FOREST FIRE DETECTION USING RF TECHNOLOGY

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

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CERTIFICATE

This is to certify that project report entitled "**FOREST FIRE DETECTION USING RF TECHNOLOGY**", submitted by **ADITI BANSAL,** 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 : 26-05-2014

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Designation: Assistant. Professor (Grade -I)

Supervisor's Signature: 26-05-2014

ACKNOWLEDGEMENT

Apart from the efforts, the success of any project depends largely on the encouragement and guidelines of many others. Therefore I take the opportunity to express my gratitude to the people who have been instrumental in the successful completion of this project.

I would also like to show my appreciation to my project guide, **Mr. Kaushlendra Kumar Pandey**, without his guidelines, tremendous support and continuous motivation the project work would not be carried out satisfactory .His kind behavior and motivation provided as the required courage to complete my project.

I would also like to thank our Director, Dean and Head of Department for their continuous support and guidance. Special thanks to my project panel because it was their concern and appreciation that made project carried out easily and satisfactorily.

Date :- 26th May, 14.

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SUMMARY

There are many applications areas in environment monitoring where wireless network is used. In this report, we conceive the problem of forest fire detection by radio frequency application.

Forest fires are one of the main causes of environmental degradation nowadays.Current surveillance systems for forest fires lack in supporting real-time monitoring of every point of a region at all times and early detection of fire threats. Wireless technology has a broad application background in the field of real-time forest fire monitoring. Solutions using wireless networks, on the other hand, can gather analogue sensory data values, such as temperature and humidity, from all points of a field continuously, day and night, and, provide fresh and accurate data to the fire-fighting centre quickly.

In this project, there is a proposed comprehensive framework for the use of wireless sensor networks for forest fire detection and monitoring by using RF Module system. This framework includes parameters such as sensors and their relay outputs in order to show fire detection through RF Communication system. The aim of the framework is to detect a fire threat as early as possible and yet consider the energy consumption of the sensor nodes and the environmental conditions that may affect the required activity level of the network. This project can provide fast reaction to forest fires while also consuming energy efficiently.

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Date :- 26th May, 14.

KAUSHLENDRA KUMAR PANDEY

Date :- 26-05-14

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LIST OF ABBREVIATIONS

- CCD :- Charge-Coupled Device
- IR :- Infrared
- OSI :- Open Systems Interconnection
- WLAN :- Wireless Local Area Network
- RF :- Radio Frequency
- UART :- Universal Asynchronous Receiver/Transmitter
- USB :- Universal Serial Bus
- Hz :- Hertz
- AC :- Alternating Current
- ULF :- Ultra Low Frequency
- FER :- Frequency Experimental Radio
- VHF :- Very High Frequency
- GPR :- Ground Penetrating Radar
- EM :- Electromagnetic
- FCC :- Ground Penetrating Radar
- IC :- Integrated Circuits
- CMOS :- Complementary Metal–Oxide–Semiconductor
- ASK :- Amplitude-Shift Keying
- SAW :- Submerged Arc Welding
- LDR :- Light Dependent Resistor
- LED :- Light Emitting Diode

  TTL :- Transistor–Transistor Logic
- PMOS :- P-type Metal-Oxide-Semiconductor
- NMOS :- N-channel MOSFET
- DSP :- Data Signaling and Processing
- RAM :- Random-Access Memory
- MC :- Micro-Controller
- EA :- External Access
- DC :- Direct Current

CHAPTER-1 Introduction

Forest fires are a fatal threat throughout the world. It is reported that for the last decade, each year, more than 100,000 in all countries. Early detection of forest fires is very important in fighting against fires. Besides early detection capability, estimating the spread direction and speed of fire is also important in extinguishing fires. Unreliability of human observation towers, in addition to the difficult life conditions of fire lookout personnel, has led the development and use of various technologies aiming to make the fire fighters aware of the forest fires as early as possible. Some important technologies and systems that are currently used towards this goal are: systems employing charge-coupled device (CCD) cameras and infrared (IR) detectors, satellite systems and images, and wireless sensor networks.

1.1 OVERVIEW OF WIRELESS NETWORKS

A wireless network is any type of computer network that uses wireless data connections for connecting network nodes.

Wireless Networking is a method by which homes, telecommunication networks and enterprise installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless Telecommunication Networks are generally implemented and administered using Radio Communication. This implementation takes place at the physical level of the OSI Model network structure.

Examples of Wireless Networks include cell phone network, WIFI local networks, and so on.

Fig1:- A Typical Wireless Icon

Properties:-

- In general sense, wireless networks offer a vast variety of uses by both, business and home users. Each wireless technology is defined by a standard that describes unique functions at both the physical and the data link layer of the OSI Model. These standards differ in their specified signaling methods, geographic ranges, and frequency usages. Such differences can make certain technologies better suited to home networks and others better suited to network larger organizations.

- In performance, each standard varies in geographical range, thus making one standard more ideal than the next depending on what it is one trying to accomplish with a wireless network. The performance of wireless network satisfies a variety of applications such as voice and video. The use of this technology also gives rooms for expansions such as from 2G to 3G and most recently 4G technology which stands for 4^{th} generation of cell phone mobile communication standards.

- Space is another characteristic of wireless networking. Wireless networks offer many advantages when it comes to difficult-to-wire areas trying to communicate such as across a street or river, a warehouse on the other side of the premise or buildings that are physically separated but operate as one. Wireless networks allow for users to designate a certain space which the network will be able to communicate with other devices through that network.

- For homeowners, wireless technology is an effective option compared to ethernet for sharing printers, scanners, and high speed internet connections. WLANs help save the cost of installation of cable mediums, save time from physical installation, and also creates mobility for devices connected to the network. Wireless networks are simple and require as few as one single wireless access point connected directly to the Internet via a router.

1.2 RF Module

An **RF module** (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through Radio Frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver.

RF Modules typically communicate with an embedded system, such as a micro controller or microprocessor. Although the module may use a standardized protocol for wireless communication, the commands sent over the micro controller interface are typically not standardized as each vendor has their own proprietary communications format. The speed of the micro controller interface depends on the speed of the underlying RF protocol used: higher speed RF protocols such as Wi-Fi require a high speed serial interface such as USB, whereas protocols with a slower data rate such as Bluetooth Low Energy may use a UART interface.

CHAPTER – 2 RADIO FREQUENCY

2.1 What Is RF?

Radio frequency (**RF**) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits or electromagnetic radiation

2.1.1 Properties of RF:

Electrical currents that oscillate at RF have special properties not shared by direct current signals. One such property is the ease with which it can ionize air to create a conductive path through air. This property is exploited by 'high frequency' units used in electric arc welding. Another special property is an electromagnetic force that drives the RF current to the surface of conductors, known as the skin effect. Another property is the ability to appear to flow through paths that contain insulating material, like the dielectric insulator of a capacitor. The degree of effect of these properties depends on the frequency of the signals.

2.1.2Different Ranges Present In RF And Applications In Their Ranges?

Extremely low frequency

ELF 3 to 30 Hz

10,000 km to 100,000 km

directly audible when converted to sound, communication with submarines

Super low frequency

SLF 30 to 300 Hz

1,000 km to 10,000 km

directly audible when converted to sound, AC power grids (50 hertz and 60 hertz)

Ultra low frequency

ULF 300 to 3000 Hz

100 km to 1,000 km

directly audible when converted to sound, communication with mines

Very low frequency

VLF 3 to 30 kHz

10 km to 100 km

directly audible when converted to sound (below ca. 18-20 kHz; or "ultrasound" 20-30+ kHz)

Low frequency

LF 30 to 300 kHz

1 km to 10 km

AM broadcasting, navigational beacons, low FER

Medium frequency

MF 300 to 3000 kHz

100 m to 1 km

navigational beacons, AM broadcasting, maritime and aviation communication

High frequency

HF 3 to 30 MHz

10 m to 100 m

Shortwave, amateur radio, citizens' band radio

Very high frequency

VHF 30 to 300 MHz

1 m to 10 m

FM broadcasting broadcast television, aviation, GPR

Ultra high frequency

UHF 300 to 3000 MHz

10 cm to 100 cm

Broadcast television, mobile telephones, cordless telephones, wireless networking, remote keyless entry for automobiles, microwave ovens, GPR

Super high frequency

SHF 3 to 30 GHz

1 cm to 10 cm

Wireless networking, satellite links, microwave links, Satellite television, door openers.

Extremely high frequency

EHF 30 to 300 GHz

1 mm to 10 mm

Microwave data links, radio astronomy, remote sensing, advanced weapons systems, advanced security scanning

2.1.3 Brief Description of RF:

Radio frequency (abbreviated RF) is a term that refers to alternating current (AC) having characteristics such that, if the current is input to an antenna, an electromagnetic (EM) field is generated suitable for wireless broadcasting and/or communications. These frequencies cover a significant portion of the electromagnetic radiation spectrum, extending from nine kilohertz (9 kHz),the lowest allocated wireless communications frequency (it's within the range of human hearing), to thousands of gigahertz(GHz).

When an RF current is supplied to an antenna, it gives rise to an electromagnetic field that propagates through space. This field is sometimes called an RF field; in less technical jargon it is a "radio wave." Any RF field has a wavelength that is inversely proportional to the frequency. In the atmosphere or in outer space, if **f** is the frequency in megahertz and **s**is the wavelength in meters, then

$$s = \mathbf{300}/f$$

The frequency of an RF signal is inversely proportional to the wavelength of the EM field to which it corresponds. At 9 kHz, the free-space wavelength is approximately 33 kilometers (km) or 21 miles (mi). At the highest radio frequencies, the EM wavelengths measure approximately one millimeter (1 mm). As the frequency is increased beyond that of the RF spectrum, EM energy takes the form of infrared (IR), visible, ultraviolet (UV), X rays, and gamma rays.

Many types of wireless devices make use of RF fields. Cordless and cellular telephone, radio and television broadcast stations, satellite communications systems, and two-way radio services all operate in the RF spectrum. Some wireless devices operate at IR or visible-light frequencies, whose electromagnetic wavelengths are shorter than those of RF fields. Examples include most television-set remote-control boxes, some cordless computer keyboards and mice, and a few wireless hi-fi stereo headsets.

The RF spectrum is divided into several ranges, or bands. With the exception of the lowest-frequency segment, each band represents an increase of frequency corresponding to an order of magnitude (power of 10). The table depicts the eight bands in the RF spectrum, showing frequency and bandwidth ranges. The SHF and EHF bands are often referred to as the **microwave spectrum.**

WHY DO WE GO FOR RF COMMUNICATION?

RF Advantages:

- No line of sight is needed.
- Not blocked by common materials: It can penetrate most solids and pass through walls.
- Longer range.
- It is not sensitive to the light;.
- It is not much sensitive to the environmental changes and weather conditions.

WHAT CARE SHOULD BE TAKEN IN RF COMMUNICATION?

RF Disadvantages:

- Interference: communication devices using similar frequencies - wireless phones, scanners, wrist radios and personal locators can interfere with transmission
- Lack of security: easier to "eavesdrop" on transmissions since signals are spread out in space rather than confined to a wire
- Higher cost than infrared
- Federal Communications Commission(FCC) licenses required for some products
- Lower speed: data rate transmission is lower than wired and infrared transmission

2.2 RF Transmitter

Ask is ask hybrid saw based transmitter module which provides a complete RF transmitter solution, which can transmit data up to 3khz from any microprocessor or standard encode IC.

The compact small size and low cost design keeps the components count down and ensuring the low hardware cost.

Features:

- Wireless security systems
- Cmos/ttl input
- No adjustable components
- Stable operating frequency
- Low current consumption
- Wide operating range
- ASK modulation
- available as 315 / 433. 92mhz

Applications:

- Complete RF transmitter
- Car alarm systems
- Remote controls.
- Sensor reporting

2.3 RF Receiver

- Modulation: ASK
- Frequency available: 315 / 433. 92mhz
- Circuit shape: SAW
- Supply voltage: 5v
- Sensitivity:-106db

CHAPTER – 3 Proposed Framework

3.1 Circuit Diagram of RF Transmitter and Receiver

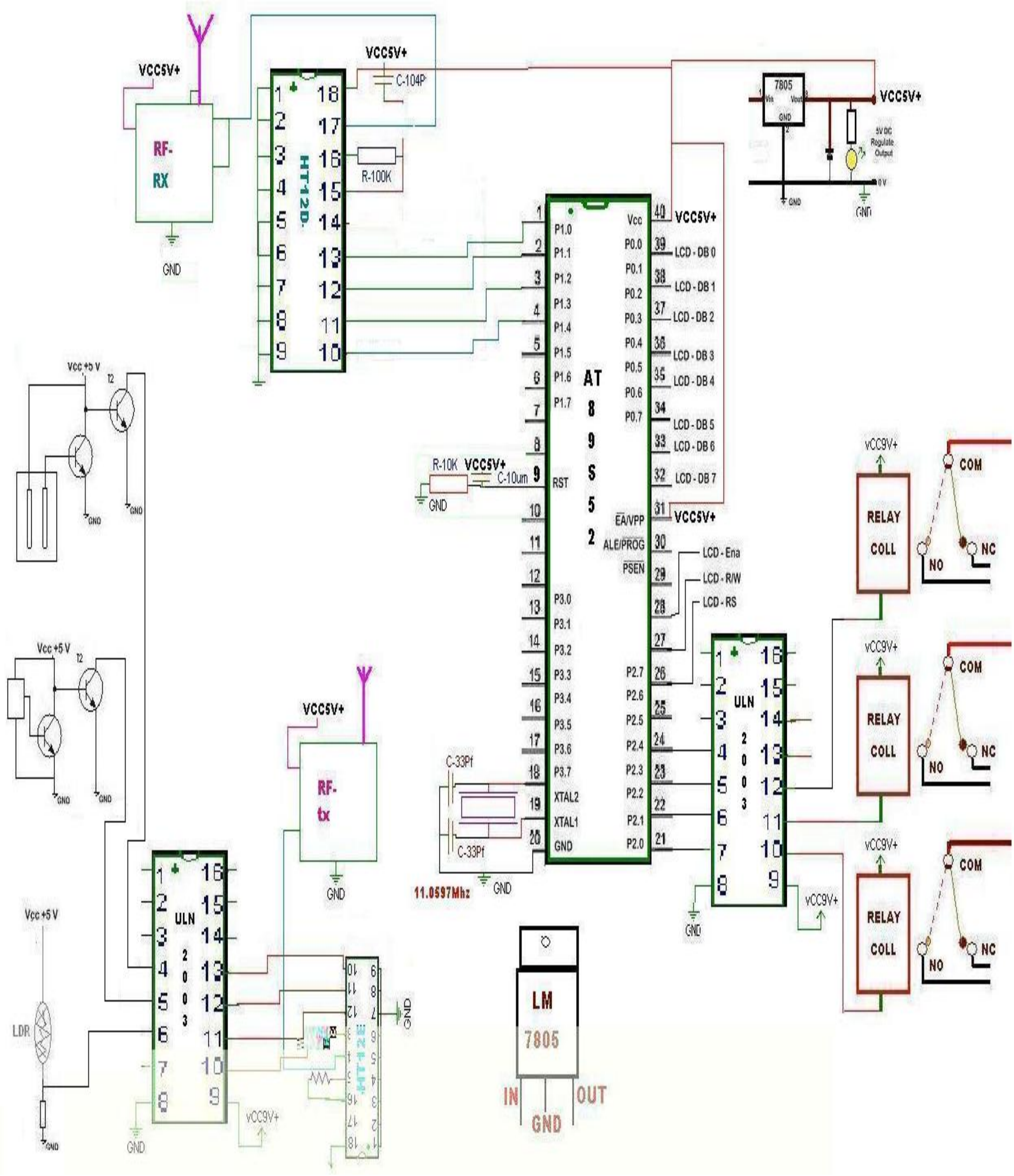


Fig2:- Circuit diagram of Transmitter and Receiver

3.2 RF TRANSMITTER

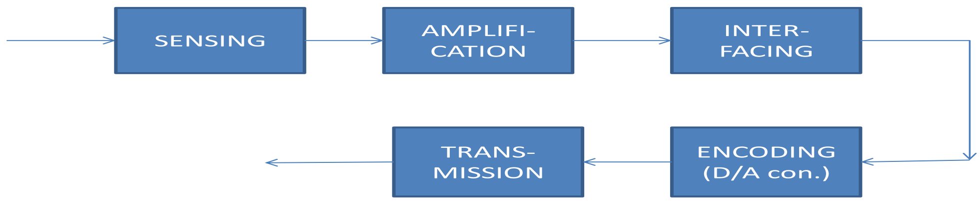


Fig3:- Block Diagram of Transmitter

Frequency Source (Carrier)

In order to make the information signal (e.g. data) pass through the air, it must be modulated on to a carrier signal whose frequency is well suited to the propagation environment, conforms to the licensed operating bands, and is sufficiently stable to allow detection by a tuned receiver in the presence of interference.

Modulation

The method of imposing the information signal onto the carrier signal is termed modulation and must be accomplished cost effectively and accurately for maximum range and minimum interference.

Amplification

The amplifier is a key part of the transceiver, and must be efficient (dc power in to RF power out), low cost, non-polluting, and possibly linear. Output power is dictated by regulation, range requirement, battery life, cost and linearity considerations.

Antenna

The antenna is often the most poorly engineered part of a radio system. Good design will ensure maximum range, high amplifier efficiency (good matching), good selectivity, minimal pollution, good interference rejection, good sensitivity, reduced design headaches.

Subject to sensing, 3 Sensors namely **MOISTURE SENSOR, HEAT SENSOR AND LDR** are proposed as some of the parameters that has been implemented to the transmitter side in order to show relay output for forest fire detection.

3.2.1 LDR SENSOR

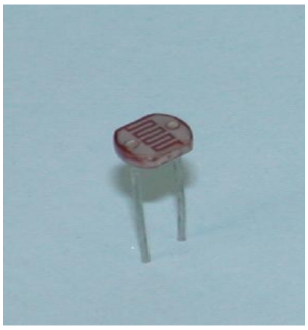


Fig4:- LDR Sensor

LDR (Light Dependent Resistors) is a simple electronic component which can be used to make light dependent switches. When LDR is uncovered then LED is in OFF state and when covered LED is in ON state. So it may be a perfect system for street lighting.

The resistance of an LDR is very high, sometimes as high as 1000 000 ohms, however when they are illuminated with light resistance drops dramatically. Thus allowing current to pass through it. Above that logic is used to switch the transistor which in turn drives the LED.

This little photocell is very useful when you need to detect light levels. The photocell changes resistance as light levels in its surrounds change.

It can be used for:

- Switching on lights when the light levels get to low.
- Log the amount of sun light per day.
- Heliostats use these to track the sun. 4 of these photocells are used and based on the difference in the sensor levels the direction of the sun's movement can be detected.
- In advanced projects this photocell can be used to keep the light at a certain level.

Dimensions:

· 2 x 4 x 5mm

· 4mm between pins

· 31mm lead length

Features:

· Light resistance : ~1k Ohm

· Dark resistance : ~10k Ohm

· Max voltage : 150V

· Max power: 100mW

3.2.2 MOISTURE SENSOR

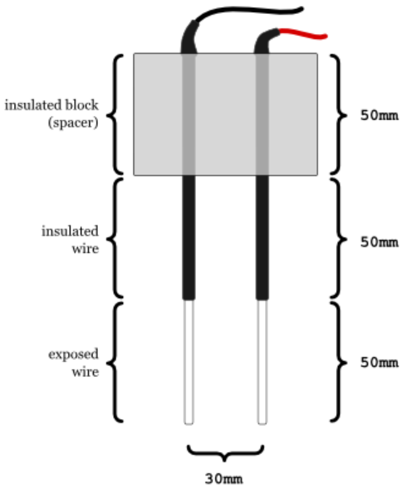


Fig5:- Moisture Sensor

Moisture sensor consists of two probes (the metal rods) held apart at a fixed distance by some insulating material. The other factor is that part of the probe is insulated so that you can control at what depth you would like to take the reading.

So, our sensor starts with a 50mm thick (tall) insulating block. This does keep the rods apart, and is also just a booster -- it's a big, foam block sitting on the soil so you don't accidentally dig up your sensor.

Next down is the insulated section of the probe (also 50mm). From here down, the probe will be under the soil. If you want to change the depth of the reading, you can just change the length of this insulated section.

Finally we have the exposed part of the probe (again 50mm). This is the part of the probe that actually takes the reading. You could experiment with different lengths here, but you will have to make changes to the local circuit (to adjust the voltage divider).

3.2.3 HEAT SENSOR

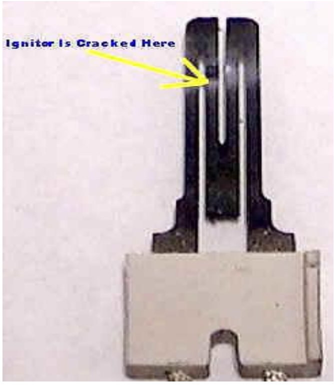


Fig6:- Heat Sensor

A heat sensor works by using pyroelectrical materials, which emit electrical impulses when heated or cooled. IR radiation passes through the front of the device and comes into contact with a set of sensors made of pyroelectrical plate, crystal or film. The electrical impulses from the sensors is then collected and electronically turned into usable data.

3.2.4 ENCODER IC HT12E

Features

· Operating voltage: – 2.4V~12V for the HT12E

· Low power and high noise immunity CMOS technology

· Low stand-by current

· Minimum transmission word: – Four words for the HT12E

· A built-in oscillator with only a 5% resistor

· Data code polarity: – HT12AE: Positive polarity

· Minimal external components

Applications

· Burglar alarm system

· Smoke and fire alarm system

· Garage door controllers

· Car door controllers

· Car alarm system

· Security system

· Cordless telephones

· Other remote control systems

General Description

The 212 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 Infra-Red transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E further enhances the application flexibility of the 212 series of encoders.

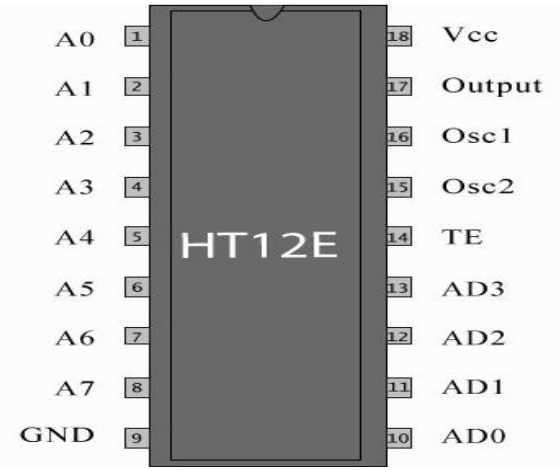


Fig7:- Pin Diagram of Encoder IC

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground
10	4 bit Data/Address pins for input	AD0
11		AD1
12		AD2
13		AD3
14	Transmission enable; active low	TE
15	Oscillator input	Osc2
16	Oscillator output	Osc1
17	Serial data output	Output
18	Supply voltage; 5V (2.4V-12V)	Vcc

Table No. 1:- Pin Description of Encoder IC

3.2.5 ULN 2803

IC ULN2803 consists of octal high voltage, high current darlington transistor arrays. The eight NPN Darlington connected transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry (such as TTL, CMOS or PMOS/NMOS) and the higher current/voltage requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications.

Features

- Eight Darlingtons with Common Emitter.
- Open–collector outputs.
- Freewheeling clamp diodes for transient suppression.
- Output Current to 500 mA.
- Output Voltage to 50 V.
- Inputs pinned opposite outputs to simplify board

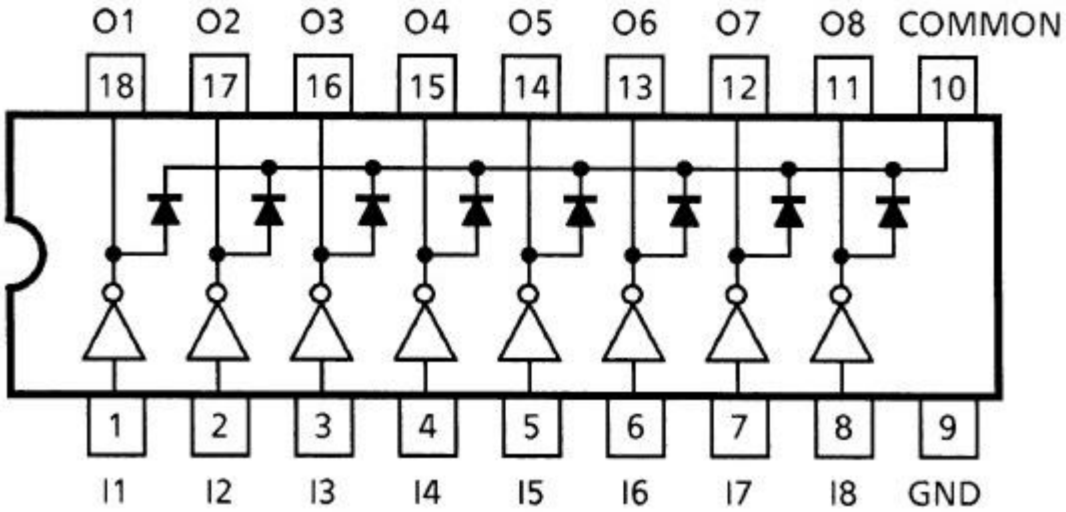


Fig8:- Pin Diagram of ULN 2803

3.3 RF RECEIVER

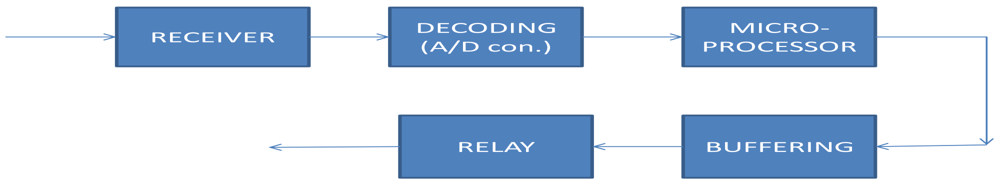


Fig9:- Block Diagram of Receiver

Reception

Key to the sensitivity, dynamic range and strong signal handling properties of the radio is the receiver 'front end'. The main task is to boost weak wanted signals, often in the presence of strong unwanted signals whilst introducing minimal noise and distortion. In many cases, some selective filtering is required to assist this task.

Demodulation

The process of removing the information signal from the carrier is termed demodulation. The challenge is to design a circuit (or algorithm) that will achieve this task optimally in the presence of noise, interference and varying signal strength, frequency and phase, whilst being compact, power efficient and cheap.

Data Processing

Pre and post processing of the information signal is often an afterthought for low power radio applications, usually implying some form of microprocessor or DSP engine with the presumed complexity, cost, power consumption and size penalties. The benefits of matched filtering, error detection and correction (coding), channel equalisation, etc, are however significant in terms of range, robust transmission, power conservation and data rate optimisation.

3.3.1 AT89S52 Micro-Controller

The microcontroller used in this project is AT89S52. Atmel Corporation introduced this 89C51 microcontroller. This microcontroller belongs to 8051 family. This microcontroller had 128 bytes of RAM, 4K bytes of on-chip ROM, two timers, one serial port and four ports (each 8-bits wide) all on a single chip. AT89S52 is Flash type 8051.

The present project is implemented on Keil U vision. In order to program the device, proload tool has been used to burn the program onto the microcontroller.

The features, pin description of the microcontroller and the software tools used are discussed in the following sections.

Features of AT89S52

- 8K Bytes of Re-programmable Flash Memory.
- RAM is 256 bytes.
- 2.7V to 6V Operating Range.
- Fully Static Operation: 0 Hz to 24 MHz.
- 32 Programmable I/O Lines.
- Two 16-bit Timer/Counters.
- Low-power Idle and Power-down Modes.

Description:

The AT89S52 is a low-voltage, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable memory. The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications.

In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning.

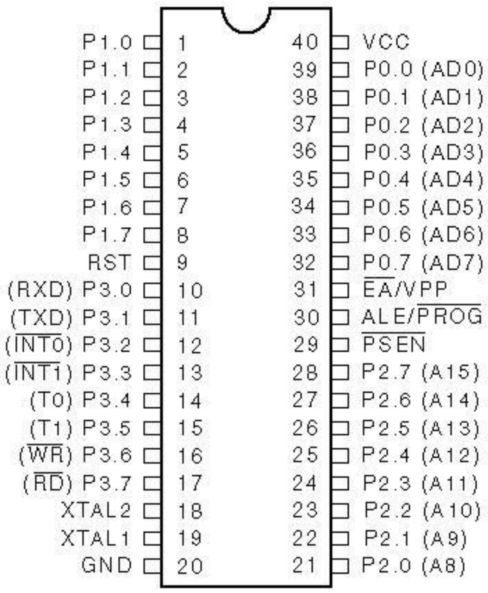


Fig10:- MC Pin Diagram

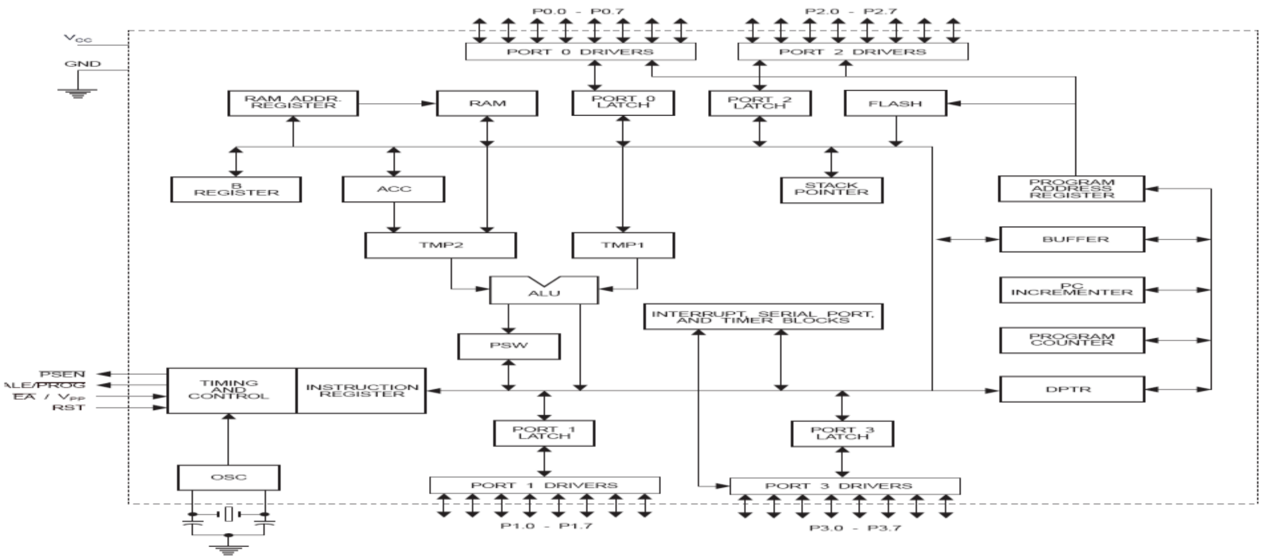


Fig11:- MC Block Diagram

PIN DESCRIPTION:

Vcc

Pin 40 provides supply voltage to the chip. The voltage source is +5V.

GND

Pin 20 is the ground.

XTAL1 and XTAL2

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator, as shown in Figure 11. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven, as shown in the below figure. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

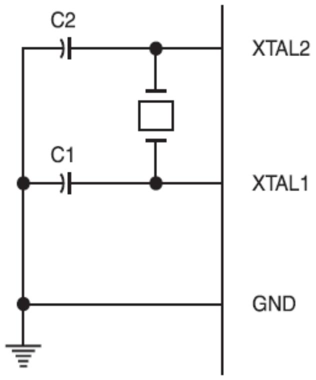


Fig12:- Oscillator Connections

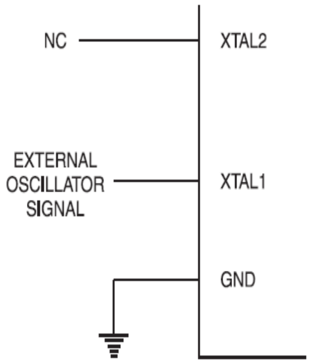


Fig13:- External Clock Drive Configuration

C1, C2 = 30 pF ± 10 pF for Crystals

= 40 pF ± 10 pF for Ceramic Resonators

RESET

Pin9 is the reset pin. It is an input and is active high. Upon applying a high pulse to this pin, the microcontroller will reset and terminate all the activities. This is often referred to as a power-on reset.

EA (External access)

Pin 31 is EA. It is an active low signal. It is an input pin and must be connected to either Vcc or GND but it cannot be left unconnected. The 8051 family members all come with on-chip ROM to store programs. In such cases, the EA pin is connected to Vcc. If the code is stored on an external ROM, the EA pin must be connected to GND to indicate that the code is stored externally.

PSEN (Program store enable)

This is an output pin.

ALE (Address latch enable)

This is an output pin and is active high.

Ports 0, 1, 2 and 3

The four ports P0, P1, P2 and P3 each use 8 pins, making them 8-bit ports. All the ports upon RESET are configured as input, since P0-P3 have value FFH on them.

Port 0(P0)

Port 0 is also designated as AD0-AD7, allowing it to be used for both address and data. ALE indicates if P0 has address or data. When ALE=0, it provides data D0-D7, but when ALE=1, it has address A0-A7. Therefore, ALE is used for de-multiplexing address and data with the help of an internal latch.

When there is no external memory connection, the pins of P0 must be connected to a 10K-ohm pull-up resistor. This is due to the fact that P0 is an open drain. With external pull-up resistors connected to P0, it can be used as a simple I/O, just like P1 and P2. But the ports P1, P2 and P3 do not need any pull-up resistors since they already have pull-up resistors internally. Upon reset, ports P1, P2 and P3 are configured as input ports.

Port 1 and Port 2

With no external memory connection, both P1 and P2 are used as simple I/O. With external memory connections, port 2 must be used along with P0 to provide the 16-bit address for the external memory. Port 2 is designated as A8-A15 indicating its dual function. While P0 provides the lower 8 bits via A0-A7, it is the job of P2 to provide bits A8-A15 of the address.

Port 3

Port 3 occupies a total of 8 pins, pins 10 through 17. It can be used as input or output. P3 does not need any pull-up resistors, the same as port 1 and port 2. Port 3 has an additional function of providing some extremely important signals such as interrupts.

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (external interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (external data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

Table No.2:- Port 3 Alternate Functions

Machine cycle for the 8051

The CPU takes a certain number of clock cycles to execute an instruction. In the 8051 family, these clock cycles are referred to as machine cycles. The length of the machine cycle depends on the frequency of the crystal oscillator. The crystal oscillator, along with on-chip circuitry, provides the clock source for the 8051 CPU.

The frequency can vary from 4 MHz to 30 MHz, depending upon the chip rating and manufacturer. But the exact frequency of 11.0592 MHz crystal oscillator is used to make the 8051 based system compatible with the serial port of the IBM PC.

In the original version of 8051, one machine cycle lasts 12 oscillator periods. Therefore, to calculate the machine cycle for the 8051, the calculation is made as 1/12 of the crystal frequency and its inverse is taken.

The assembly language program is written and this program has to be dumped into the microcontroller for the hardware kit to function according to the software. The program dumped in the microcontroller is stored in the Flash memory in the microcontroller. Before that, this Flash memory has to be programmed and is discussed in the next section.

3.3.2 DECODER IC HT12D

Features

· Operating voltage: 2.4V~12V

· Low power and high noise immunity CMOS technology

· Low stand-by current

· Capable of decoding 12 bits of information

· Pairs with HOLTEK's 212 series of encoders

· Binary address setting

· Three times of receiving check

· Address/Data number combination: – HT12D: 8 address bits and 4 data bits

· A built-in oscillator with only a 5% resistor

· A valid transmission indicator

· Easy interface with an RF or an Infra-Red transmission medium

· Minimal external components

Applications

· Burglar alarm system

· Smoke and fire alarm system

· Garage door controllers

· Car door controllers

· Car alarm system

· Security system

· Cordless telephones

· Other remote control systems

General Description

The 212 decoders are a series of CMOS LSIs for remote control system applications. They are paired with HOLTEK's 212 series of encoders. 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 212 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 have been 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 212 series of decoders is capable of decoding information that consists 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.

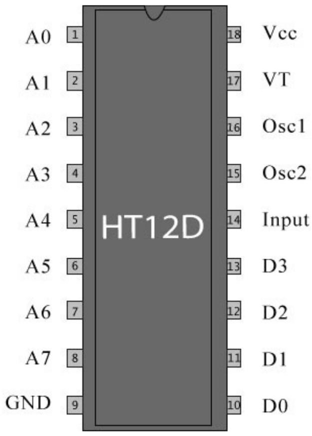


Fig14:- Pin Diagram of Decoder IC

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground
10	4 bit Data/Address pins for output	D0
11		D1
12		D2
13		D3
14	Serial data input	Input
15	Oscillator output	Osc2
16	Oscillator input	Osc1
17	Valid transmission; active high	VT
18	Supply voltage; 5V (2.4V-12V)	Vcc

Table No.3:- Pin Description of Decoder IC

3.3.3 ULN 2003

ULN2003 is a high voltage and high current Darlington array IC. It contains seven open collector darlington pairs with common emitters. A darlington pair is an arrangement of two bipolar transistors.

ULN2003 belongs to the family of ULN200X series of ICs. Different versions of this family interface to different logic families. ULN2003 is for 5V TTL, CMOS logic devices. These ICs are used when driving a wide range of loads and are used as relay drivers, display drivers, line drivers etc. ULN2003 is also commonly used while driving Stepper Motors Refer Stepper Motor interfacing using ULN2003.

Each channel or darlington pair in **ULN2003** is rated at 500mA and can withstand peak current of 600mA. The inputs and outputs are provided opposite to each other in the pin layout. Each driver also contains a suppression diode to dissipate voltage spikes while driving inductive loads. The schematic for each driver is given below:

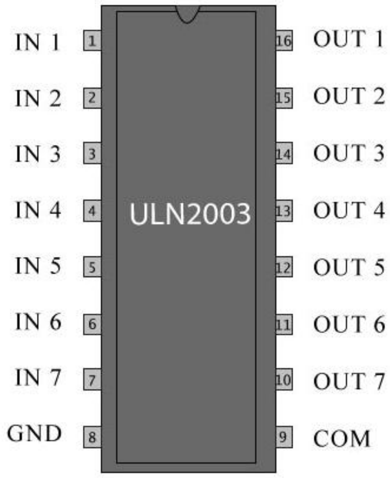


Fig15:-Pin Diagram of ULN 2003

Pin No	Function	Name
1	Input for 1st channel	Input 1
2	Input for 2nd channel	Input 2
3	Input for 3rd channel	Input 3
4	Input for 4th channel	Input 4
5	Input for 5th channel	Input 5
6	Input for 6th channel	Input 6
7	Input for 7th channel	Input 7
8	Ground (0V)	Ground
9	Common free wheeling diodes	Common
10	Output for 7th channel	Output 7
11	Output for 6th channel	Output 6
12	Output for 5th channel	Output 5
13	Output for 4th channel	Output 4
14	Output for 3rd channel	Output 3
15	Output for 2nd channel	Output 2
16	Output for 1st channel	Output 1

Table No.4:- Pin Description of ULN 2003

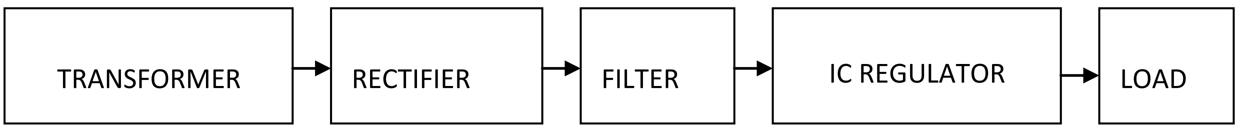
3.3.4 RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on ainther circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The relay used in this project is KT-603.

Fig16:-Relay

3.3.5 Power Supply

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.



3.3.5.1 Transformer:

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the a.c input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level.

3.3.5.2 Rectifier:

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability and full wave rectification.

3.3.5.3 Filter:

Capacitive filter is used in this project. It removes the ripples from the output of rectifier and smoothens the D.C. Output received from this filter is constant until the mains voltage and load is maintained constant. However, if either of the two is varied, D.C. voltage received at this point changes. Therefore a regulator is applied at the output stage.

3.3.5.4 Voltage regulator:

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels**.**

3.3.6 RELAY OUTPUTS

3.3.6.1 LED LIGHT

Light-emitting diodes are elements for light signalization in electronics. They are manufactured in different shapes, colors and sizes. For their low price, low consumption and simple use, they have almost completely pushed aside other light sources- bulbs at first place. They perform similar to common diodes with the difference that they emit light when current flows through them.

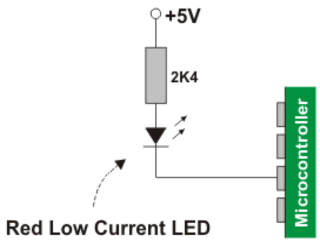


Fig17:- LED Diagram

3.3.6.2 BUZZER

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Son alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

3.3.6.3 FAN

Fig18:-DC Motor

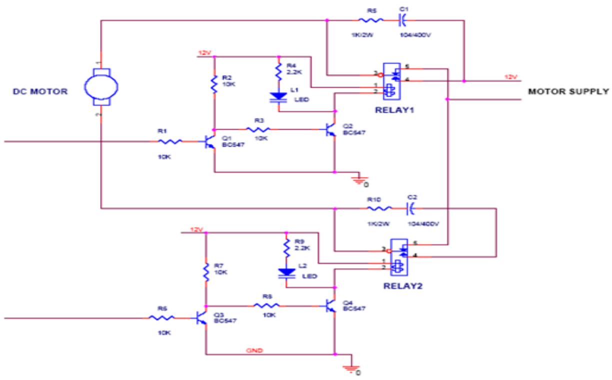


Fig19:-Circuit Diagram of DC Motor

Circuit working Description:

This circuit is designed to control the motor in the forward and reverse direction. It consists of two relays named as relay1, relay2. The relay ON and OFF is controlled by the pair of switching transistors. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and normally open (NO). The common pin of two relay is connected to positive and negative terminal of motor through snubber circuit respectively. The relays are connected in the collector terminal of the transistors T2 and T4.

When high pulse signal is given to either base of the T1 or T3 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the T2 or T4 transistor. So the relay is turned OFF state.

When low pulse is given to either base of transistor T1 or T3 transistor, the transistor is turned OFF. Now 12v is given to base of T2 or T4 transistor so the transistor is conducting and relay is turn ON. The NO and NC pins of two relays are interconnected so only one relay can be operated at a time.

The series combination of resistor and capacitor is called as snubber circuit. When the relay is turn ON and turn OFF continuously, the back emf may fault the relays. So the back emf is grounded through the snubber circuit.

- When relay 1 is in the ON state and relay 2 is in the OFF state, the motor is running in the forward direction.
- When relay 2 is in the ON state and relay 1 is in the OFF state, the motor is running in the reverse direction.

CONCLUSION & FUTURE SCOPE

The aim of this project work was to propose a comprehensive framework for detection and monitoring forest fires which cover all parts of the cycle of wireless networks while continuously maintaining early detection of forest wires.

The improvement of the level of modernization of forest fires monitoring using information and communication technologies has strategic significance for many countries where forest fires occur frequently. Compared with the traditional techniques of forest fires detection, wireless networks technology is a very promising green technology in efficiently detecting the forest fires.

Forest fire detection using this RF technology has got certain merits as well as demerits. Its primary merits include like these analogue sensors can be deployed in the forest ignoring the fact that it would cause any hindrance in the installation as RF technology is not much sensitive to environmental changes and weather conditions. It is of a longer range which is of about 200 meters, i.e. without repeaters and also, it not very sensitive to light. It has come out to be quite a successful experiment and as far as its future scope is concerned Zigbee is a very promising technology that requires only data rate, long battery life, and secures networking.

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