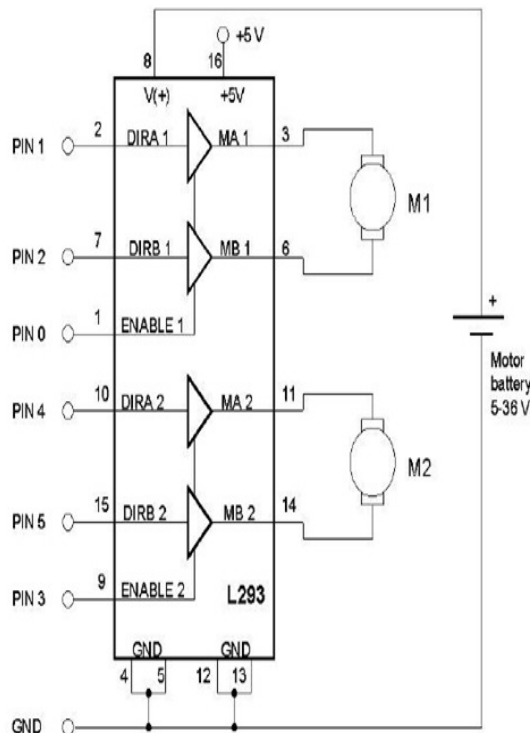
Operation of motor driver

▶ L293D has 2 set of arrangements where one set has input 1, input 2, output 1 and output 2 and other set has input 3, input 4, output 3 and output 4, according to block diagram if pin no 2 & 7 are high then pin no 3 & 6 are also high.

▶ If enable 1 and pin number 2 are high leaving pin number 7 as low then the motor rotates in forward direction.

▶ If enable 2 and pin number 10 are high leaving pin number 15 as low then the motor rotates in forward direction.

▶ If enable 1 and pin number 2 are low leaving pin number 7 as high then the motor rotates in reverse direction.



▶ If enable 2 and pin number 15 are high leaving pin number 10 as low then the motor rotates in forward direction.

Working of project

▶ The project uses HT12E Encoder which converts 4 bit data to serial output which is then fed to the RF module for transmitting the same to be received by the receiver RF module the output of which is fed to HT12D the serial decoder IC, the output of which is fed to controller.

▶ The transmitting end MC is connected to a set of pushbutton. Thus while a particular button is pressed the program executed delivers corresponding 4-bit data which are then transmitted serially at port 1.

▶ The data so received at the receiver end of port 1 operates the motor through motor driver IC L293D as required being interfaced from the Microcontroller output port 2.

▶ The transmitter is powered by a 6v battery in series with a silicon diode to finally develop required voltage for microcontroller circuit.

▶ The receiver is powered by a 12v battery in series with a silicon diode to protect the circuits from accidental reverse battery connection.



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- ▶ 5V DC out of the 12V available from regulator IC 7805 is fed to the controller, decoder, the motor driver IC L293D pin 8 for operation of the motor.
 - ▶ The receiving unit uses one more motor driver IC L293D for driving one DC Motor for arm operation with a boom mounted on its shaft.
 - ▶ At the end of the shaft a nozzle is connected to a water tanks mounted water pump which is powered from “NO” contacts of a relay that is driven by transistor Q_1 from the output of MC pin 15, thus in the event of a fire the robotic vehicle is moved over to the location by operating the left, right, forward & backward button etc.
 - ▶ After it reaches the site the nozzle mounted motor takes position through the water on the fire from the water tank mounted DC pump actuated by the relay RL1. Thus the fire can be extinguished.
- Software requirements**
- ▶ Keil an ARM Company makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators for ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251, and 8051 MCU families.
 - ▶ Compilers are programs used to convert a High Level Language to object code. Desktop compilers produce an output object code for the underlying microprocessor, but not for other microprocessors.
 - ▶ i.e., the programs written in one of the HLL like ‘C’ will compile the code to run on the system for a particular processor like x86 (underlying microprocessor in the computer).
 - ▶ For example compilers for Dos platform is different from the Compilers for Unix platform So if one wants to define a compiler then compiler is a program that translates source code into object code.

V. CONCLUSION

This project presents a fire fighting robot using RF communication and it is designed and implemented with Atmel 89S52 MCU in embedded system domain. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed method is verified to be beneficial for the security purpose and industrial purpose.

REFERNCES

1. Muhammad Ali Mazidi, the 8051 Microcontroller and Embedded Systems.
2. Wireless communication technologies: new multimedia Systems By Norihiko Morinaga
3. Verner, I.; and Betzer, N. 2001. Machine Control - A Design and Technology Discipline in Israel's Senior High Schools. International Journal of Technology, In press.
4. Encyclopedia of Fire fighter surveillance robot
5. Jones, J.; Seiger, B.; and Flynn, A. 1999. Mobile Robots, Inspiration to Implementation, 2nd ed. Natick, Mass: A. K. Peters.