AUTOMATIC FIRE DETECTION AND CONTROL USING PROJECTILE EXTINGUISHING

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***Abstract*- Fire accidents are becoming a common occurrence all around the World. Several innovations have been made so far to reduce the repercussions of fire accidents, be it damageto assets or casualties due to panicked surges in the crowd. The aim of our project is to develop a comprehensive fire detection and control system for prompt identification thus reducing the property damage of fire accidents in both residential and commercial settings. This can be done by detecting the area of fire at the earliest using image processing for precise fire extinguishing only in the vicinity of fire, thus preventing spreading of fire and reducing property damage. The system will consist of variouscomponents including micro-controllers, relays and motors. Our project will also involve educating the public on fire safety measures and conducting regular safety inspections toensure compliance with safety standards. Additionally, our project will explore the use of technologies such as Python and Image processing to enhance the effectiveness and efficiency of the fire detection and control system. The successful implementation of this project will result in a significant reduction in fire-related deaths and property damage, thereby improving public safety and security.**

Keywords: **Micro-controllers, Relays, Python, Image Processing Technique.**

1. INTRODUCTION

1.1 PROJECT OVERVIEW

Nowadays fire accidents are very frequent and the man powerto put out large fires is insufficient due to the prevailing threatof the job. Several solutions are being proposed to reduce theman-power and also for an efficient extinguishing.

Fire accidents causes heavy irreplaceable damage to propertyand lives. The mortality cases have increased substantially over the past few years and even more innovations are beingmade for an optimal outcome.

The best way to reduce the loss of lives in a fire accident is toreduce the human interface in the area of incident.

1.2 OBJECTIVE OF THE PROJECTThe objectives for this project are:

- To design an extinguisher system that detects fire ininitial stage and extinguishes it properly.
- The system intends to perform focusedextinguishing to reduce material damage due to excessive sprinkling in unwanted areas.

1.3 PROJECT SCOPE

The scopes for this project are:

- The idea was inspired by the aim to create a systemcapable of detecting fires and taking necessary action withoutthe need for human participation.
- It allows us to outsource jobs to Al Systems that were previously demanded of people but were potentially harmful to their lives.
- It could also be improved by connecting it to a camera so that the person in charge can remotely observe theAl System's operation on a screen.

1.4 STATISTICAL STUDY ON FIRE ACCIDENTS

According to a research from Accidental Deaths and Suicidesin India (ADSI), which is kept by the National Crime Records Bureau, fire-related mishaps killed 35 persons each day on average between 2016 and 2020. This is despite the fact that the number of such incidents has progressively decreased.

During this point, the number of fires went down by 44%, from 16,695 in 2016 to 9,329 in 2020, and the number of individuals killed in these incidents decreased by 46%, from16,900 in 2016 to 9,110 in 2020.

As seen in fig1.4, the number of individuals injured in fires has fluctuated throughout time. The year 2017 had the fewestfire-related deaths (348), but it increased by 123% to 777 in 2018, and has been on a declining trend ever since.

	Fire accidents	Deaths	Injuries
2016	16,695	16,900	998
2017	13,397	13,159	348
2018	13,099	12,748	777
2019	11,037	10,915	441
2020	9,329	9,110	468

Fig 1.4 FIRE ACCIDENTS OVER THE YEARS
(Source: Business Standards Article, March, 2023)

Maharashtra, which has the biggest contribution to the country's GDP, also has the highest number of unintentional fires. Maharashtra led the list with 9,344 instances in the previous five years, followed by Madhya Pradesh (9,065). However, the number of these incidents in Maharashtra has been continuously decreasing — from 3,063 in 2016 to 762 in 2020, a drop of about 75%. Many other states, like Karnataka (55.9%), Gujarat (74%), and Rajasthan (62.6%), have witnessed similar developments.

Odisha, on the other hand, had a 205% increase in unintentional fires between 2016 and 2020. Other majorstates, such as Tamil Nadu, Chhattisgarh, and Uttar Pradesh,have witnessed varying patterns, but an overall decline in thenumber of fires.

1.4.1 FIRE ACCIDENTS IN 2022 IN INDIA

- This year, the period from April 1 to June 30 had thehighest number of fire occurrences, which was partially attributed to the sweltering heat and heatwave that prevailedduring that time.
- The Delhi Fire Service (DFS) reported over 10,350fire occurrences in the first six months of the year, with 60 persons killed and 395 injured.
- The operators at the DFS control room have had a busy yearthus far, attending 16,763 calls between January 1 and June 30 of this year, according to data seen by PTI.
- Of these calls, 10,379 were made in response to fire events,1,548 for animal rescue, 1,805 for avian rescue, and a few hundred more for drowning, etc. According to the fire officials, there were a number of significant fire events that occurred in industries and JJ clusters during the year.
- This year, the period from April 1 to June 30 had the highestnumber of fire occurrences, which was partially attributed tothe severe temperatures and heatwave that prevailed during that time.

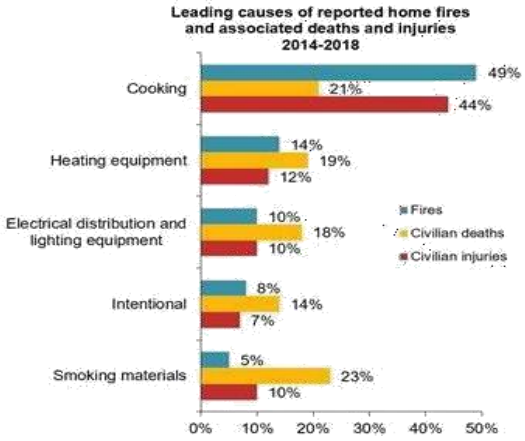


Fig 1.4.1 CAUSES OF FIRE ACCIDENTS (Source: National Fire Protection Association NFPA Article on "General Causes of Fire", December 2020)

The causes of the fire accident are shown above in the fig 1.4.1.

2. PROPOSED SYSTEM

2.1 INTRODUCTION

In this chapter, we will discuss the proposed system to obtainan optimal fire extinguishing system. The key component of our proposed system is the Raspberry Pi to make the extinguisher more efficient.

2.2 OVERVIEW

The proposed system is made up of the automatic sprinkler system. The automatic sprinkler systems have the ability to self-start, based on a variety of early fire characteristics. By properly spraying water over the burning area, they canprevent the fire from spreading and put it out.

The proposed work also allows the water to focus the projectile of motion so it can focus only on the area where thefire is affected.

This is done by using the relays and DC motor to obtain a clear motion of the water nozzle towards the affected area which is connected to the camera.
The camera provides a 360-degree view which makes it easierto identify the fire as soon as it goes, thus preventing spreading of the fire.

2.3 BLOCK DIAGRAM OF PROPOSED SYSTEM
The proposed system consists of a fire extinguisher which candetect fire even before it produces smoke that is visible to thenaked eye.
Our automated fire extinguisher contains a DC motor and relays which aids in projectile extinguishing.

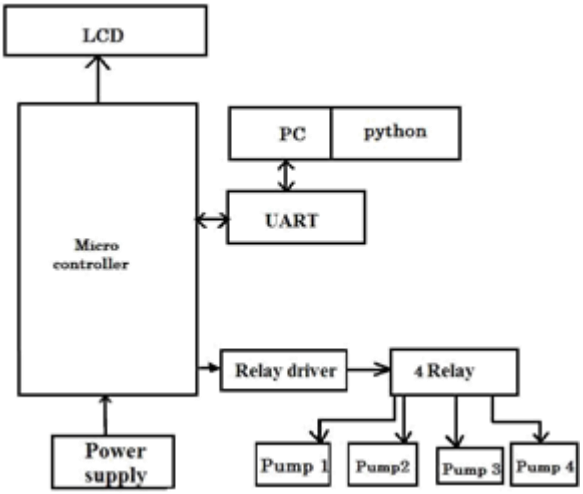


Fig 3.3 BLOCK DIAGRAM OF PROPOSED SYSYTEM

Smart devices attached to the system (refer fig 4.3) has sensing and communicating module which develop to sense the information from the atmosphere and store it in the server

A. Hardware Components
An electronic display module called an LCD (Liquid CrystalDisplay) screen has several uses. A 16x2 LCD display is a very fundamental module that is frequently included into many different devices and circuits. These modules are preferable over multi-segment LEDs with seven segments and additional segments. The explanations are that LCDs are inexpensive, simply programmable, and have no restrictionson showing customised and even customised characters, animations, and other content

A 16x2 LCD has two lines that can each display 16 characters, as seen in fig. 4.4.1. Each character on this LCD is presented using a 5x7 pixel matrix. The Command and Data registers on this LCD are its two registers.

Fig 4.4.1 LCD

The command instructions sent to the LCD are stored in the command register. A command is a directive issued to an LCD device to carry out a certain action, such as initialising it, clearing its screen, adjusting the cursor, managing the display, etc. The data that will be shown on the LCD is kept in the data register. The character's ASCII value, which will be shown on the LCD, is the data. Click to find out more about an LCD's internal construction.

4.4.1.1 LCD PIN DIAGRAM

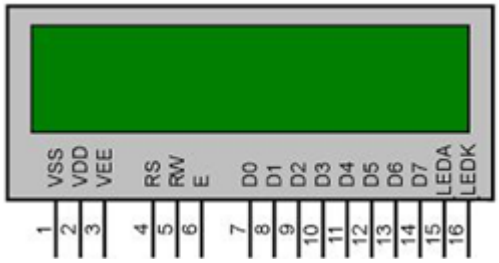


FIG 4.4.1.1 LCD PIN DIAGRAM

A Visual Guide to the Connection and Function of Each Pinon an LCD Screen is shown in fig 4.4.1.1

4.4.1.2 LCD COMMANDS

There are some preset commands instructions in LCD, which we need to send to LCD through some Micro- Controller. Some important command instructions are givenbelow:

Table 4.4.1.2 LCD COMMANDS

Hex Code	**Command to LCD Instruction Register**
0F	LCD ON, cursor ON
01	Clear display screen
02	Return home
04	Decrement cursor (shift cursor to left)
06	Increment cursor (shift cursor to right)
05	Shift display right
07	Shift display left
0E	Display ON, cursor blinking
80	Force cursor to beginning of first line
C0	Force cursor to beginning of second line

The majority of relays are made to be mounted on a PCB, however if you take care to prevent melting the plastic relay casing, you may connect wires straight to the pins.

ADVANTAGES OF RELAYS

- Relays can switch both AC and DC power, but transistorscan only handle DC power.
- Transistors cannot switch high voltages; relays can.
- Relays are preferable when switching big currents (morethan 5A).
- Multiple contacts can be switched at once using relays.

4.4.3 UART

A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs, with other communication standards such asEIA RS-232 are used commonly in conjunction.

4.4.2 RELAY

An electrically controlled switch is a relay. A magnetic fieldproduced by current passing through the relay's coil draws a lever and modifies the switch contacts. Relays feature two switch positions and are double throw (changeover) switchessince the coil current can be either on or off.

Relays enable one circuit to switch another, potentially entirely independent, circuit. For instance, a relay may switcha 230V AC mains circuit in a low voltage battery circuit. Thelink between the two circuits in the relay is mechanical and magnetic; there is no electrical connection between them.

A relay's coil normally transfers a sizable amount of current—30mA for a 12V relay, but up to 100mA for relays made to work with lower voltages—through its circuitry. Since most ICs (integrated circuits) (chips) are unable to A UART is often a single integrated circuit (or a portion of an integrated circuit) used for serial communications across aserial port on a computer or peripheral device. Nowadays, UARTs are frequently seen in microcontrollers. A dual UART, sometimes known as a DUART, integrates two UARTs into one chip. These days, many new ICs include a UART (also known as a USART) that can communicate synchronously.

The main element of a computer's serial communications subsystem is the Universal Asynchronous Receiver/Transmitter (UART) controller. Bytes of data are taken and sent by the UART as consecutive bits. The bits areput back together into whole bytes at the destination via a second UART. It is significantly more affordable to transmitdigital information (bits) serially over a single wire or other media than parallel transmission through multiple wires.

At either end of the link, a UART is utilised to transform thesent data between its sequential and parallel forms. Shift registers, the essential device for converting between serial and parallel modes, are found within each UART.

(A) MAX232:

supply this current, a transistor is typically employed toincrease the modest IC current to the higher amount needed for the relay coil. The ubiquitous 555 timer IC's 200mA maximum output current allows these gadgets to directly power relay coils without amplification.

Relays often feature SPDT or DPDT switch contacts, but they can also have many more sets. For instance, relays with foursets of changeover contacts are widely available. Please see the article on switches for further details on switch contacts and the terminology used to describe them.The MAX232 is an integrated circuit that transforms signalscoming from an RS-232 serial port into signals that may be used in digital logic circuits that are compatible with TTL. The RX, TX, CTS, and RTS signals are commonly converted by the MAX232, a dual driver/receiver.

The drivers utilise on-chip charge pumps and external capacitors to deliver RS-232 voltage level outputs (about 7.5V) from a single + 5 V supply. Due to the fact that the powersupply design does not need to be sophisticated in order to

drive the RS-232 in this scenario, it is beneficial for implementing RS-232 in devices that would not ordinarily require any voltages outside of the 0 V to + 5 V range.

Receivers lower RS-232 inputs, which can reach up to 25 V,to 5 V TTL levels. These receivers typically feature a 1.3 V threshold and a 0.5 V hysteresis.
Although the newer MAX232A can function at faster baud rates and with smaller external capacitors (0.1 F as opposed to the 1.0 F capacitors used with the original device), it is backwards compatible with the earlier MAX232.

4.4.3.1 PIN DIAGRAM OF UART FEATURES

Fig 4.4.4 MICRO-CONTROLLER

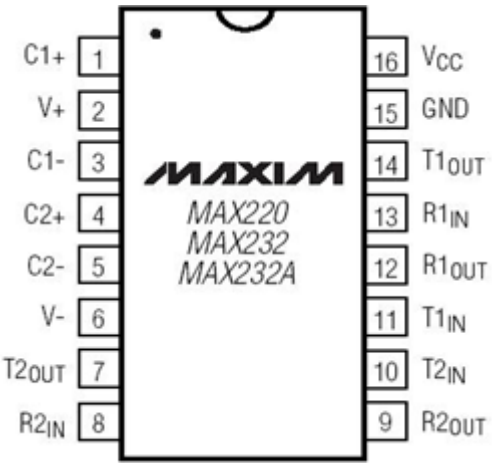


Fig 4.4.3.1 PIN DIAGRAM OF UART

Figure 4.4.3.1 provides a visual depiction of the different pins and their respective roles in a Universal Asynchronous Receiver/Transmitter (UART)communication interface.

4.4.4 AT89S52 MICRO-CONTROLLER
A CMOS 8-bit Micro-Controller with low power consumption and great performance, the AT89S52 has 8K bytes of internal programmable flash memory. The product ismade with high-density non-volatile memory technology from Atmel, and its pinout and instruction set are compliant with industry standards.
Compatible with MCS®-51 Products.

- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Operating Range: 4.0 to 5.5 volts.
- Operating Frequency Range: 0 Hz to 33 MH
- Programme Memory Lock with three levels
- Internal RAM of 256 x 8 bits.
- 32 I/O lines utilising programming
- Three timer/counters in 16-bit format.
- Eight Sources that Interrupt
- UART Serial Channel with Full Duplex.
- Power-down and low-power idle modes.
- Interrupt Power-down Mode Recovery.
- The watchdog timer.
- Double Data Pointer.

- Flag for power-off.
- Quick programming turnaround.
- ISP Programming Flexibility (Byte and Page Mode).
- Packaging that is eco-friendly (Pb/Halide-free).

(B) DESCRIPTION

A CMOS 8-bit Micro-Controller with low power consumption and great performance, the AT89S52 has 8K bytes of internal programmable flash memory.

The product is made with high-density nonvolatile memory technology from Atmel, and its pinout and instruction set arecompliant with industry standards.

The programme memory may be updated in-system or usingtraditional nonvolatile memory pro-grammes thanks to the on-chip Flash. The Atmel AT89S52 is a potent Micro- Controller that offers a highly flexible and economical solution to many embedded control applications by combining an adaptable 8-bit CPU with in-system programmable Flash on a monolithic chip.

The AT89S52 offers the following features as standard: 32 I/O lines, 8K bytes of Flash, 256 bytes of RAM, three 16-bit timer/counters, a Watchdog timer, two data pointers, a six- vector two-level interrupt architecture, an on-chip oscillator,and clock circuits are all included.

The AT89S52 also features two software configurable powersaving modes and static logic allowing operating down to zero frequency. The CPU is turned off in idle mode, but the RAM, timers and counters, serial port, and interrupt system are still operational.

The oscillator is frozen in the Power-down mode, which alsodisables all other chip operations until the next interrupt or hardware reset. However, the RAM contents are saved.

4.4.4.1 PIN CONFIGURATION

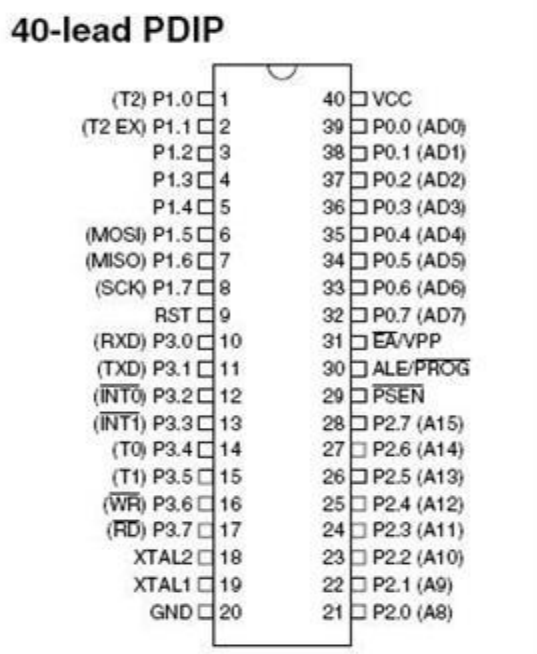


Fig 4.4.4.1 Pin Configuration Of The Micro-Controller

The pin configuration of the micro-controller is shown in thefigure 4.4

4.4.4.2 PIN DESCRIPTION

(A) VCC

It supplies voltage to the Micro-Controller.
(B) GNDGround.
(C) Port 0
An 8-bit open drain bidirectional I/O port is Port 0. Each pinhas an output port that can accept eight TTL inputs. The pinson port 0 can be utilised as high-impedance inputs when 1s are written to them.
When accessing external programme and data memory, Port0 can also be set up to serve as the multiplexed low-order address/data bus. P0 features internal pull-ups in this mode.
During Flash programming and programme verification, Port0 also receives and outputs the code bytes. It is necessary to do external pull-ups while verifying a programme.

(D) Port 1
Port 1 is an internal pull-up, 8-bit, bidirectional I/O port. FourTTL inputs can be sourced or sunk via the Port 1 output buffers. When 1s are written to Port 1 pins, the internal pull-ups raise them so they may be utilised as inputs.

Because of the internal pull-ups, Port 1 pins that are externally pushed low will source current (IIL). Additionally,as indicated in the accompanying table 4.4.4.1, P1.0 and P1.1can be set up to represent the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively.

The low-order address bytes during Flash programming and verification are also received on port 1.

Table 4.4.4.1 Port 1 Functions

Port Pin	Alternate Functions
P1.0	T2 (external count input to Timer/Counter 2), clock-out
P1.1	T2EX (Timer/Counter 2 capture/reload trigger and direction control)
P1.5	MOSI (used for In-System Programming)
P1.6	MISO (used for In-System Programming)
P1.7	SCK (used for In-System Programming)

(E) Port 2

Port 2 is an internal pull-up, 8-bit, bidirectional I/O port. FourTTL inputs can be sourced or sunk using the Port 2 output buffers. When 1s are written to Port 2 pins, the internal pull-ups raise them so they may be utilised as inputs.

Because of the internal pull-ups, Port 2 pins that are externally pushed low will source current (IIL). When accessing external data memory using 16-bit addresses (MOVX @ DPTR) and fetching data from external programme memory, Port 2 transmits the high-order addressbyte.

Port 2 emits 1s with substantial internal pull-ups in this application. Port 2 emits the data from the P2 Special Function Register when it makes an 8-bit address (MOVX @RI) access to an external data memory.

During Flash programming and verification, Port 2 additionally gets some control signals as well as the high- order address bits.

Alternative Functions for Port Pin P1.0 T2, clock-out (external count input to Timer/Counter 2). P1.1 T2EX (Trigger and direction control for Timer/Counter 2 capture/reload) (Used for In-System Programming) P1.5 MOSI (Used for In-System Programming) P1.6 MISO (Usedfor In-System Programming) P1.7 SCK

(F) Port 3

An 8-bit bidirectional I/O port with inbuilt pull-ups is port number 3. Four TTL inputs can be sourced or sunk via the Port 3 output buffers. When 1s are written to Port 3 pins, theinternal pull-ups raise them so they may be utilised as inputs.

Because of the pull-ups, Port 3 pins that are being pulled lowexternally will source current (IIL). Some control signals arereceived on Port 3 for Flash programming and verification. As may be seen in the accompanying table 4.4.4.2, port 3 is also used by the AT89S52's many special features.

Table 4.4.4.2 PORT 3 FUNCTIONS

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

(G) RST
Input is reset. While the oscillator is functioning, a high on this pin for two machine cycles resets the gadget.

After the Watchdog timer expires, this pin remains high for 98 oscillator cycles. It is possible to deactivate this function by setting the DISRTO bit in the SFR AUXR (address 8EH).The RESET HIGH out capability is active in bit DISRTO's default configuration.

(H) ALE/PROG
When accessing external memory, the low byte of the addressis latched using the Address Latch Enable (ALE) output pulse. Additionally, during Flash programming, this pin serves as the programme pulse input (PROG).

For external timing or clocking reasons, ALE, which emits ata steady rate of 1/6 the oscillator frequency during normal operation, may be employed. However, take note that each time you access external data memory, one ALE pulse is skipped.

Setting bit 0 at SFR position 8EH will prevent ALE functionality if desired. The bit must be set in order for ALEto operate outside of a MOVX or MOVC command.

Otherwise, the pin is only shakily raised. If the Micro- Controller is operating in external execution mode, setting theALE-disable bit has no impact.

(I) PSEN
The read strobe for external programme memory is called Programme Store Enable (PSEN).

PSEN is engaged twice each machine cycle while the AT89S52 is running code from external programme memory,but two PSEN activations are ignored if external data memory is accessed.

(J) EA/VPP
Enable External Access. The device can only fetch code fromaddresses in external programme memory starting at 0000H through FFFFH if EA is connected to GND.

To be aware of, EA will be internally latched on reset if lockbit 1 is configured. In order to execute internal programmes,EA should be fastened to VCC. During Flash programming, this pin additionally receives the 12-volt programming enablevoltage (VPP).

(K) XTAL1
Input to the operational circuit for the internal clock as well as input to the inverting oscillator amplifier.

(L) XTAL2
The inverting oscillator amplifier's output.

(M) Memory organisation
Programme and data memory have their own address spacesin MCS-51 devices. External Programme and Data Memory can be addressed in blocks of up to 64K bytes each.

(N) Programme Memory
All programme fetches are routed to external memory if the EA pin is linked to GND. Programme fetches to locations 0000H through 1FFFH on the AT89S52 are directed to internal memory, while fetches to addresses 2000H through FFFFH are addressed to external memory if EA is connectedto VCC.

(O) DATA MEMORY
On-chip RAM in the AT89S52 is implemented with 256 bytes. A parallel address space for the Special FunctionRegisters is used

by the first 128 bytes.

As a result, even though the upper 128 bytes share addresseswith SFR space, they are physically distinct from it.

The address mode used in the instruction determines whetherthe CPU accesses the upper 128 bytes of RAM or the SFR space when an instruction visits an internal location above address 7FH. Direct addressing instructions have access to the SFR space.

The SFR is accessed, for instance, by the following direct addressing instruction at position 0A0H (P2). 0A0H MOV, #data Indirect addressing instructions have access to the top 128 bytes of RAM.

For instance, the following indirect addressing instruction accesses the data byte at address 0A0H rather than P2 (whoseaddress is 0A0H), as R0 includes the address 0A0H.

Motion @R0, data Keep in mind that indirect addressing is used for stack operations, therefore the first 128 bytes of thedata RAM are accessible for use as stack space.

(P) WATCHDOG TIMER

The WDT is designed to act as a recovery technique when the CPU is possibly affected by software disruptions. The Watchdog Timer Reset (WDTRST) SFR and a 14-bit countermake up the WDT. The WDT is initially disabled upon reset.

A user must write 01EH and 0E1H in that order to theWDTRST register (SFR location 0A6H) in order to turn on the WDT.

While the oscillator is functioning, the WDT will increase every machine cycle when it is enabled. The external clock frequency affects how long the WDT timeout period lasts.

Only a reset (either a hardware reset or a WDT overflow reset) can disable the WDT. WDT will produce an output RESET HIGH pulse at the RST pin when it overflows.

(Q) USING THE WDT

A user must write 01EH and 0E1H in that order to theWDTRST register (SFR location 0A6H) in order to turn on the WDT.

To prevent a WDT overflow when the WDT is activated, theuser must service it by writing 01EH and 0E1H to WDTRST.
When the 14-bit counter reaches 16383 (3FFFH), it overflows and resets the device.

While the oscillator is functioning, the WDT will increase every machine cycle when it is enabled. This indicates that atleast every 16383 machine cycles, the user must reset the WDT.

The user needs write 01EH and 0E1H to WDTRST in order to reset the WDT. A write-only register is WDTRST. There is no way to read or write to the WDT counter.

WDT will provide an output RESET pulse at the RST pin if it overflows. The RESET pulse lasts 98xTOSC, with TOSC equal to 1/FOSC.

The WDT should be maintained in those areas of code that will be frequently performed within the time necessary to prevent a WDT reset in order to get the most out of it.

(R) WDT DURING POWER-DOWN AND IDLE

The oscillator stops in power-down mode, which also stops the WDT. The user is not required to maintain the WDT whenit is in Power-down mode.

A hardware reset or a level-activated external interrupt that has been enabled before entering Power-down mode are the two ways to escape the mode.

Servicing the WDT should proceed as usual anytime the AT89S52 is reset after Power-down is ended with hardware reset. The way things work when Power-down is interruptedis very different. Long enough for the oscillator to stabilise, the interrupt is kept low.

Interrupts are handled when they are raised in priority. The WDT is not activated until the interrupt is pushed high in order to avoid the WDT from reseting the device while the interrupt pin is maintained low. In order to escape Power- down mode, it is advised that the WDT be reset during the interrupt service.

It is preferable to reset the WDT right before entering Power-down mode to prevent the WDT from overflowing within a few states of departing Power-down. The WDIDLE bit in SFR AUXR is used to determine whether the WDT continuesto count if enabled before entering the IDLE mode.

When IDLE is the default state (WDIDLE bit = 0), the WDTcontinues to count. The user should always set up a timer thatwill regularly exit IDLE, service the WDT, and then return IDLE mode in order to avoid the WDT from reseting the AT89S52 while it is in IDLE mode.

When the WDIDLE bit is enabled, the WDT will halt counting while in IDLE mode and begin counting when IDLE is exited.

(S) USES OF MICRO-CONTROLLER

This effective element is, like all excellent things, fundamentally quite straightforward. It is created by combining tried-and-true, premium "ingredients"(components) in accordance with the protocol below:

- The "brain" of the next system is the most basic computer processor.
- A little memory, a few A/D converters, timers, input/outputlines, etc. are added based on the manufacturer's preferences.
- All of stuff is contained in a few of the common packages.
- Software that is both easy to use and capable of controllingeverything has been created.

Numerous varieties of Micro-Controllers were created basedon these principles, and they swiftly evolved into man'sinvisible friend. Their astonishing simplicity and adaptabilitylong ago won us over.

The development and success of the Micro-Controllers havebeen greatly influenced by the following factors:

- The Micro-Controllers' potent and carefully selected embedded electronics can independently control various processes and devices, such as industrial automation, electriccurrent, temperature, engine performance, etc., or they can do so via input/output devices (switches, push buttons, sensors, LCD displays, relays, etc.).
- Due to their extremely cheap pricing, they may now be included into devices where it was previously not profitable to do so. Because of this, the world is currently overrun withinexpensive automated gadgets and different "smart" products.
- Programming virtually ever requires prior knowledge. It is sufficient to have a PC with software that is both user-friendly and not at all demanding, as well as a basic tool called a programmer for "loading" pre-made programmes into a microcontroller.

Therefore, if you have been infected by the electronics virus,your only option is to learn how to harness its power.

4.4.5 DC MOTOR

Simple electromagnetism underpins the operation of anyelectric motor. When a conductor carrying current is exposedto an external magnetic field, it produces a magnetic field thatgenerates a magnetic field that is proportional to both the external magnetic field's intensity and the conductor's current. As you are well aware from your childhood experiences with magnets, like polarities (North and North, South and South) repel whereas opposing polarities (North and South) attract. A DC motor's internal structure is made to take use of the magnetic interaction that occurs when acurrent-carrying conductor interacts with an external magnetic field to produce rotational motion.

The field winding is not linked in series with the armature like it is with a series motor; rather, it is connected in parallel.It's important to keep in mind that a parallel circuit is frequently referred to as a shunt in fundamental electrical theory. The field winding is known as a shunt winding and the motor is known as a shunt motor since it is connected in parallel with the armature. Figure depicts a shunt motordiagram. The armature terminals are labelled Al and A2, while the field terminals are designated Fl and F2. You should note that a thin line used to depict the shunt field in this diagram has numerous twists.

Let's begin by taking a look at a basic two-pole DC motor (inthis case, red denotes a magnet or winding with "North" polarisation and green denotes a magnet or winding with "South" polarisation).

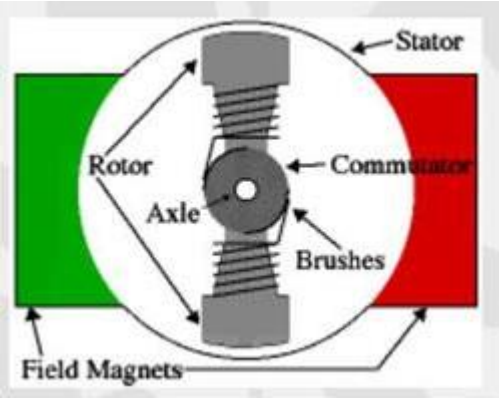


Fig 4.4.5 DC MOTOR

Every DC motor, as seen in fig. 4.4.5, consists of six fundamental components: the axle, the rotor (also known as the armature), the stator, the commutator, the field magnet(s), and the brushes. High-strength permanent magnets are used to create the external magnetic field in the majority of typicalDC motors (and all that Beamers will see)1. The motor's fixed component is known as the stator, which also contains the motor housing and one to two permanent magnet pole parts. Rotation with regard to the stator is accomplished by the rotor, together with the axle and associated commutator. Thecommutator is electrically coupled to the windings that makeup the rotor, which are typically on a core. A typical motor configuration may be seen in the diagram above, whichplaces the rotor inside the stator (field) magnets.

The brushes, commutator contacts, and rotor windings are arranged geometrically (see fig. 4.4.5.1) in such a way that when power is provided, the energised winding's polarity andthe stator magnet(s) are out of alignment. As a result, the rotorrotates until it is almost aligned with the stator's field magnets. The brushes travel to the following commutator contacts as the rotor aligns and energise the following winding. With regard to our two-pole example motor, spinning causes the current flowing through the rotor winding to reverse, which causes the rotor's magnetic field to "flip," causing the rotor to continue revolving.

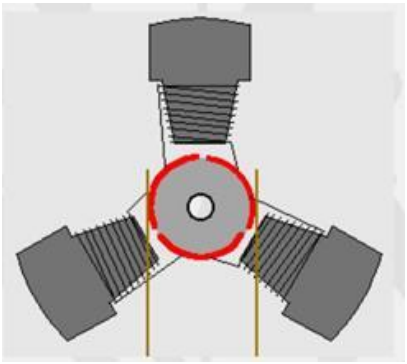


Fig 4.4.5.1 GEOMETRY OF DC MOTOR

DC motors will almost usually have three poles or more (four is also a popular number). This prevents "dead spots" in the commutator, in particular. You can see how, in our example two-pole motor, the rotor will become "stuck" if it is completely aligned with the field magnets in the midst of its revolution. A two-pole motor's commutator can briefly cut off the power supply when both brushes make simultaneous contact with both commutator contacts. The power supply would suffer, energy would be wasted, and motor parts wouldalso be harmed. The fact that such a straightforward motor would show a significant amount of torque "ripple" is still another drawback.

4.4.5.1 DC SHUNT MOTOR

The variation in speed with a change in load and the variationof torque with a change in load are two parameters that mustbe taken into consideration when choosing a motor for a given application. Shunt motors function essentially as constant speed machines. A load will usually cause the motorto slow down.

The little speed reduction lowers the counter emf, which raises the armature current. Until the increasing current creates enough torque to satisfy the needs of the increased load, this procedure is continued. A change in load always results in a reaction that adjusts the power input to the changein load, therefore the shunt motor is in a stable equilibrium condition as a consequence.

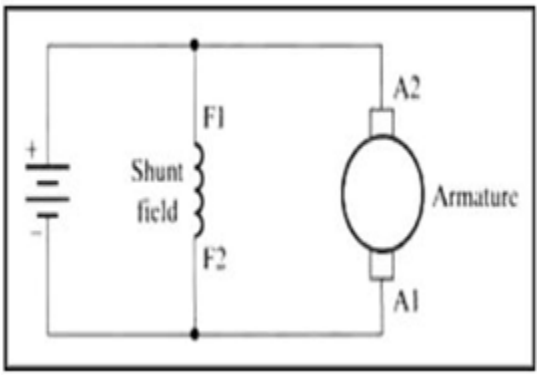


Fig 4.4.5.2 DIAGRAM OF DC SHUNT MOTOR

Figure 4.4.5.2 depicts a shunt motor's fundamental circuit. The only winding seen is the shunt field winding. The series winding that has been added to the figure counteracts the effects of armature response. Figure illustrates a compound motor as seen from the perspective of a schematic diagram.

The fact that the commutating winding is not wound on the same pole as the field winding and that the series field only has a small number of wire turns in series with the armature circuit prevents this type of motor from being classified as a compound motor. The operating characteristics therefore resemble those of a shunt motor. The phrases compensated shunt motor or stabilised are used on the motor's nameplate to indicate this.

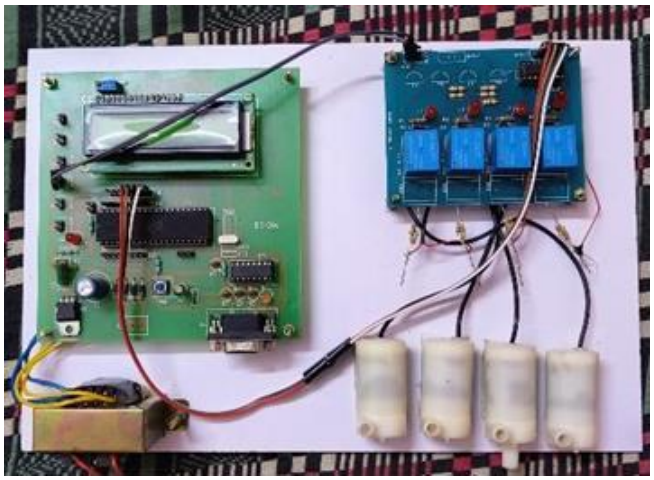
B. Software Components

B.1 Python

Utilise the AppDynamics Application Intelligence Platform to identify the primary contributors to performance bottlenecks in your Python apps. When operating in a real- time production environment, AppDynamics allows you to dive deep into request stack traces to identify performance bottlenecks in your mission-critical Python applications. Forthose responsible for assuring the performance of Python programmes, the new world of distributed web apps has generated a completely new set of issues. Python programmes today function in fast changing contexts as a result of the move towards service-oriented architectures(SOA) and micro services. As a result, performance issues emerge that are frequently challenging to find, recognise, andresolve.

It's more crucial than ever to have a quick and easy approachto monitor, diagnose, and fix application issues before they have an impact on sales as these apps grow more and more vital to the company. With minimum cost, AppDynamics enables you to monitor your Python apps in production,giving you real-time visibility into performance and allowingyou to quickly identify the source of any code bottlenecks. Through process-level code visibility, proactive monitoring, and deep analysis, AppDynamics unveils the inner workingsof your application and infrastructure, allowing performanceand capacity optimisation. With our help, businesses can track down the core of the problem 90% quicker and monitor,debug, and diagnose their production applications with 10x more visibility than they now have.

3. RESULT AND ANALYSIS



The hardware kit shown in Fig 5.1 shows us some of the basiccomponents like the Relays and the DC Motor. The smart fire extinguisher is used to detect the presence of a fire, and oncethe fire is detected with the exact location, it sends a signal tothe microcontroller of the relay in the prototype. The microcontroller then activates the relay, which turns on the DC motor.

The DC motor is connected to the water pump, which in turndraws water from the tank and sprays it onto the area of the fire identified by the extinguisher. The relay is used to switchthe DC motor on and off, controlling the flow of water and ensuring that the fire is extinguished efficiently and as quickly as possible

CONCLUSIONS

To conclude the proposed project, even though fire accidentshave been common and unchanging for a very long time throughout the years, the method of fire extinguishing can beupgraded according to the requirements and the evolving technology to make living for the human race even a little bitenhanced and modernized.

The ability of the Smart Fire Extinguisher's system to even function without any kind of human interface is what makes it ideal and convenient. The main objective of our project is to identify fire as earliest as possible and put it out using focused extinguishing using relays and DC motors without causing unwanted damage to any important property and helpcontain the fire from spreading any further.

4. FUTURE SCOPE

The smart fire extinguisher in the future can be maximized inperformance by including several hardware components suchas a battery backup system, a pressure gauge, and an LCD display to provide information about the device's status and conduct. This can also help providing real-time monitoring and control capabilities that can improve overall safety and efficiency. The System can also include a 360° camera for clear magnified viewing.

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