ELECTRICAL FAULT PROTECTION IN INDUSTRIES

A Thesis Submitted in partial fulfillment of the Requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

in

ELECTRICAL AND ELECTRONICS ENGINEERING

to

Jawaharlal Nehru Technological University, Hyderabad

by

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We wish them every success in life.

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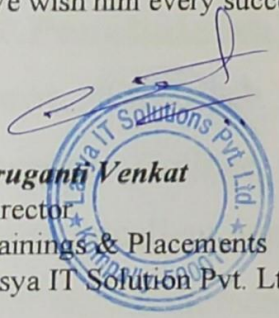

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LIST OF CONTENTS

DESCRIPTION			PAGE NO.
Certificate			i
Acknowledgement			ii
Declaration			iii
List of Contents			iv-v
List of Figure			vi
List of Tables			vii
List of Photographs			vii
Nomenclature			viii-ix
Abstract			x
Chapter-1	**INTRODUCTION**		
1.1.1	Introduction to the project		1-2
1.2	Literature survey		2-4
Chapter-2	**INTRODUCTION ABOUT EMBEDDED SYSTEMS**		
2.1	Introduction		5
2.2	Block diagram of embedded system		6
2.3	Applications of Embedded system		6
Chapter-3	**MICRO CONTROLLER UNIT**		
3.1	ATMEGA328		7-8
3.2	Board types		9-12
3.3	Board description		13-15
3.4	Pin description of ATMEGA328		16
Chapter-4	**POWER SUPPLY UNIT**		
4.1	Introduction		17
4.1.1	Block diagram of power supply		17
4.1.2	Description of power supply		18
4.2	Capacitor filter		18-19
4.3	Voltage regulator		19
Chapter-5	**PROJECT DESCRIPTION**		
5.1	Hardware requirement		20
5.2	Block diagram of project		20
5.3	Voltage sensor		20
5.3.1	Voltage sensor module pinout configuration		21
5.3.2	Voltage detection sensor module sensor features & specifications		21-22
5.4	Relay		22-24

Chapter-6 SOFTWARE EXPLANATION

6.1 Software explanation 25

6.1.1 Arduino software 25-33

6.2 MC Programming language: Embedded C 33

6.3 Proteus 33-41

6.4 Project code 42-43

Chapter-7 RESULT & CONCLUSION

7.1 Application of the project 44

7.2 Advantages of the project 44

7.3 Result 45-46

7.4 Conclusion 47

7.5 Future scope 48

8 References 49-50

LIST OF FIGURES

Figure No	Description	Page No.
2.2	Block diagram of embedded system	6
3.1	Arduino Uno	8
3.3	Board Description	13
3.7	Pin Description of ATMGA328	16
4.4.1	Block Diagram of Power Supply	17
4.4.1(A)	Schematic Diagram of Power Supply	17
4.5	Capacitor Filter	18
4.5(A)	Full –Wave Rectifier with a Capacitor Filter	19
4.6	Regulator	19
5.2	Block diagram of the project	20
5.3.2	Internal circuit diagram	22
5.4(A)	Relay	22
5.4(B).	SPST Relay	23
5.4(C)	SPDT Relay	23
5.4(D)	DPST Relay	27
6.1	Arduino with battery	32
6.3.1 Proteus File Menu		34
6.3.2	Proteus Default Template Select	35
6.3.3	Proteus Design Sheet	36
6.3.4	Component Mode	36
6.3.5	Pick from Libraries	37
6.3.6	Keyword Textbox	37
6.3.7	Push Button Selection	38
6.3.8	Component Selection	38
6.3.9	Component Properties Selection	39
6.3.10	Component Properties Edit	39
6..3.11	Simulation Run	40
6.3.12	Simulation Animating	40
6.3.13	Simulation Step-Pause-Stop Buttons	41

LIST OF TABLES

Table No.	Description	Page No.
3	ATMEGA328 specifications	7
3.1	Arduino based on ATMEGA328 microcontroller	9-11
3.2	Arduino based on ATMEGA32u4 microcontroller	11
3.3	Arduino based on ATMEGA2560 microcontroller	11-12
3.4	Arduino based on AT91SAM3X8E microcontroller	12
3.5	Board description	13-15
5.3.1	Voltage sensor module pinout configuaration	21

LIST OF PHOTOGRAPHS

Photograph No.	Description	Page No.
7.3	Result	45-46

NOMENCLATURE

ASIC	:	Application specific integrated circuit
ALP	:	Arithmetic logic program
IDE	:	Integrated development environment
USB	:	Universal serial bus
GND	:	Ground
SPI	:	Serial peripheral interface
LED	:	Light emitting diode
TX	:	Transmit
RX	:	Receive
AREF	:	Analog reference
LCD	:	Liquid crystal displays
SPST	:	Single pole single through
SPDT	:	Single pole double through
DPST	:	Double pole single through
GPS	:	Global Positioning System
GSM	:	Global System for Mobile Communication
DSP	:	Digital Signal Processing
PC	:	Personal Computer
RAM	:	Random Access Memory
FPU'S	:	Floating-Point Processing Unit
TCB	:	Trusted Computing Base
LCD	:	Liquid Crystal Display
API	:	Application Program Interface
LED	:	Light Emitting Diode
RPS	:	Regulated Power Supply
EEPROM	:	Electrically Erasable Programmable Read Only Memory
GPRS	:	General Packet Radio Services
VLR	:	Visitor Location Register
EIR	:	Equipment Identity Register
OSS	:	Operation Support Subsystem
TMC	:	Telecommunication Management Network
EIA	:	Electronic Industries Association
RF	:	Radio Frequency
IEEE	:	Institute of Electrical & Electronics Engineering
EN	:	Enable

RW	:	Read/Write
RS	:	Register Select
FREEDM	:	Future renewable electric energy delivery & management

ABSTRACT

Protection of an induction motor (IM) or any other loads against possible problems, such as overvoltage, overcurrent, overload, over temperature, and under voltage, occurring in the course of its operation is very important, because it is used intensively in industry as an actuator. In industries loads can be protected using some components, such as timers, contactors, voltage, and relays. This method is known as the classical method that is very basic and involves mechanical dynamic parts. Computer and programmable integrated circuit based protection methods have eliminated most of the mechanical components. However, the computer-based protection method requires an analog-to-digital conversion (ADC) card, and the controller-based protection method does not visualize the electrical parameters measured. In this method, the voltages measured by voltage sensor are monitored and warning messages are shown on the LCD.

CHAPTER-1

INTRODUCTION

1.1.1. Introduction to the project:

In earlier days dc motors were frequently used for industrial applications. A large number of motors is being used for general purposes in our surrounding from household equipment to machine tools in industrial facilities. The electric motor is now a necessary and indispensable source of power in many industries. The function and performance required for these motor are wide-ranging. With the invention of AC induction motors that have higher overall performance attributes over DC motor, industrial automation are being broadly achieved with it. An induction is an electric motor in which the electric contemporary inside the rotor, needed to produce torque is obtained by means of electromagnetic induction from the magnetic field of the stator winding. the primary benefits of the IM are its reliability, low value, and ease of production with recognize to presently used high overall performance vehicles however it's miles a great deal more difficult to manipulate. Single segment and 3 phase induction machines are very popular inside the industries due to their substantial programs. Induction Motor are the maximum extensively used motor for home equipment, induction manipulate, and automation; subsequently they may be roust, dependable and sturdy. Induction motor usually suffers from underneath voltage, over voltage, overheating. Due to this electrical fault the winding of motor get heated which cause insulation failure and as a consequence reduce the existence time of motor. When the Induction motor deliver with better voltage than is rated then induction motor starts off evolved over heated. When deliver voltage is lower than rated then voltage drop across the resistance is better than it protects the motor from this fault. Whilst deliver voltage is lower than voltage drop across the resistance is decrease than precise cost and motor fails to begin. it's miles especially preferred that Induction motor works freely from the such types of faults.

This fault is generated in induction motor due to variant in induction motor parameters. When Induction motor runs constantly, it's miles necessary to shield the motor from these anticipated faults.

The safety of induction motor plays a vital function in its long existence provider. The small scale industries are not able to offer expensive protection to the drives in use as it wills growth their capital value. Consequently a cheap and compact design has been executed for safety of induction motor in opposition to under voltage, over voltage, over present day, below modern.

Because of the poor electricity quality the harm of induction automobiles in small scale industries desires to be sorted. Therefore it becomes important to protect them against faults on the way to make sure uninterrupted operation and functioning. Numerous parameter controlling and monitoring systems are present for other varieties of system, however in case of the induction gadget the controlling and monitoring structures aren't considerably used because of high cost of set up and physical constraints. in order to triumph over the restrictions in monitoring and controlling, Arduino based gadget is used which makes it fee-effective and easy. One-of-a-kind tactics have been evolved for induction motor manage and parameter estimation, but most effective partial results were obtained. In it is managed by means of acquiring records concerning stator flux

and motor velocity. In the manipulate gadget makes use of unknown time varying rotor resistance and cargo torque and in the data is obtained throughout normal operation. After going through all these papers it was concluded that the Arduino primarily based safety system of the induction motor is feasible and may be accurately carried out for the use of business automation.

1.2 Literature survey:

KV Baoze Wei in his paper demonstrated that, in order to prevent working accidents by electrocution in high voltage systems, the main safety measure consists in connecting the earthing devices, on the both sides of working area. In any of these three cases, if the earthing devices are chosen and placed correctly, in the working area, as we expected, the drop voltage, is limited to a safety value.

The worker on the console can touch one phase at a maximum distance of 2 m, and the voltage does not exceed 1 V, for 10 of the earth dispersion resistance. Rakesh Maisuriya in simulation of short circuit condition and fault analysis in power system .From the discussion of IEEE 14 bus power system Mat-Lab model we can conclude that in an interconnected electrical power system if there is a fault occurs in any of the subsystem , all the system voltages and system currents are affected and must be improved otherwise it will creates fault of circuit parameters to other lines.

This paper presents the Research literature work and the Review about the Short Circuit Analysis of a large Power System Network.

Survey and lot of research papers have been presented for the improvement and new methods to analyze the Short Circuit Calculation in a Power System. The Aim of this Review Paper is to propose a calculation method in effortless technique for Short Circuit Analysis.

The analysis of the most serious short-circuit fault provides a very high inrush current which is very dangerous for the system so to chop out this heavy current, a suitable step should be taken so that the dangerous effects of symmetrical faults can diminish and making the system more reliable.

If we will not improve or disconnected faulty lines or area from healthy lines or area then huge crisis of power will be occurred, even blackouts. So instability, transient stability, fault analysis are very important in power network. Sharthak Munasib in Short-Circuit Protection for LowVoltage DC Distribution Systems Based on Solid-State Circuit Breakers The work presented in this thesis addressed some important issues regarding the short-circuit protection of low-voltage dc distribution systems. The following conclusions and contributions are drawn from the results presented and analyzed in the thesis: The RB-IGCT seems the best semiconductor device for implementing a 1- KVDC SSCB since it has the short-circuit capability of a thyristor (~ 3 kA), extremely low on-state voltage drop (~1.25 V) during normal SSCB operation, and blocks voltages in forward and reverse directions but conducts current only in the forward direction. It has low thermal resistance, assisted by double-sided cooling and hermetic sealing resulting from its hockey-puck, thyristor-type package.

All of these attributes should result in increased efficiency, compactness and reliability when compared to other controllable devices Compared to the standardized opening time of 35-40 ms during a fault for electromechanical circuit breakers, the SSCB containing RB-IGCT as the semiconductor switch would exhibit an opening time of 40µs Unavoidable controller delays require that additional devices be connected in

parallel to sustain higher. Main power circuit based hardware protection or combined with modified algorithm control method: In some other literatures, the protection methods are based on modifying the main power circuit by adding auxiliary protection circuit or using different control method in the software under fault condition.

The concept of the protection in is using an auxiliary switch, connected along with driving circuit, between the positive rail of the DC bus capacitors and the collector/drain terminal of the upper switching transistor. The disadvantage is that the complexity of the circuit is increased given that auxiliary drive circuit need to be incorporated for switching the protecting transistor.

Also it proposed another protection method called linear current protection method, which contains more auxiliary switches and resistors for the protection circuit. This method will increase the cost and the volume of the system; also will increase the power loss because of the auxiliary components. Algorithm based overload or short circuit protection method :

The over current control strategy in is based on generating new current reference according to a current limit function, an auxiliary control loop, and a look up table is used to store the original current reference. In a current limiting method was proposed based on a hysteresis comparator circuit and switched to current controlled mode after over current happens.

CHAPTER-2

INTRODUCTION ABOUT EMBEDDED SYSTEMS

2.1 Introduction:

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious.

All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases, a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes.

The applications software on such processors is sometimes referred to as firmware.

The simplest devices consist of a single microprocessor (often called a "chip”), which may itself be packaged with other chips in a hybrid system or Application Specific Integrated Circuit (ASIC). Its input comes from a detector or sensor and its output goes to a switch or activator which (for example) may start or stop the operation of a machine or, by operating a valve, may control the flow of fuel to an engine.

As the embedded system is the combination of both software and hardware

2.2 Block diagram of embedded system:

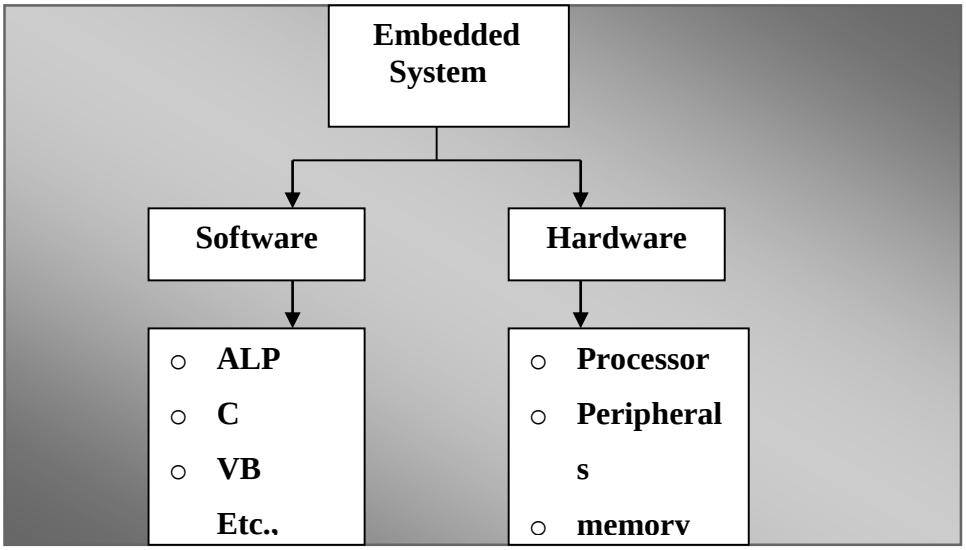


Fig.2.2: Block diagram of embedded system

Software deals with the languages like ALP, C, and VB etc., and Hardware deals with Processors, Peripherals, and Memory

2.3 Applications of embedded systems:

- Manufacturing and process control
- Construction industry
- Transport
- Buildings and premises
- Domestic service
- Communications

CHAPTER-3

MICRO CONTROLLER UNIT

3.1 ATMEGA328

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog , input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

The ATmega8 microcontroller contains 32 general purpose working registers. As shown in the below figure these registers are directly connected to ALU. Two registers can carry one single instruction consequently in one clock cycle.

Specifications:

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 Ma
DC Current on 3.3V Pin	50 Ma
Flash Memory	32 KB (0.5 KB is used for Boot loader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Table 3.1: Atmega328 specifications

Arduino:

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are −

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

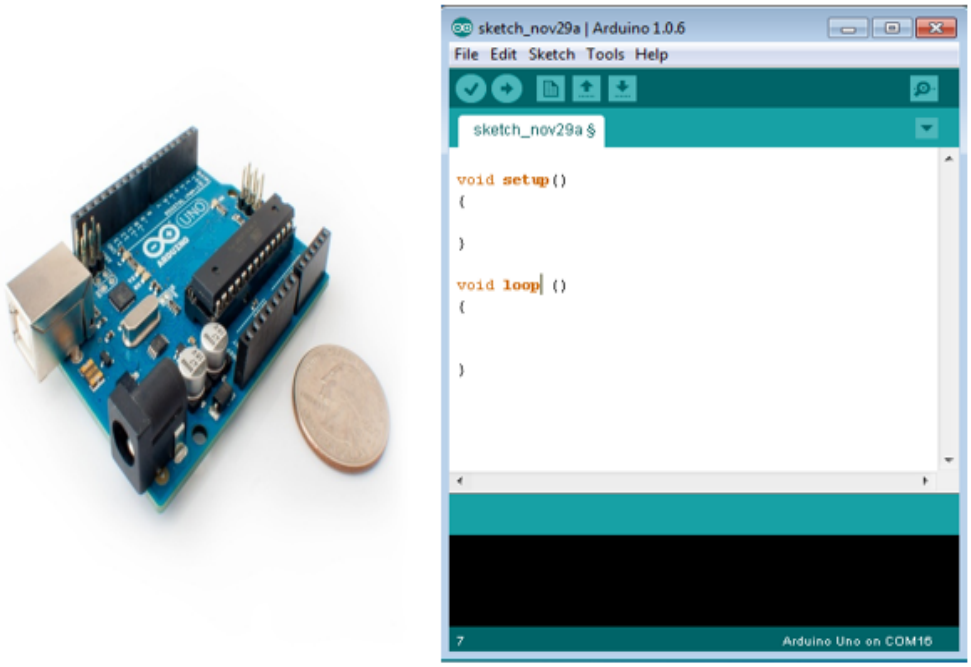


Fig 3.1 Arduino Uno

3.2 Board Types

Various kinds of Arduino boards are available depending on different microcontrollers used. However, all Arduino boards have one thing in common: they are programed through the Arduino IDE.

The differences are based on the number of inputs and outputs (the number of sensors, LEDs, and buttons you can use on a single board), speed, operating voltage, form factor etc. Some boards are designed to be embedded and have no programming interface (hardware), which you would need to buy separately. Some can run directly from a 3.7V battery, others need at least 5V.

Here is a list of different Arduino boards available.

Table 3.1 Arduino boards based on ATMEGA328 microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Uno R3	5V	16MHz	14	6	6	1	USB via ATMega16U2
Arduino Uno R3 SMD	5V	16MHz	14	6	6	1	USB via ATMega16U2
Red Board	5V	16MHz	14	6	6	1	USB via FTDI
Arduino Pro 3.3v/8 MHz	3.3V	8MHz	14	6	6	1	FTDI-Compatible Header
Arduino Pro 5V/16MHz	5V	16MHz	14	6	6	1	FTDI-Compatible Header
Arduino mini 05	5V	16MHz	14	8	6	1	FTDI-Compatible Header
Arduino Pro mini 3.3v/8mhz	3.3V	8MHz	14	8	6	1	FTDI-Compatible Header
Arduino Pro mini 5v/16mhz	5V	16MHz	14	8	6	1	FTDI-Compatible Header

Arduino Ethernet	5V	16MHz	14	6	6	1	FTDI-Compatible Header
Arduino Fio	3.3V	8MHz	14	8	6	1	FTDI-Compatible Header
LilyPad Arduino 328 main board	3.3V	8MHz	14	6	6	1	FTDI-Compati
LilyPad Arduino simple board	3.3V	8MHz	9	4	5	0	FTDI-Compatible Header

Table 3.2 Arduino boards based on ATMEGA32u4 microcontroller

Board Name	**Operating Volt**	**Clock Speed**	**Digital i/o**	**Analog Inputs**	**PWM**	**UART**	**Programming Interface**
Arduino Leonardo	5V	16MHz	20	12	7	1	Native USB
Pro micro 5V/16MHz	5V	16MHz	14	6	6	1	Native USB
Pro micro 3.3V/8MHz	5V	16MHz	14	6	6	1	Native USB
LilyPad Arduino USB	3.3V	8MHz	14	6	6	1	Native USB

Table 3.3 Arduino boards based on ATMEGA2560 microcontroller

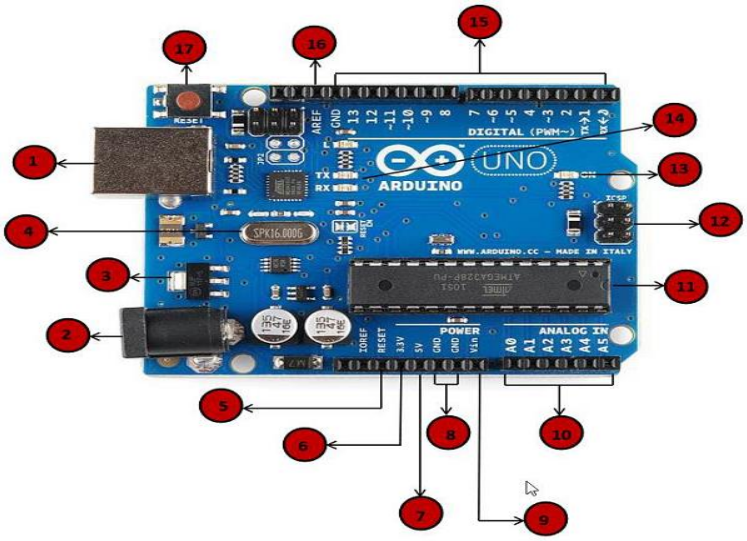
Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Mega 2560 R3	5V	16MHz	54	16	14	4	USB via ATMega16 U2B
Mega Pro 3.3V	3.3V	8MHz	54	16	14	4	FTDI-Compatible Header
Mega Pro 5V	5V	16MHz	54	16	14	4	FTDI-Compatible Header
Mega Pro Mini 3.3V	3.3V	8MHz	54	16	14	4	FTDI-Compatible Header

Table 3.4 Arduino boards based on AT91SAM3X8E microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Mega 2560 R3	3.3V	84MHz	54	12	12	4	USB native

3.3 Board Description:

In this chapter, we will learn about the different components on the Arduino board. We will study the Arduino UNO board because it is the most popular board in the Arduino board family. In addition, it is the best board to get started with electronics and coding. Some boards look a bit different from the one given below, but most Arduinos have majority of these components in common.



1	**Power USB** Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).
2	**Power (Barrel Jack)** Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).
3	**Voltage Regulator** The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.
4	**Crystal Oscillator**

	The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
5, 17	**Arduino Reset** You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
6, 7, 8, 9	**Pins (3.3, 5, GND, Vin)** 3.3V (6) − Supply 3.3 output volt 5V (7) − Supply 5 output volt Most of the components used with Arduino board works fine with 3.3 volt and 5 volt. GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit. Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
10	**Analog pins** The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.
11	**Main microcontroller** Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.
12	**ICSP pin** Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred

	to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.
13	**Power LED indicator** This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.
14	**TX and RX LEDs** On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.
15	**Digital I/O** The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.
16	**AREF** AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

3.4 PIN DESCRIPTION OF ATMEGA328

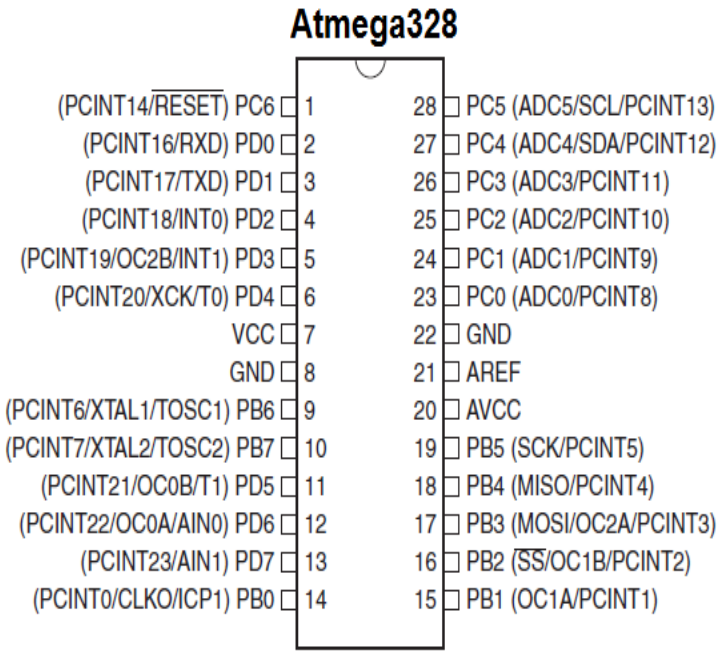


Fig.3.7: Pin description of ATMEGA328

ADVANTAGES OF ARDUINO

- It is cheap
- It comes with an open supply hardware feature that permits users to develop their own kit
- The software of the Arduino is well-suited with all kinds of in operation systems like Linux, Windows, and Macintosh, etc.
- It also comes with open supply software system feature that permits tough software system developers to use the Arduino code to merge with the prevailing programming language libraries and may be extended and changed.
- For beginners, it is very simple to use.

CHAPTER-4

POWER SUPPLY UNIT

4.1 INTRODUCTION:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply".

4.1.1 BLOCK DIAGRAM OF POWER SUPPLY:

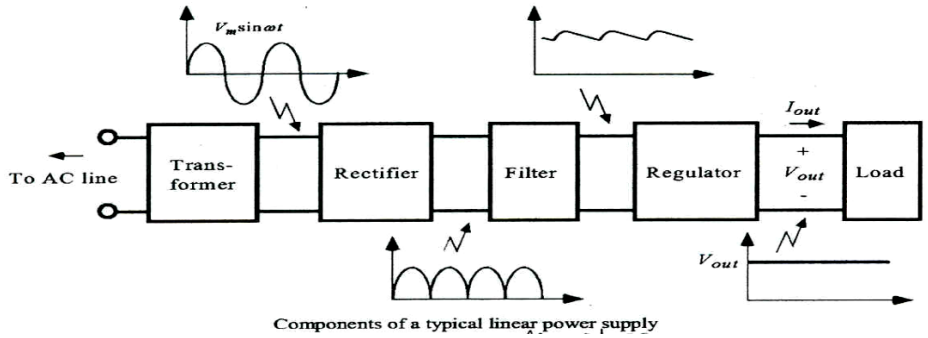


Fig.4.1.1: Block Diagram of Power Supply

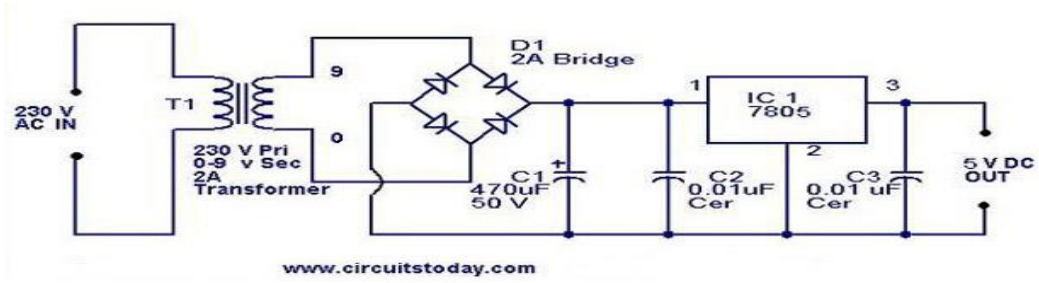


Fig.4.1.1(A): Schematic Diagram of Power Supply

4.1.2 DESCRIPTION OF POWER SUPPLY:

A power supply is a component that supplies power to at least one electric load. Typically, it converts one type of electrical power to another, but it may also convert a a different form of energy – such as solar, mechanical, or chemical - into electrical energy.

A power supply provides components with electric power. The term usually pertains to devices integrated within the component being powered. For example, computer power supplies convert AC current to DC current and are generally located at the rear of the computer case, along with at least one fan. A power supply is also known as a power supply unit, power brick or power adapter.

4.2 CAPACITOR FILTER:

The capacitor-input filter, also called "Pi" filter due to its shape that looks like the Greek letter pi, is a type of electronic filter. Filter circuits are used to remove unwanted or undesired frequencies from a signal.

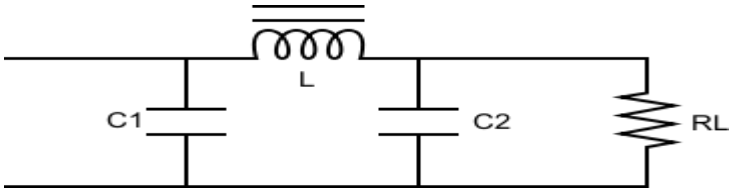


Fig.4.5: Capacitor Filter

A typical capacitor input filter consists of a filter capacitor C1, connected across the rectifier output, an inductor L, in series and another filter capacitor connected across the load.

1. . As a result, the DC component flows through the inductor while the AC component The capacitor C1 offers low reactance to the AC component of the rectifier output while it offers infinite reactance to the DC component. As a result the capacitor shunts an appreciable amount of the AC component while the DC component continues its journey to the inductor L
2. The inductor L offers high reactance to the AC component but it offers almost zero reactance to the DC componentis blocked.
3. The capacitor C2 bypasses the AC component which the inductor had failed to block. As a result, only the DC component appears across the load RL.

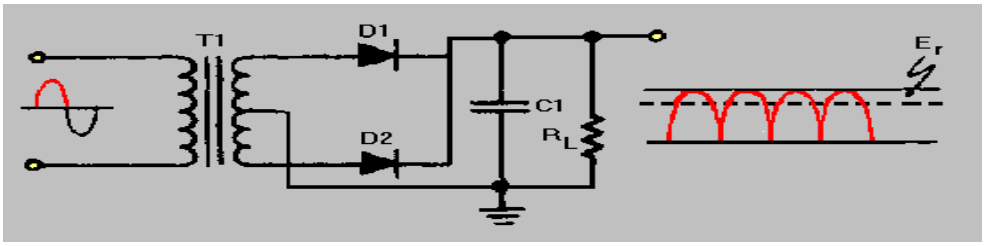


Fig.4.5(A): Centered Tapped Full-Wave Rectifier with a Capacitor Filter

4.3 VOLTAGE REGULATOR:

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or passive or active electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. There are two types of regulator are they.

- Positive Voltage Series (78xx) and
- Negative Voltage Series (79xx)

78xx:'78' indicate the positive series and 'xx'indicates the voltage rating. Suppose 7805 produces the maximum 5V.'05'indicates the regulator output is 5V.

79xx:’78’ indicate the negative series and ‘xx’indicates the voltage rating. Suppose 7905 produces the maximum -5V.’05’indicates the regulator output is -5V.

These regulators consist the three pins there are

Pin1: It is used for input pin.

Pin2: This is ground pin for regulator

Pin3: It is used for output pin. Through this pin we get the output.

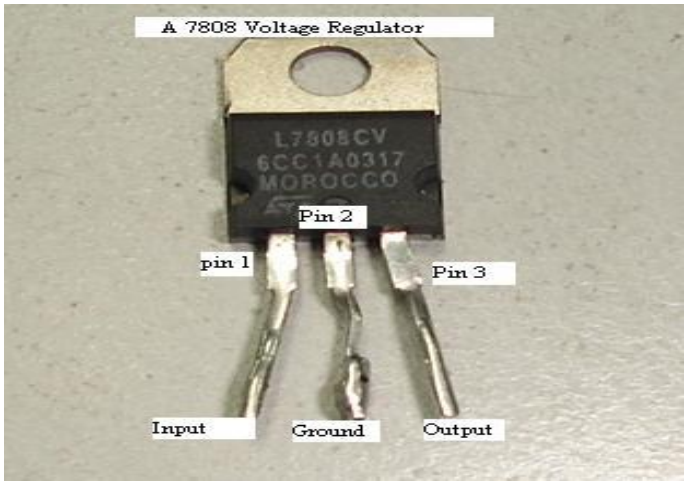


Fig.4.6: Regulator

CHAPTER-5

PROJECT DESCRIPTION

5.1 Hardware Requirement:

- Arduino UNO
- Power supply
- LCD
- Relay
- Load
- Voltage Sensor

5.2 BLOCK DIAGRAM OF PROJECT:

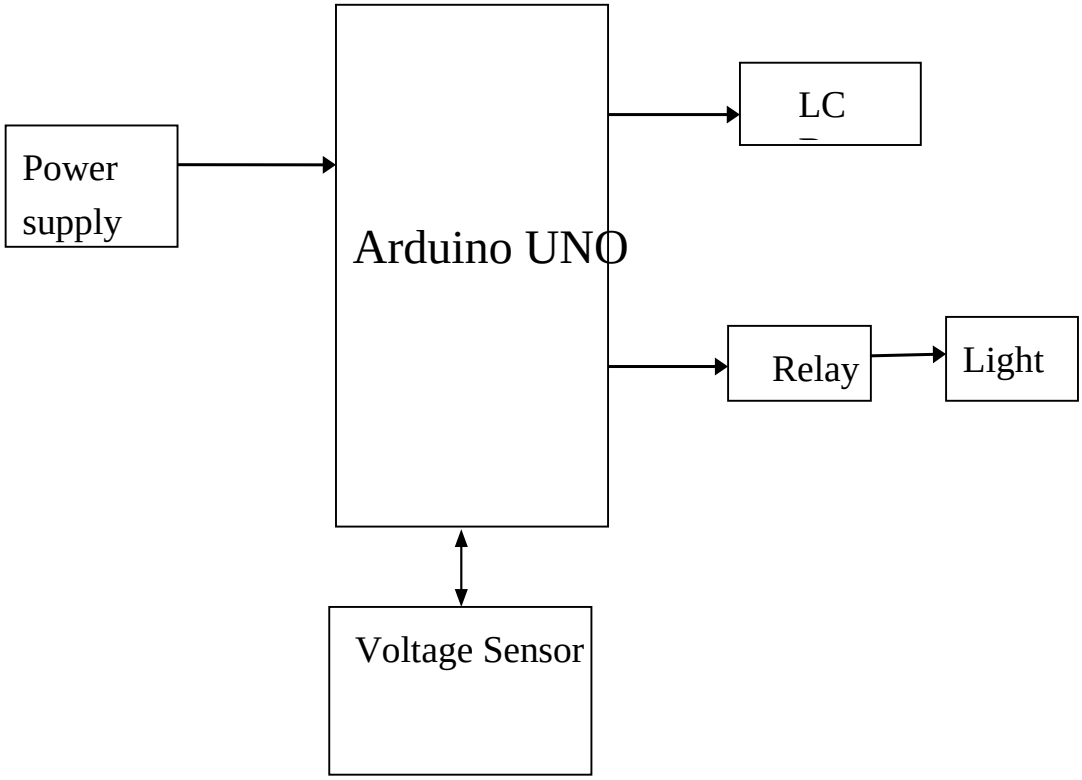


Fig.5.2: Block diagram of the project

5.3 VOLTAGE SENSOR:

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.

5.3.1 Voltage Sensor Module Pinout Configuration :

Pin Name	Description

5.3.2

VCC	Positive terminal of the External voltage source (0-25V)
GND	Negative terminal of the External voltage source
S	Analog pin connected to Analog pin of Arduino
+	Not Connected
-	Ground Pin connected to GND of Arduino

Voltage Detection Sensor Module Features & Specifications:

- Input Voltage: 0 to 25V
- Voltage Detection Range: 0.02445 to 25
- Analog Voltage Resolution: 0.00489V
- Needs no external components
- Easy to use with Microcontrollers
- Small, cheap and easily available
- Dimensions: 4 × 3 × 2 cm

Structure and configuration:

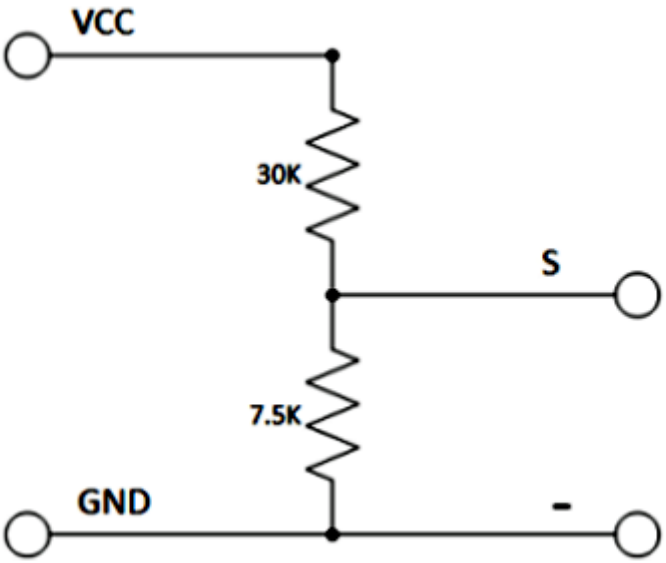


Fig: Internal circuit diagram

5.4 Relay

A relay is used to isolate one electrical circuit from another. It allows a low current control circuit to make or break an electrically isolated high current circuit path. The basic relay consists of a coil and a set of contacts. The most common relay coil is a length of magnet wire wrapped around a metal core. When voltage is applied to the coil, current passes through the wire and creates a magnetic field. This magnetic field pulls the contacts together and holds them there until the current flow in the coil has stopped. The diagram below shows the parts of a simple relay.

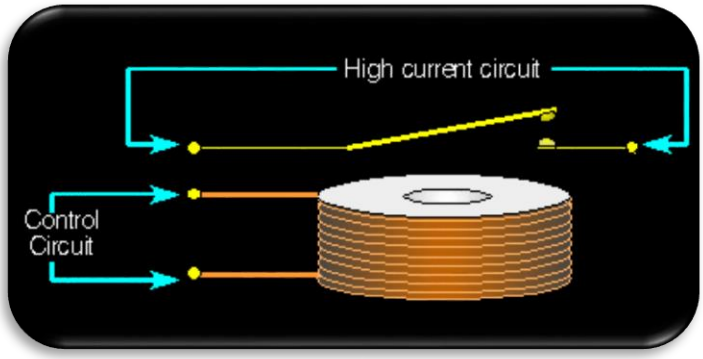


Fig5.4(a) Relay

Operation:

When a current flow through the coil, the resulting magnetic field attracts an armature that is mechanically linked to a moving contact. The movement either makes or breaks a connection with a fixed contact. When the current is switched off, the armature is usually returned by a spring to its resting position shown in figure 6.6(b). Latching relays exist that require operation of a second coil to reset the contact position.

By analogy with the functions of the original electromagnetic device, a solid-state relay operates a thyristor or other solid-state switching device with a transformer or light-emitting diode to trigger it.

SPST

SPST relay stands for Single Pole Single Throw relay. Current will only flow through the contacts when the relay coil is energized.

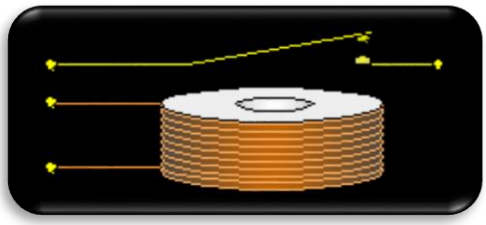


Fig5.4(b): SPST Relay

SPDT Relay

SPDT Relay stands for Single Pole Double Throw relay. Current will flow between the movable contact and one fixed contact when the coil is De-energized and between the movable contact and the alternate fixed contact when the relay coil is energized. The most commonly used relay in car audio, the Bosch relay, is a SPDT relay.

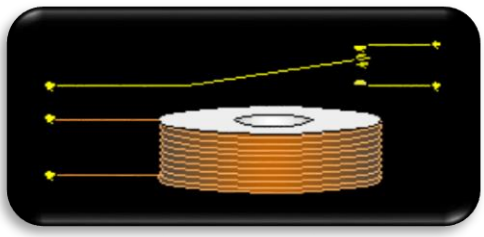


Figure5.4(c): SPDT Relay

DPST Relay

DPST relay stands for Double Pole Single Throw relay. When the relay coil is energized, two separate and electrically isolated sets of contacts are pulled down to make contact with their stationary counterparts. There is no complete circuit path when the relay is De-energized.

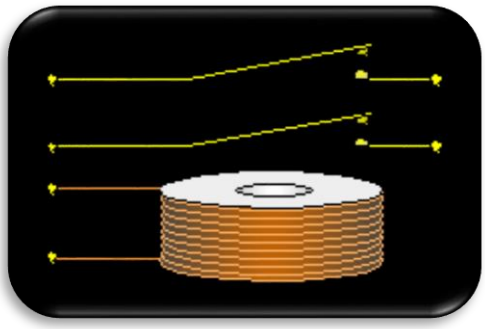


Figure5.4(d): DPST Relay

CHAPTER -6

SOFTWARE EXPLANATION

6.1 SOFTWARE EXPLANATION:

Software Requirements

- Proteus simulation
- Arduino software
- Programming language

6.1.1 Arduino software:

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IOT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online

with other members of the Arduino community. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than$50
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers c an make their own version

- Of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money
- Getting Started with Arduino and Genuino products:-
  Install the Arduino Software (IDE) on Windows PCs-

  …This document explains how to install the Arduino Software (IDE) on Windows machines.

- ✓ Download the Arduino Software(IDE)
- ✓ Proceed with board specific instructions.

How to Download the Arduino Software (IDE):

Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually.

When the download finishes, proceed with the installation and please allow the driver installation process when you get a warning from the operating system.

Installation:

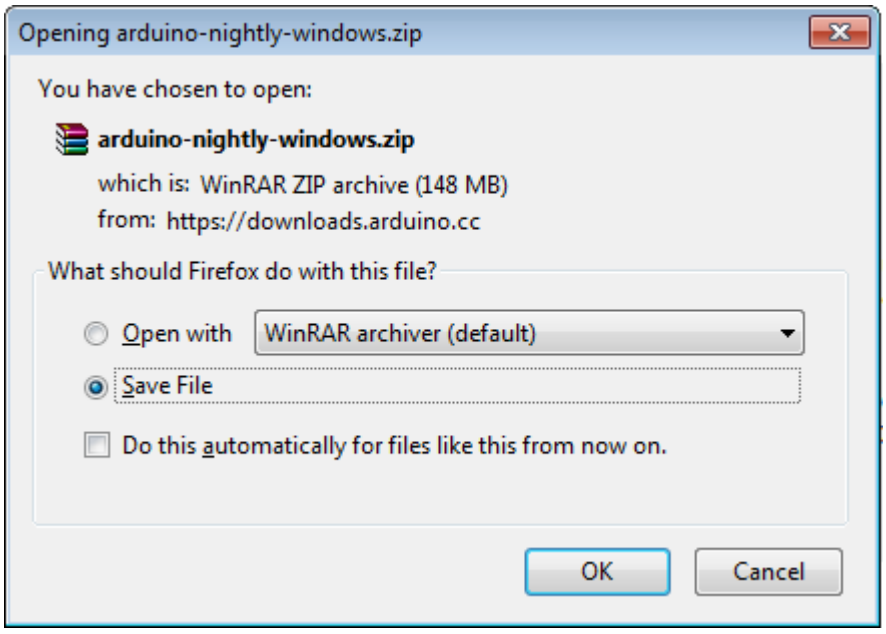
In this section, we will learn in easy steps, how to set up the Arduino IDE on our computer and prepare the board to receive the program via USB cable.

Step 1 − First you must have your Arduino board (you can choose your favorite board) and a USB cable. In case you use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, you will need a standard USB cable (A plug to B plug), the kind you would connect to a USB printer as shown in the following image.

In case you use Arduino Nano, you will need an A to Mini-B cable instead as shown in the following image.

Step 2 − Download Arduino IDE Software.

You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.



Step 3 − Power up your board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If you are using an Arduino Diecimila, you have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port.

Connect the Arduino board to your computer using the USB cable. The green power LED (labeled PWR) should glow.

Step 4 − Launch Arduino IDE.

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.

Step 5 − Open your first project.

Once the software starts, you have two options −

- Create a new project.
- Open an existing project example.

To create a new project, select File → **New**.

To open an existing project example, select File → Example → Basics → Blink.

Here, we are selecting just one of the examples with the name **Blink**. It turns the LED on and off with some time delay. You can select any other example from the list.

Step 6 − Select your Arduino board.

To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer.

Go to Tools → Board and select your board.

Here, we have selected Arduino Uno board according to our tutorial, but you must select the name matching the board that you are using.

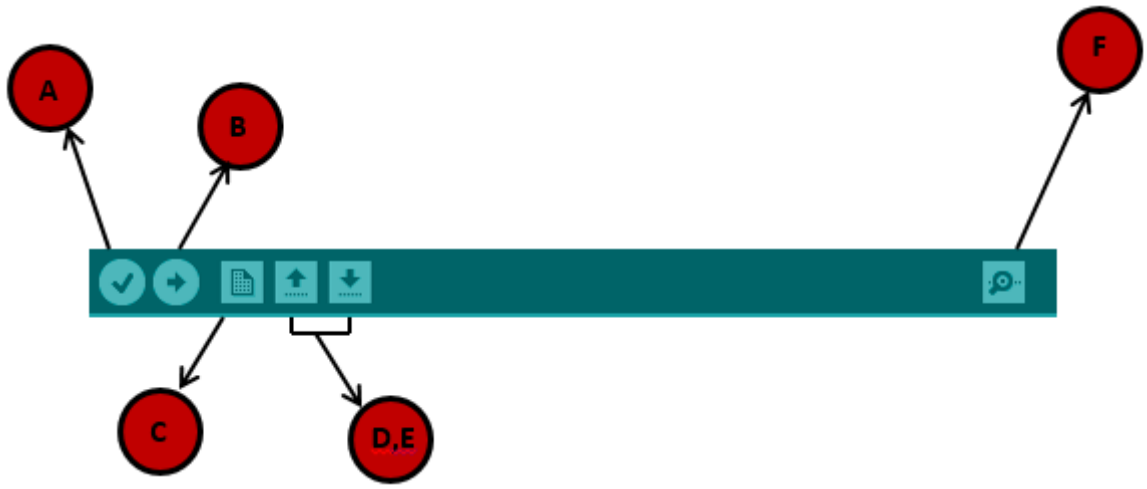
Step 7 − Select your serial port.

Select the serial device of the Arduino board. Go to **Tools → Serial Port** menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports).

To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

Step 8 − Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



A − Used to check if there is any compilation error.

B − Used to upload a program to the Arduino board.

C − Shortcut used to create a new sketch.

D − Used to directly open one of the example sketch.

E − Used to save your sketch.

F − Serial monitor used to receive serial data from the board and send the serial data to the board.

Now, simply click the "Upload" button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.

Note − If you have an Arduino Mini, NG, or other board, you need to press the reset button physically on the board, immediately before clicking the upload button on the Arduino Software.

Connecting a Battery

For stand-alone operation, the board is powered by a battery rather than through the USB connection to the computer. While the external power can be anywhere in the range of 6 to 24 V (for example, you could use a car battery), a standard 9 V battery is convenient. While you could jam the leads of a battery snap into the Vin and Gnd connections on the board, it is better to solder the battery snap leads to a DC power plug and connect to the power jack on the board. A suitable plug is part number 28760 from www.jameco.com. Here is what this looks like.

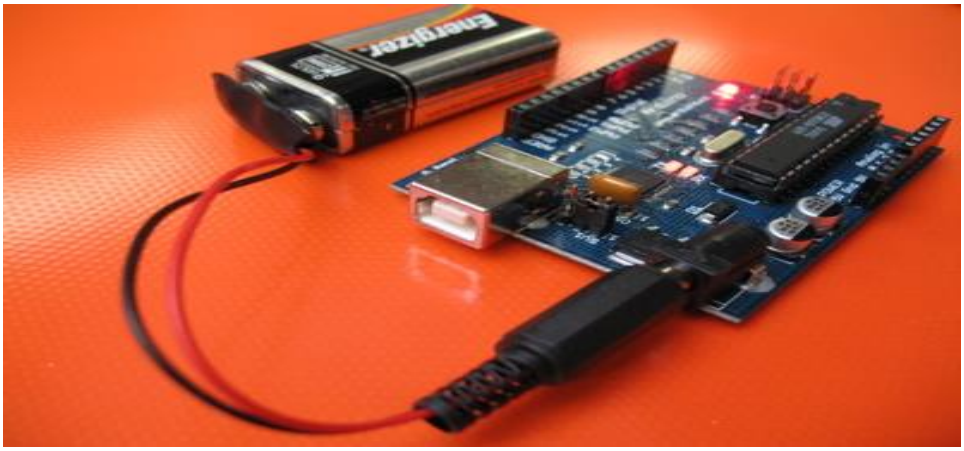


Fig.6.1: Arduino with battery

Disconnect your Arduino from the computer. Connect a 9 V battery to the Arduino power jack using the battery snap adapter. Confirm that the blinking program runs. This shows that you can power the Arduino from a battery and that the program you download runs without needing a connection to the host PC .

Moving On

Connect your Arduino to the computer with the USB cable. You do not need the battery for now. The green PWR LED will light. If there was already a program burned into the Arduino, it will run.

Start the Arduino development environment. In Arduino-speak, programs are called “sketches”, but here we will just call them programs.

In the editing window that comes up, enter the following program, paying attention to where semi-colons appear at the end of command lines.

```
void setup()
```

```
{
  Serial.begin(9600);
  Serial.println("Hello World");
}
void loop() {}
```

6.2 MC Programming Language: Embedded C

This is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements. Embedded C is perhaps the most popular languages among Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability.

6.3 Proteus:

Proteus:

Proteus is a simulation and design software tool developed by Lab centre Electronics for Electrical and Electronic circuit design. It also possess 2D CAD drawing feature. It deserves to bear the tagline “From concept to completion”.

About Proteus

It is a software suite containing schematic, simulation as well as PCB designing.

ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.

ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.

The designer can also develop 2D drawings for the product.

Features

ISIS has wide range of components in its library. It has sources, signal generators, measurement and analysis tools like oscilloscope, voltmeter, ammeter etc., probes for real time monitoring of the parameters of the circuit, switches, displays, loads like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog Integrated circuits, semi-conductor switches, relays, microcontrollers, processors, sensors etc.

ARES offers PCB designing up to 14 inner layers, with surface mount and through whole packages. It is embedded with the foot prints of different category of components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB Designer. The schematic drawn in the ISIS can be directly transferred ARES.

Starting New Design

Step 1: Open ISIS software and select New design in File menu

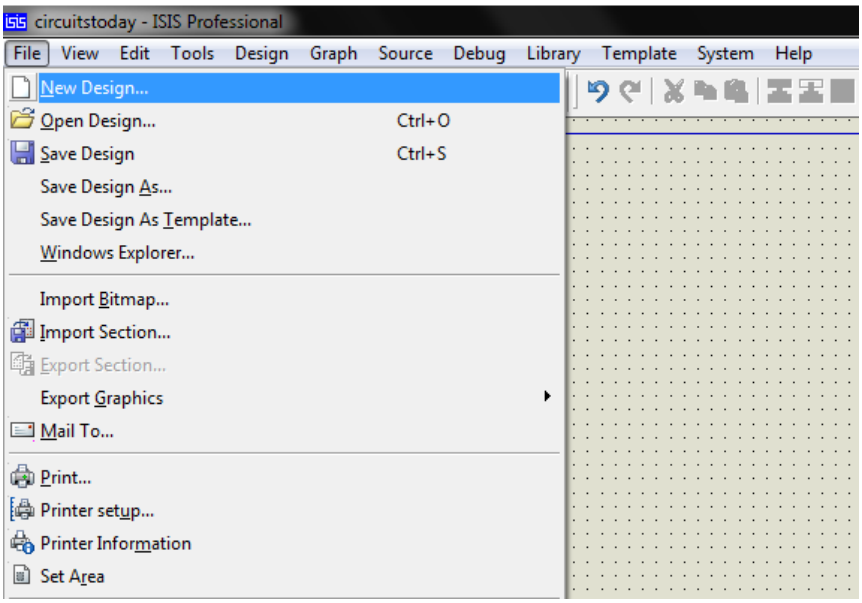


Fig Proteus File Menu

Step 2: A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template.

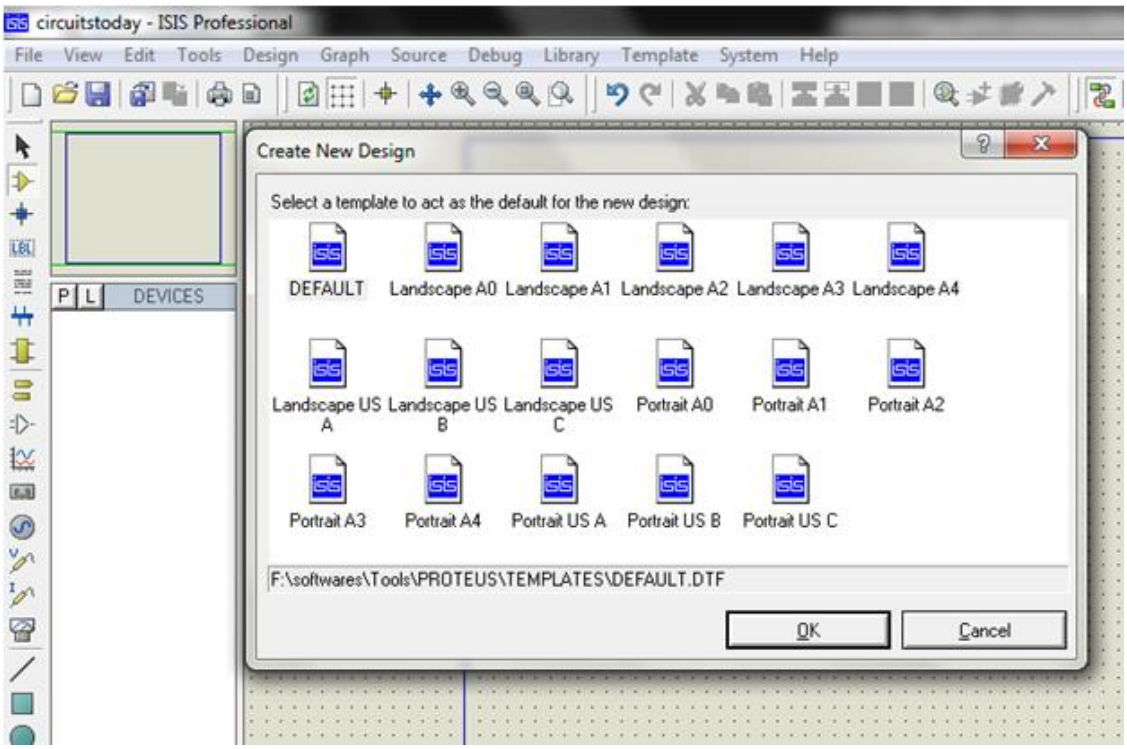


Fig Proteus Default Template Select

Step 3: An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.

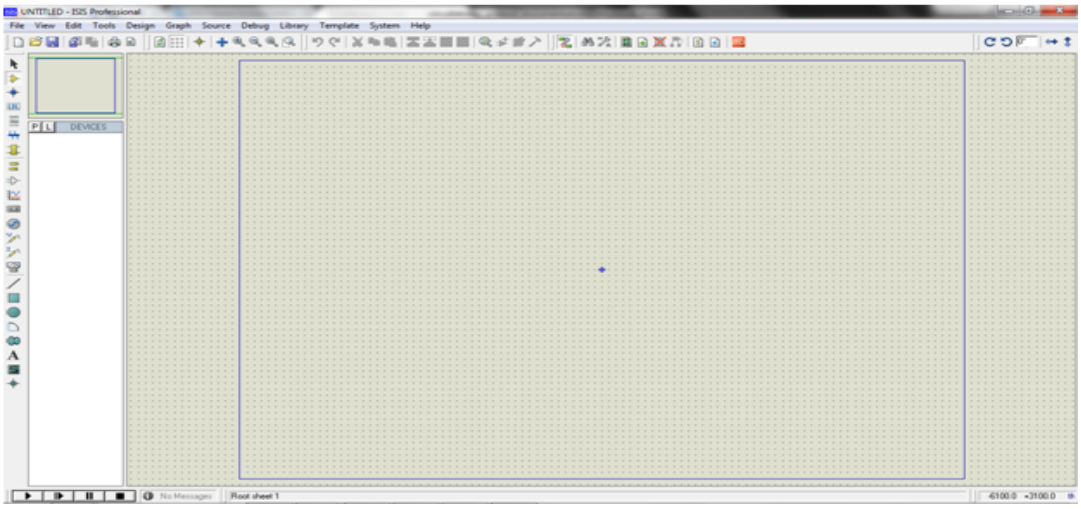


Fig Proteus Design Sheet

Step 4: To Select components, Click on the component mode button.

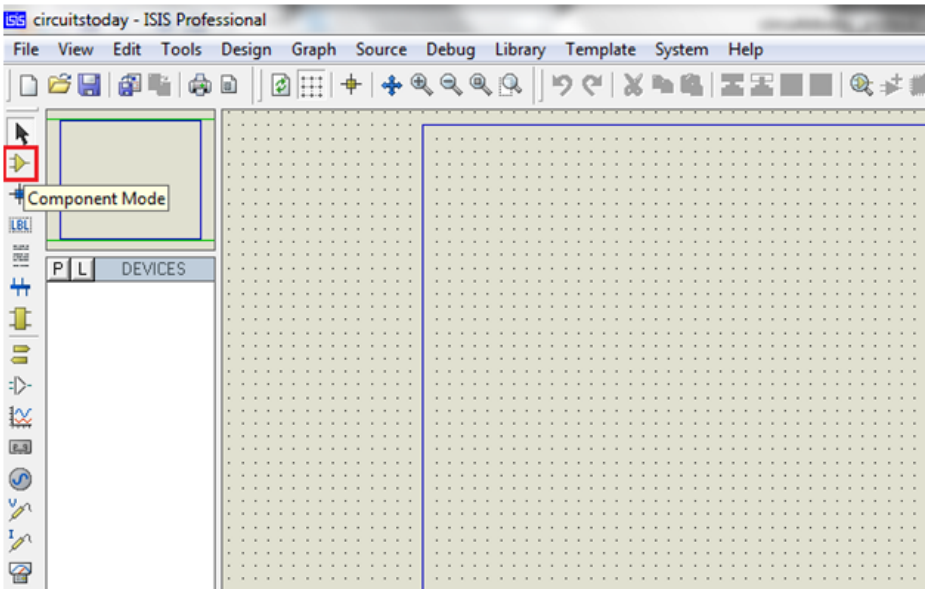


Fig Component Mode

Step 5: Click on Pick from Libraries. It shows the categories of components available and a search option to enter the part name.

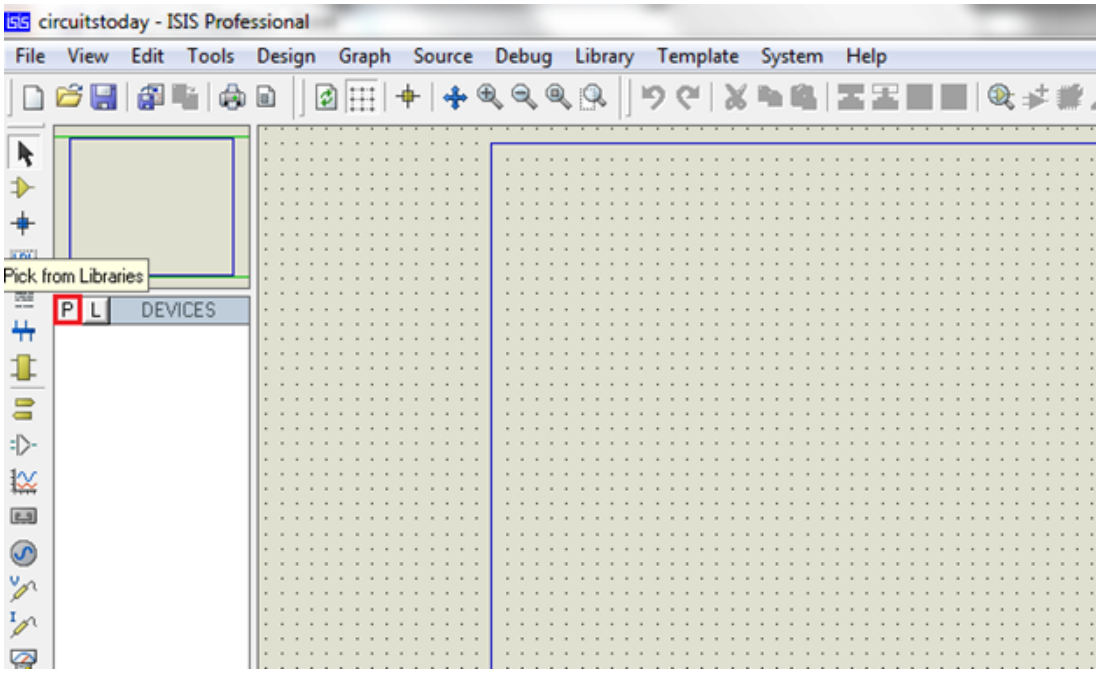


Fig Pick from Libraries

Step 6: Select the components from categories or type the part name in Keywords text box.

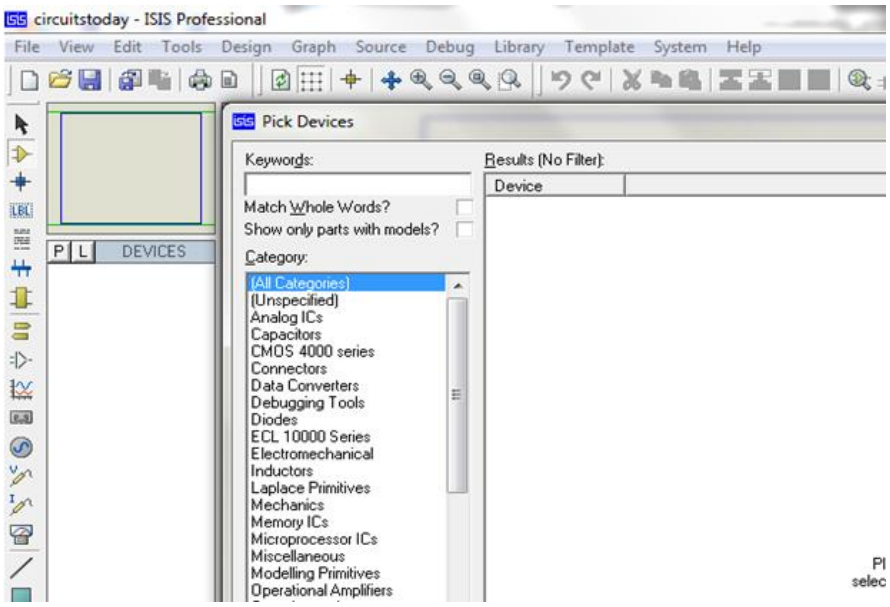


Fig Keywords Textbox

Example shows selection of push button. Select the components accordingly.

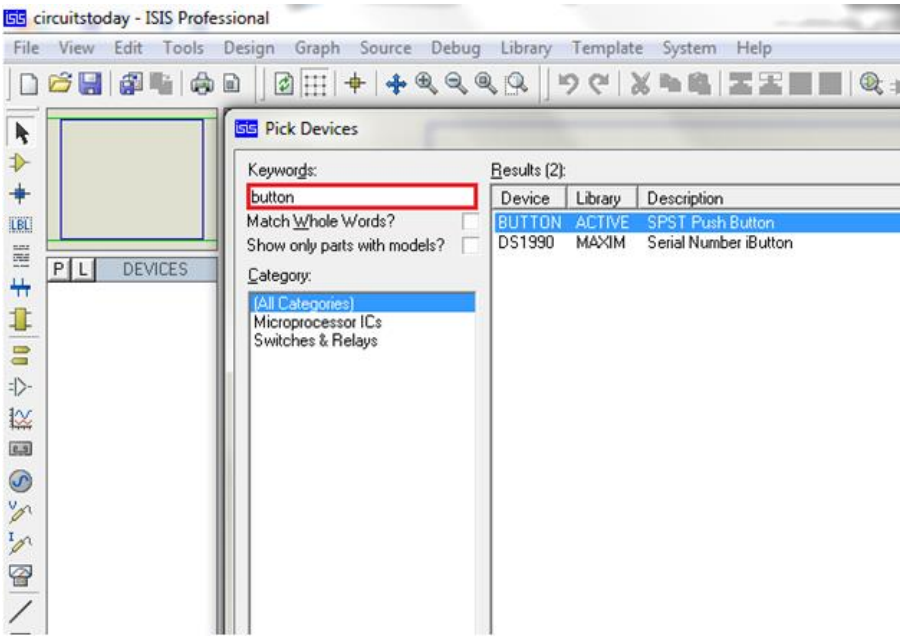


Fig Push Button Selection

Step 7: The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.

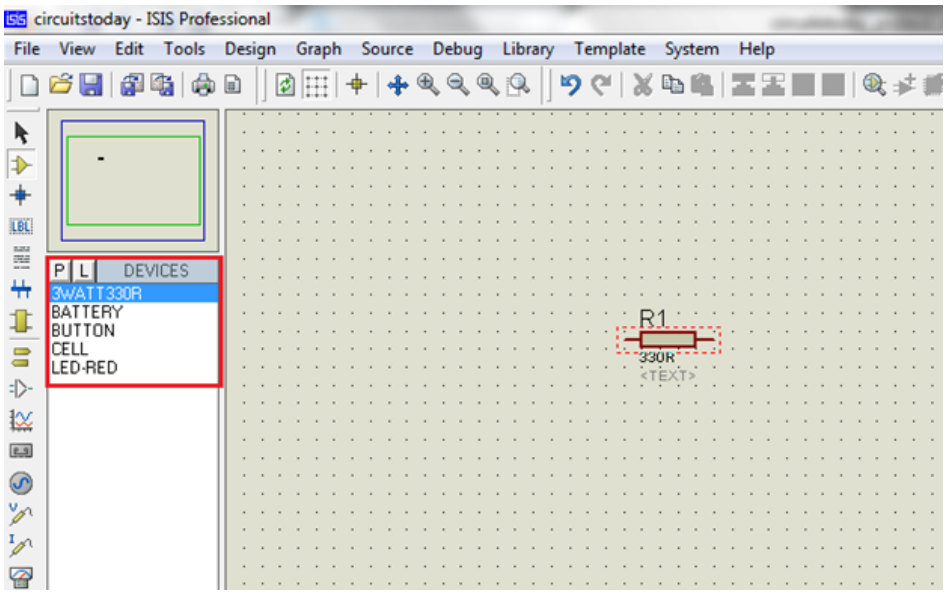


Fig Component Selection

Place all the required components and route the wires i.e., make connections.

Either selection mode above the component mode or component mode allows to connect through wires. Left click from one terminal to other to make connection. Double right-click on the connected wire or the component to remove connection or the component respectively.

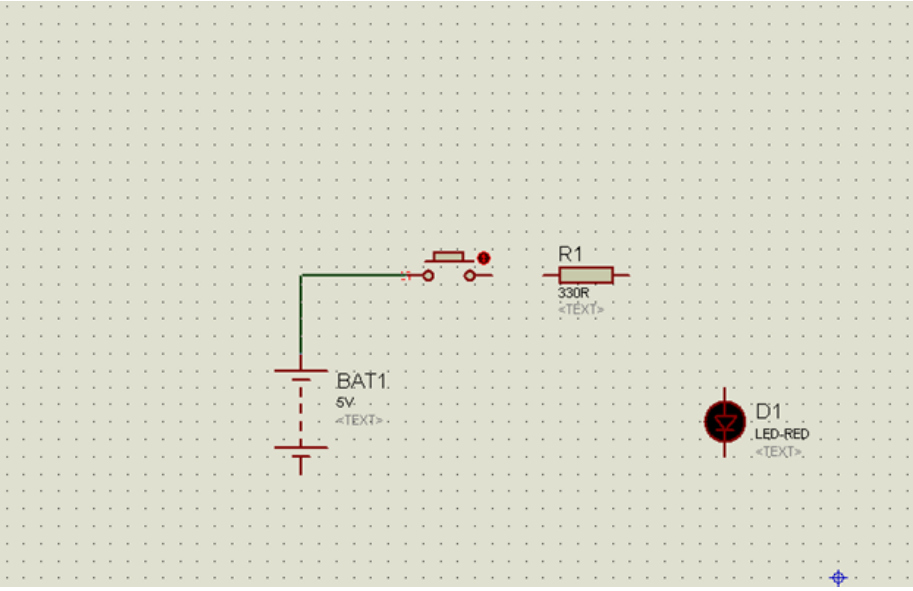


Fig Component Properties Selection

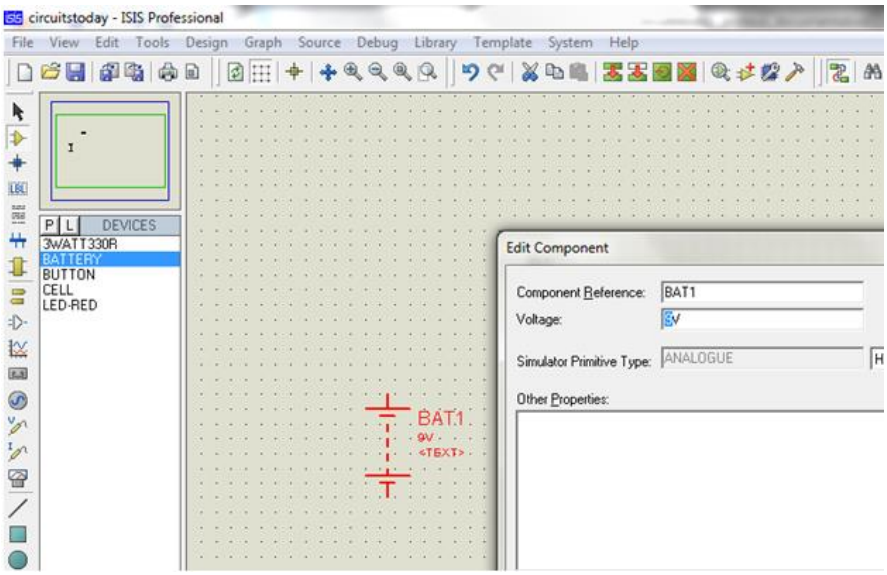


Fig Component Properties Edit

Step 8: After connecting the circuit, click on the play button to run the simulation.

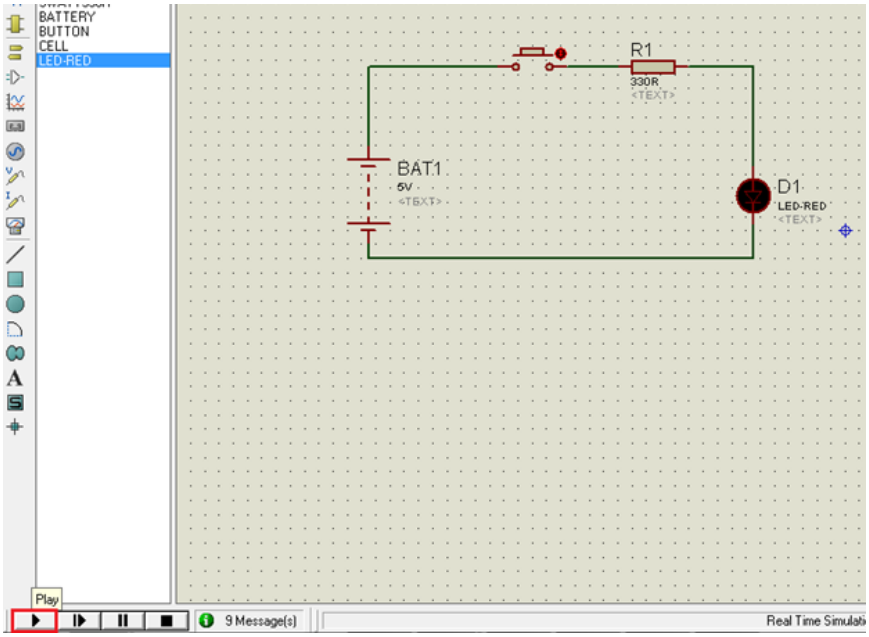


Fig Simulation Run

In this example simulation, the button is depressed during simulation by clicking on it to make LED glow.

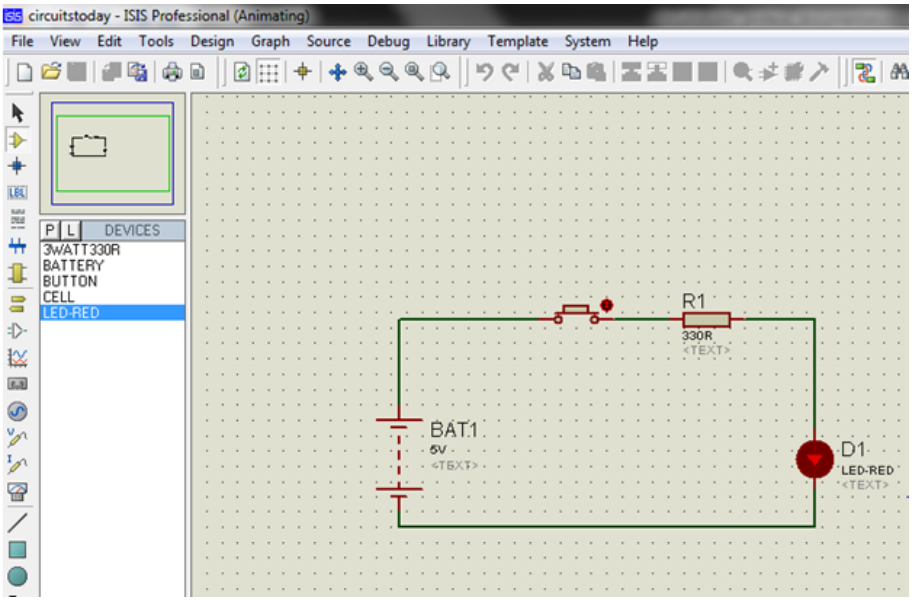


Fig Simulation Animating

Simulation can be stepped, paused or stopped at any time.

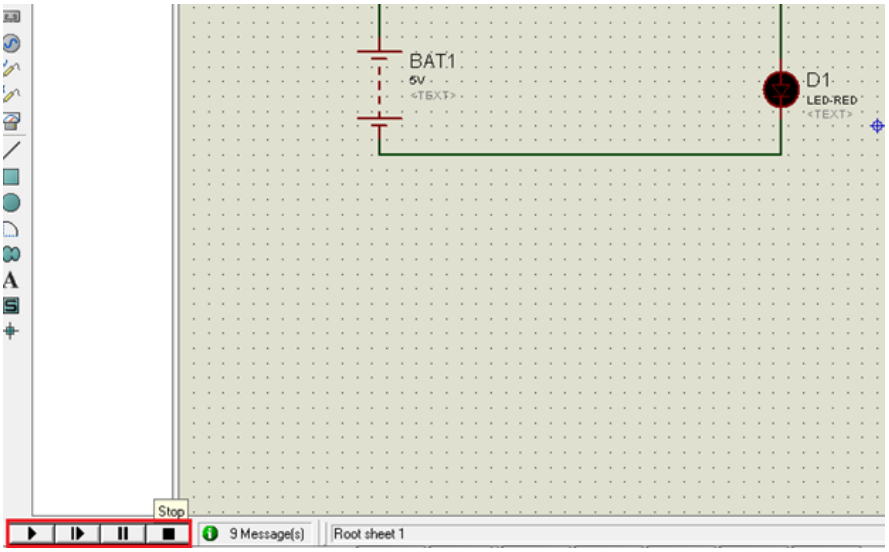


Fig Simulation Step-Pause-Stop Buttons

6.4 Project Code:

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(2,3);

#include <LiquidCrystal.h>
```

```
LiquidCrystal lcd(13,12,11,10,9,8);



int motor=5;
int voltage = A0;


void setup() {

  pinMode(motor,OUTPUT);


 digitalWrite(motor,LOW);







 Serial.begin(9600);

 lcd.begin(16,2);
 lcd.clear();lcd.setCursor(0, 0);lcd.print("WELCOME");
 delay(4000);


}

void loop()
{


   int voltageData = analogRead(voltage);
   digitalWrite(motor,HIGH);
   lcd.clear();
```

```
lcd.setCursor(0, 0);lcd.print("V:");lcd.print(voltageData);




   if(voltageData > 40)
   {
     digitalWrite(motor,LOW);


     lcd.clear();lcd.setCursor(0, 0);lcd.print("Motor Off");
   }

}
```

CHAPTER-7

RESULT & CONCLUSION

7.1 APPLICATION OF THE PROJECT:

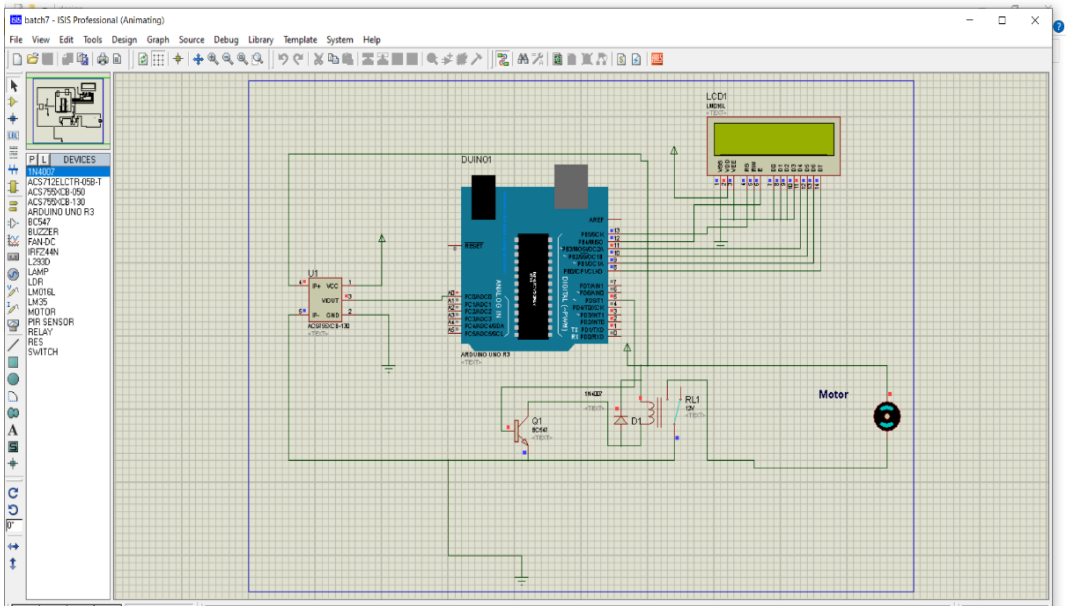
- Used in industries.
- Primary and back up protection.
- Property can be saved.
- Avoid explosions.

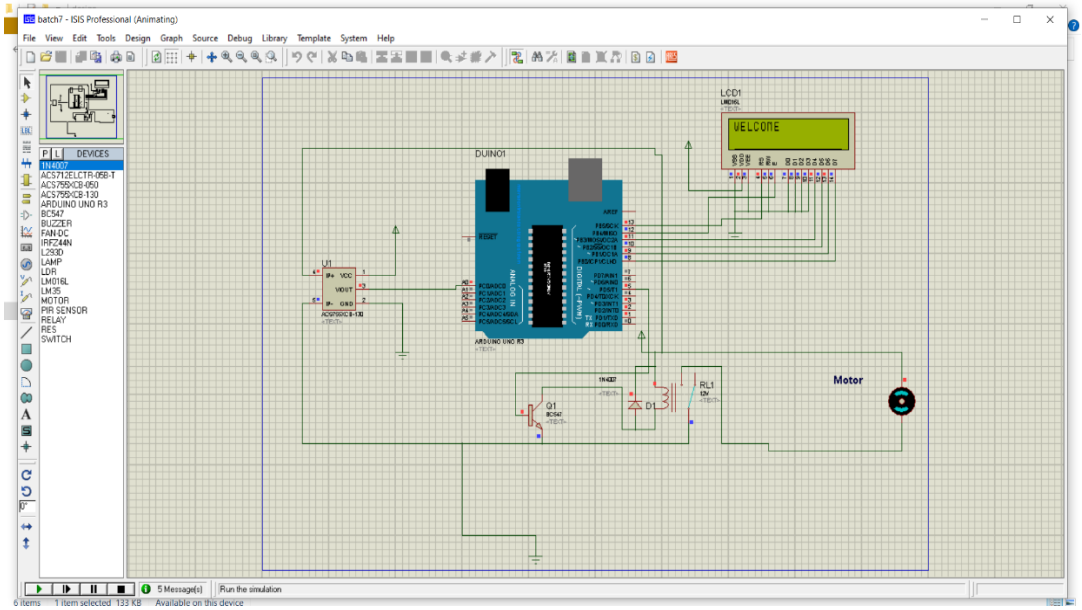
7.2 ADVANTAGES OF THE PROJECT:

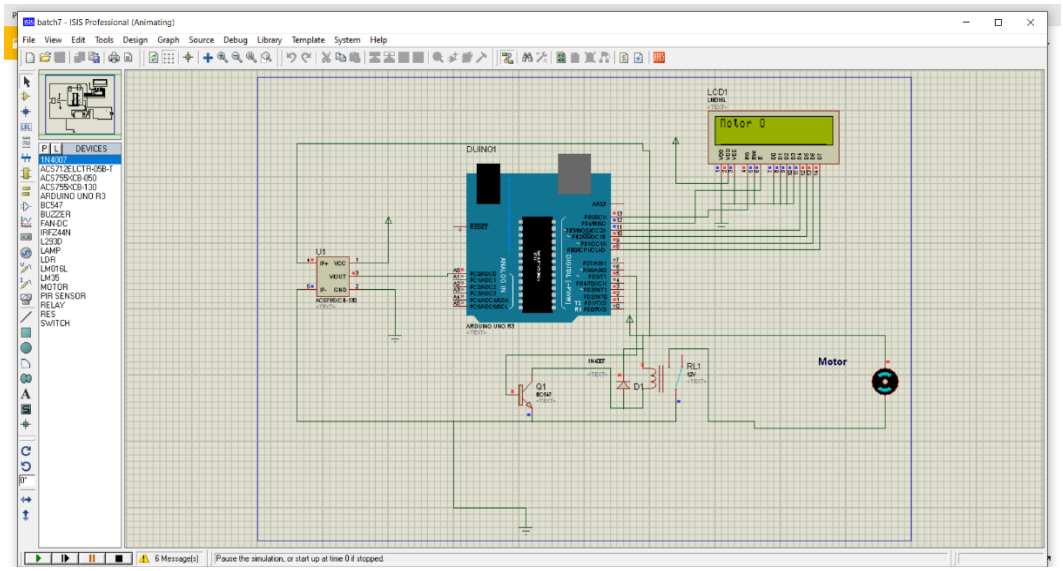
- Efficient and low cost design.
- Low power consumption.
- Real time monitoring.
- Reliability of protection.

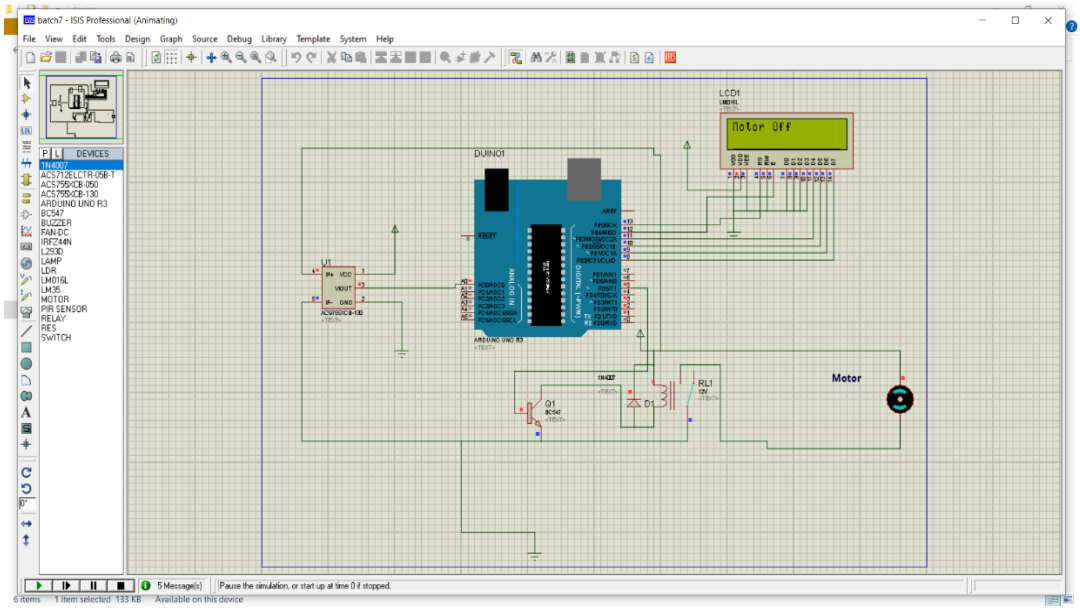
7.3 RESULT:

By using this performance we can clearly emphasize that we can protect from fault and if there is fault occurred it need not to go any further.









7.4 CONCLUSION:

- Now in growing technology, the Electricity is Ubiquitous. So, interruption of power may be devastates the whole system.

- This interruption or delay in power by in plethora of other parameters which are concerned with power.

- Thus, these are overcome by before they were happened, Interruption in power perhaps called as fault.
- That's why we selected a remedy to protect devices from faults in the form of programing (simulation).
- We made a application, through which we can detect the fault and protect from a fault in particular electrical part with out procrastination.
- Finally it is reliable , portable and compartable.

7.5 FUTURE SCOPE:

- In the perspective of alertness and rapid action in minimization of faults, it is more convenient than the manual operation.
- Embedded system is the future. Every industry needs some artificial intelligence into it can be given by embedded systems only.
- Due to above reason, by development a protection equipment through the embedded system may gives the numerous response compared to other techniques.

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