A

MINI- PROJECT REPORT ON

Circuit Shield

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In

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CERTIFICATE

This is to certify that the Mini-Project Report entitled

“CIRCUIT SHIELD”

has been successfully completed by

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towards the partial fulfillment of the degree of **Bachelor of Engineering** in **Electronics and Telecommunication** as awarded by the Savitribai Phule Pune University, at **Pune Vidyarthi Griha’s College of Engineering** during the academic year 2023-2024.

(Prof.Mrs.V.U.Gongane) (Dr. Y. B. Thakare)

Mini-Project Guide Head, Department of E &TC

Place: Pune

Date:

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ABSTRACT

Electrical safety is of paramount importance in various settings, especially in households where live wires carrying current can pose a significant risk if proper precautions are not taken. This project aims to enhance safety measures by designing a live wire circuit that incorporates an automatic switch to mitigate potential dangers. The primary objective is to reduce the voltage at the terminals when a load is not connected, thereby minimizing the risk of injury or damage.

The methodology involves the integration of several components, including a microcontroller, relays, switches, and other necessary elements. The automatic switch is designed to detect the absence of a load in the circuit and promptly reduce the voltage at the terminals. The code for the microcontroller is carefully crafted to ensure the switch operates effectively and in line with the desired logic.

The proposed solution has the potential to significantly contribute to the field of electrical safety by providing a safer environment for working with household AC power supplies. By implementing this automatic switch, the project addresses the critical issue of high voltage at the terminals when the load is not connected.

The success of this project relies on the meticulous design and thorough testing of the automatic switch and its accompanying components. Reliability and robustness are essential factors to consider during the design phase, guaranteeing that the switch functions as intended and ensures the safety of individuals and property.

In conclusion, this project seeks to tackle the crucial challenge of electrical safety by implementing an automatic switch in the live wire circuit. By reducing the voltage at the terminals when a load is not connected, the risk of electrical shocks and damage is significantly minimized. The designed circuit holds promise for enhancing safety measures and serves as a valuable contribution to the field of electrical safety. Continued efforts in careful design, testing, and implementation will lead to a safer working environment with household AC power supplies.

ABBREVIATIONS AND ACRONYMS

PIC	Peripheral Interface Controller
ACS712	Allegro Acs712 Hall Effect-Based Linear Current Sensor Ic
LED	Light Emitting Diode
PCB	Printed Circuit Board
ADC	Analog To Digital Converter
AC	Alternating Current
DC	Direct Current
MA	Mili Ampere
HZ	Harz

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CHAPTER 1

INTRODUCTION

1.1 Back Ground And Context

There are many cases of death occurred due to the electric shock. The reason behind is many of the times lack of safety in electric circuit or appliances. To reduce this harmful effect, it is important to focus on safety of devices running on high voltage. The project focuses on enhancing the safety of live wires carrying current, particularly in household settings. When a load is not connected, the terminals connected to the load can contain high voltage, posing a potential danger to those who come into contact with the live wires. To address this issue, the project proposes the use of an automatic switch placed in the circuit.

1.2 Aim

To design a damage control and safety measurement live wire circuit using automatic switch.

1.3 Problem Definition

The design of the project focuses on enhancing the safety of live wires carrying current, particularly in household settings. When a load is not connected, the terminals connected to the load can contain high voltage, posing a potential danger to those who come into contact with the live wires. To address this issue the project should work properly.

1.4 Scope and Objective

1] To focus on household loads and their handling.

2] To give safety measures for human beings.

3] To detect faulty load.

4] To avoid shock from moisture around the switch are

CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

The insights gained from the literature survey, in conjunction with our own project objectives and requirements, will serve as a foundation for the design, development, and testing phases of the automatic switch. By building upon the existing research and exploring new avenues for improvement, we aim to deliver a reliable, robust, and safe solution that can make a significant contribution to enhancing electrical safety, both in household environments and potentially in industrial settings

2.2 Papers

Student manual on electrical safety with information on recognizing, evaluating and avoiding hazards related to electricity. January 2002

The severity of injury from electrical shock depends on the amount of electrical current and the length of time the current passes through the body. For example, 1/10 of an ampere (amp) of electricity going through the body for just 2 seconds is enough to cause death. The amount of internal current a person can withstand and still be able to control the muscles of the arm and hand can be less than 10 milliamperes (milliamps or mA). Currents above 10 mA can paralyze or “freeze” muscles. When this “freezing” happens, a person is no longer able to release a tool, wire, or other object. In fact, the electrified object may be held even more tightly, resulting in longer exposure to the shocking current. For this reason, handheld tools that give a shock can be very dangerous. If you cannot let go of the tool, current continues through your body for a longer time, which can lead to respiratory paralysis (the muscles that control breathing cannot move). You stop breathing for a period. People have stopped breathing when shocked with currents from voltages as low as 49 volts. Usually, it takes about 30 mA of current to cause respiratory paralysis.

“Deaths Due to Electrocution in Central India: A Study of Two Years” by Umesh Kumar Choudhary, Vinod V Rathod, Pankaj S Ghormade, Ajay N Keoliya.

A total of 74 deaths due to electrocution were studied in which male’s outnumbered females. Approximately half of cases was observed in the age group of 21-30 years (36 cases i.e 48.64%) which included 05 females. More than 2/3rd i.e 56 victims (71.6%) were electrocuted by low tension domestic supply, out of which 38 were electrocuted at home. 18 victims (24.4%) were electrocuted by high tension current. Only 03victims survived for period of 24-48 hours whereas 71(95.9%) victims died on the spot. In half i.e 52.4%of the cases only entry wound was present, followed by presence of both entry and exit wound in 36.4% cases. Information gathered from police documents and history by relatives revealed that almost all of the electrocution deaths were because of accidental electrocution, only two suicidal cases were observed. Most common his to-pathological finding was focal separation of dermis and epidermis, epidermal nuclear elongation and palisading. The risk of getting electrocuted in domestic surroundings from the haphazardly installed electric wires without proper maintenance is indeed a matter of concern. Adoption of proper insulation safety measures are important factors required for prevention of fatal electrocution.

"Implementation of a high accuracy ac current sensing scheme using hall-sensor" by Asim Datta, Kanishka Raj, Rishiraj Sarker.

The paper represents an accurate and economic low range (up to 5 A) ac current sensing scheme using high precision ACS712 hall-sensor. AT mega microcontroller is used in

processing signal and for data-acquisition from the hall-sensor output in order to make the system self-dependency. The reproducibility of the developed system is increased due to highspeed operation and wide temperature-tolerance range ofACS712 hall-sensor. A prototype of current sensing system is designed to sense up to 5 A (ac) with a precision of 0.01 A and resolution of 10 bit. Simulation and experimental validations are included to defend performance of the design regarding high quality current sensing ability.

"Automatic detection and identification of electric loads at the event of switching-on that load" by Tharmarajah Thiruvaran, Member, IEEE, Toan Phung, Member, IEEE, Eliathamby Ambikarajah, Member, IEEE.

Automatic detection of the event of switching-on an electric load, estimation of that switch-on instant and subsequent automatic identification of that electric load using current transient signal around the switch-on instant are studied in this paper. The time variation of the current harmonics is used to first detect the event of switching-on an electric load and then spectral features extracted from the current harmonic signal around the estimated switching-on instant is used for automatic identification of that load. Feature based on the second derivative of the magnitude of second harmonic of the current signal is proposed to be used for automatic detection of the event of switch-on. This feature provided an error rate of 9.4% of event detection with 0.27 seconds of average error in estimating the switch-on instant. Finally, the overall system that combines this detection of the event of switch-on and the automatic identification of that load gave an accuracy of 87.5% in a cross-fold validation experiment tested with four loads

“Comparative Study Regarding Measurements of Different AC Current Sensors” by VIOREL Miron Alexe, “VALAHIA” University of Târgoviște, Doctoral School of “Engineering Sciences” – “Electrical Engineering”.

Unlike digital sensors, analog sensors are cost effective, more simple, easier to interface and are accurate enough to render close to real values from readings for a system in which they will be implemented. We are comparing two analog current sensors, which are different from the operating principal point of view. The system in which the sensors will operate is represented by a programmable embedded platform

called Arduino, based on a low power, high performance, 8bit, Atmel-AVR [1]. microcontroller that is capable, using an algorithm, to make decisions in a energy-sharing, autonomous, smart grid. The system reads and manages the power consumption between users (homes, buildings that produce their own energy using renewables) by sharing excess energy from one to another using a common switchable grid.

CHAPTER 3

PROJECT SYSTEM DESIGN

3.1 Introduction

The automatic switch will be designed to detect the absence of a load in the circuit and instantly reduce the voltage at the terminals, thereby reducing the risk of injury or damage.

The circuit will include components such as a microcontroller, relays, switches, and other components as required. The code for the microcontroller will be written based on appropriate logic to ensure the switch functions as intended.

This project has the potential to make a significant contribution to the field of electrical safety. By reducing the high voltage at the terminals when the load is not connected, it will make working with household AC power supplies safer. The success of the project will depend on the careful design and testing of the automatic switch and its components. The project team will need to ensure that the switch is reliable, robust, and functions as intended.

3.2 Block Diagram

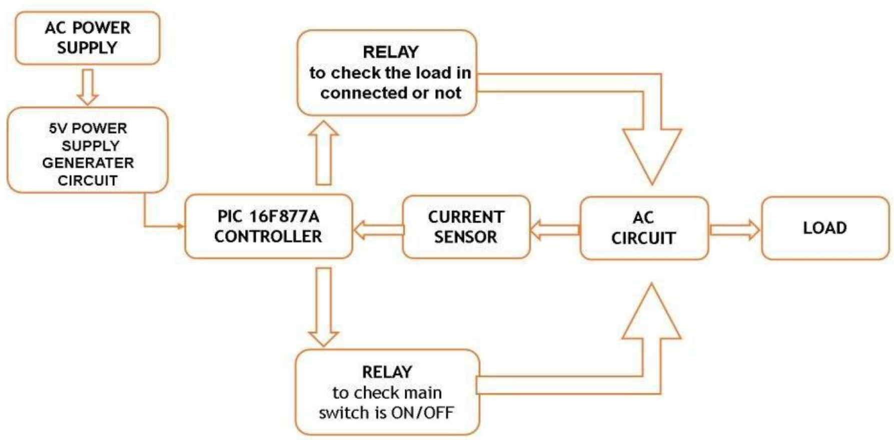

Fig 3.2 Block Diagram

The block diagram consists of a power supply, Microcontroller, Ac block. The power supply will be provided properly to the microcontroller, two relays and the current sensor.

The current sensor will measure the current flowing in circuit and give that data to PIC microcontroller and based on that data microcontroller will operate the relays which are acting as switch in AC circuit

3.3 Selection of Components and Specifications

1] Microcontroller selection: -

Requirements Needed

- Low power consumption
- Availability of ADC
- Maximum number of I/O pins
- Small Size
- Higher processing speed
- DIP packing
- Easy and familiarity

The PIC16F877A microcontroller meets most of the requirements you listed, here's a breakdown of its features:

1. Low power consumption: The PIC16F877A is designed to operate on low power, with power consumption as low as 2.5V and 100 nA in sleep mode.

2. Availability of ADC: The PIC16F877A has an integrated 10-bit ADC with up to 8 channels, which can be used to measure analog signals.

3. Maximum number of I/O pins: The PIC16F877A has a total of 33 I/O pins, which includes 5 input-only pins, 5 output-only pins, and 23 bidirectional I/O pins.

4. Small size: The PIC16F877A comes in a 40-pin DIP (dual inline package) which measures 0.6" x 2.1", making it a relatively small microcontroller.

5. Higher processing speed: The PIC16F877A operates at a maximum clock speed of 20 MHz, allowing for high processing speeds.

6. DIP packing: The PIC16F877A comes in a standard 40-pin DIP package, making it easy to integrate into a PCB design.
7. Easy and familiarity: The PIC16F877A is a widely used microcontroller with a large community of users, which makes it easier to find resources, documentation,

and support. Additionally, the PIC architecture is well-known and familiar to many embedded systems developers.

Overall, the PIC16F877A is a good choice for a low-power, high-performance microcontroller with integrated ADC, many I/O pins, and easy-to-use DIP packaging.

Table 3.1 PIC16F87XA FEATURES

Key Features	PIC16F873A	PIC16F874A	PIC16F876A	PIC16F877A
Operating Frequency	DC – 20 MHz	DC – 20 MHz	DC – 20 MHz	DC – 20 MHz
Resets (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
Flash Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory (bytes)	128	128	256	256
Interrupts	14	15	14	15
I/O Ports	Ports A, B, C	Ports A, B, C, D, E	Ports A, B, C	Ports A, B, C, D, E
Timers	3	3	3	3
Capture/Compare/PWM modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Analog Comparators	2	2	2	2
Instruction Set	35 Instructions	35 Instructions	35 Instructions	35 Instructions
Packages	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin PLCC 44-pin TQFP 44-pin QFN	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin PLCC 44-pin TQFP 44-pin QFN

2]Current Sensor Selection:

Requirement of current sensor:

1]Output voltage proportional to AC or DC

2] Low-profile SOIC8 package.

3]Easy for implementation and interfacing.

4]Response time is the interval between the application of an input excitation and the appearance of the corresponding output signal

5]Through hole technology (THT) mounts components on a printed circuit board by inserting component leads through holes in the board and then soldering the leads in place on the opposite side of the board

4]Moderate sensitivity for current sensing.

5]Vcc up to 5v.

6]cost effective

Out of no. of Current Sensors we have selected ACS712 - 20A current sensor.

IC-ACS712 is available in 3 ratings (5A,20A,30A)
Out of this we have selected 20A as it has moderate sensitivity.

For measuring current in a circuit, a sensor is required. ACS712 Current Sensor is the sensor that can be used to measure and calculate the amount of current applied to the conductor without affecting the performance of the system.
ACS712 Current Sensor is a fully integrated, Hall-effect based linear sensor IC. This IC has a 2.1kV RMS voltage isolation along with a low resistance current conductor.

"ACS712 is a relatively cheap, small package and accurate AC and DC current sensor, fitted for industrial and commercial use. "

Table 3.2: CHARACTERISTICS REPORT FOR SCT-013 AND ACS712

Characteristics	Mentions	SCT-013	ACS7 12
Adapted for Arduino ADC (2.5V offset)	-	no	yes
Is easy to implement	From connection point of view (or fast plug)	yes	no
Accuracy error	Under 0.5%	no	yes
Physical resistance	Resistant/protection to repeated wearing or industrial environment	yes	no
Is easy to interface with microcontrollers or PLCs	Has the possibility to scale values proportionally to voltage	no	yes
Electrical resistance to high voltages/currents	ACS712 – can be adapted for higher currents using shunt at the cost of accuracy	yes	yes

Selection Guide

The ACS712 is provided in a small, surface mount SOIC8 package. The leadframe is plated with 100% matte tin, which is compatible with standard lead (Pb) free printed circuit board assembly processes.

Table 3.3: Selection Guide ACS712

Part Number	Packing*	T_A (°C)	Optimized Range, I_P (A)	Sensitivity, Sens (Typ) (mV/A)
ACS712ELCTR -05B-T	Tape and reel, 3000 pieces/reel	–40 to 85	±5	185
ACS712ELCTR -20A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±20	100
ACS712ELCTR -30A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±30	66

3]Other Components:

1) Power supply:
    1. step down transformer secondary voltage 9v and 1 amp
    2. Diode 1N4007 x 4
    3. 470 uF 50v capacitor
    4. Ac capacitor 0.1 uF X2
    5. voltage regulator ic LM7805
    6. 2 pin pinch crews
    7.
2) Oscillator circuit:
    1. Crystal oscillator 20 MHz
    2. Two 33pF capacitors

3) Relays:
    1. 5v relays X 2
    2. BC 548 transistor X 2
    3. 220-ohm resistor X 2
    4. 3 pin pinch screw X 2

The features of the 5V relay include the following.

1. Normal Voltage is 5V DC
2. Normal Current is 70mA
3. AC load current Max is 10A at 250VAC or 125V AC
4. DC load current Max is 10A at 30V DC or 28V DC
5. It includes 5-pins & designed with plastic material
6. Operating time is 10 msec
7. Release time is 5 msec
8. Maximum switching is 300 operating per minute

4) 1 switch
5) 1 bulb (load) rating
6) Vertical Bulb socket

4] LOAD SELECTION

Load is an important part of the AC Circuit and has major varieties in the project. We choose the most common load which will be used in day-to-day life that is bulb. The bulb comes with different wattages and a proper watt bulb must be chosen according to the sensitivity of the current sensor. This is explained below.

We know Power = Voltage x Current

Our Current sensor is an ACS712 20A sensor which has a sensitivity of 100 mV/A .

If we use 15 W bulb so the at 220V voltage the current flowing through the circuit is

P= IV (watt)

15= I x 220

I = 0.068A

Which is very low and cannot be detected by current sensors very easily and can create different problems for microcontrollers to make decisions.

So after using 100W bulb so the at 220V voltage the current flowing through the circuit is

P= IV (watt)

100 = I x 220

I = 0.45 A

CHAPTER 4

DEVELOPMENT AND TESTING

4.1 Introduction

Ensured successful implementation of simulation circuit on bare board. Validated the selection of the load. Verified that the fully assembled circuit meets all required conditions and criteria for optimal functionality. Identified any potential defects or malfunctions in the circuit through testing. Ensured the circuit performs as intended under various operating conditions. Addressed any identified issues before release to improve overall quality and reliability of the circuit.

A] Power Supply

Is a single output power supply which converts AC Input signal into DC output of desired specification. Linear regulated power supplies are Often used in situations where the regulation and removal of noise is of great importance. Linear regulated power supplies gain their name from the fact that they use linear i.e., non-switching techniques to regulate the voltage output from the power supply. The term linear power supply implies that the power supply is regulated to provide the correct voltage at the output. Sometimes the sensing of the voltage maybe accomplished at the output terminals, or on some occasions it may be achieved directly at the load. In our projects we need a power supply for converting mains AC voltage to a regulated 5 DC voltage. For making a power supply designing of each component is essential.

Steps:
Step 1: The selection of regulator IC
Step 2: The selection of transformer
Step 3: The selection of diodes for the bridge
Step 4: The Selection of smoothing capacitor and calculations
Step 5: Making the power supply safe

To find the proper value of capacitance, use the formula below:

C= I0/2*3.14*f*V0
Where,
I0 = Load Current 0.5A
V0 = Output Voltage 5V
f = frequency 50Hz
so,
C = 500mA / (2*3.14*50*5) = 3.1847 * 10-4

The frequency is 50Hz because in our country mains AC is 220 @ 50Hz. You might have 120v 60Hz mains AC. If so, then put the value according. By using the capacitor formula, the practical standard value close to 3.1847 * 10-4 Is 470 uF.

B] Checking of working condition of components: -

PIC16F877A:

To check if the PIC16F877A microcontroller was working correctly, an LED blink program was built using the PIC. After successful completion of this task, it was confirmed that the PIC was functioning correctly, and the process of burning the code inside the PIC16 was also understood.

Relay:

To check the relay, appropriate connections were made, and it was verified whether the relay was being turned on and off smoothly.

By performing these checks, the working condition of each component was verified, and any issues or malfunctions were identified and addressed before the final implementation of the
circuit on a bare board. These checks ensured that all components were in good working condition, leading to the successful implementation of the stimulation circuit.

ASC712 20A Current Sensor:

To verify the functionality of the ASC712 20A current sensor, voltage readings were taken for a specific current in the circuit. Detailed readings of the voltage values obtained by the current sensor are provided below.

Current sensor output table (input current vs output voltage) and ADC value in PIC16F877a microcontroller

The ACS712 is a hall-effect based linear current sensor that provides a proportional voltage output relative to the amount of current flowing through the sensor. The output voltage is directly proportional to the measured current, and the sensitivity of the sensor is typically 100mV/A or 66mV/A depending on the model.

4.2 Testing

Load Testing

1. In our project, we will be using an incandescent bulb in the AC circuit as it is easily observable and provides a clear indication of the output.
2. To determine the appropriate bulb power, we used the formula P = IV, where P represents power, I represents current, and V represents voltage.
3. The voltage in our case is 220V AC, and we used a current sensor with a sensitivity of 100 mV/A and a maximum current rating of 20A.
4. We selected a 100W bulb (load), and using the formula I = P/V, we calculated the current required in the circuit.
5. The calculated current in the circuit is 0.45A, which is within the maximum current rating of the current sensor.

4.3 Troubleshooting

1. To test the functionality of the stimulation circuit on the bare board, the following procedure was carried out:
2. First, a bulb was connected in the circuit, and the main switch was turned on. As a result, the current started flowing in the circuit, and the bulb started glowing.
3. Next, the bulb was removed from the circuit to check if the circuit would break and the current in the circuit would tend to zero, resulting in a voltage drop across the terminals that would also tend to zero. This process would take only a few milliseconds.
4. Finally, the circuit was tested to ensure that if the bulb was reconnected to the circuit, it would work in a regular fashion, and the bulb would glow again.
5. If the main switch was off, there would be no need to check if the load was connected or not, and the relay would not function.
6. By carrying out these testing procedures, the performance of the stimulation circuit on the bare board was evaluated, and any issues or malfunctions were identified and addressed before the final implementation of the circuit. This ensured that the circuit would function correctly and reliably when connected to a load and operate as expected.

4.3 Simulation

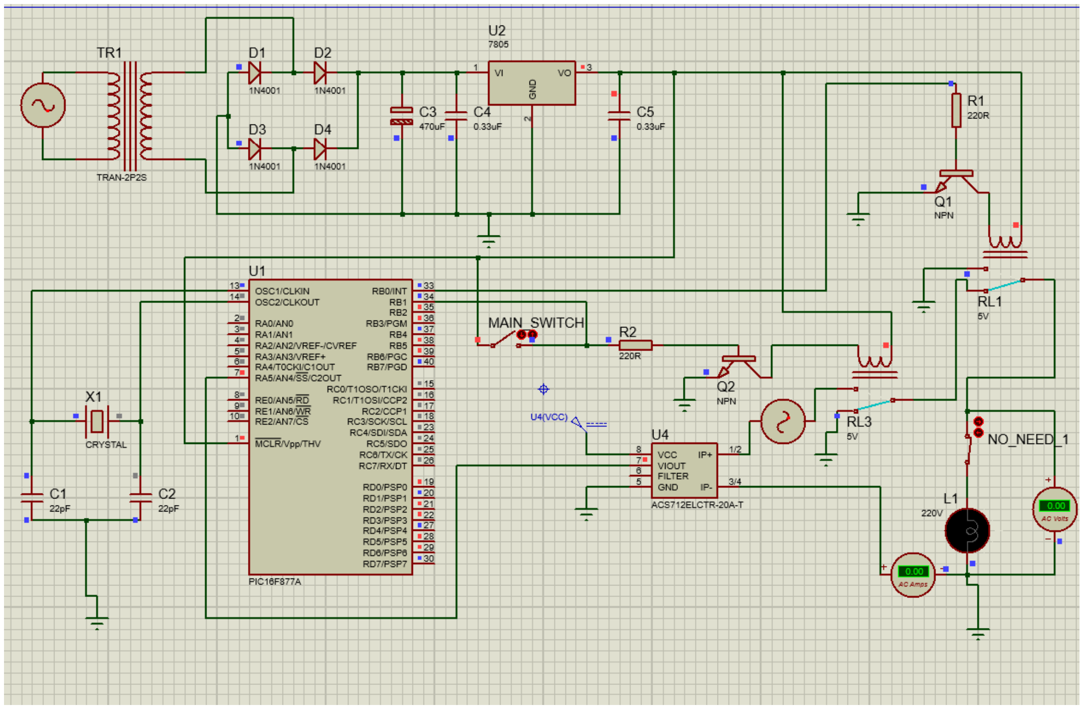

Fig 4.2A First the main switch is OFF

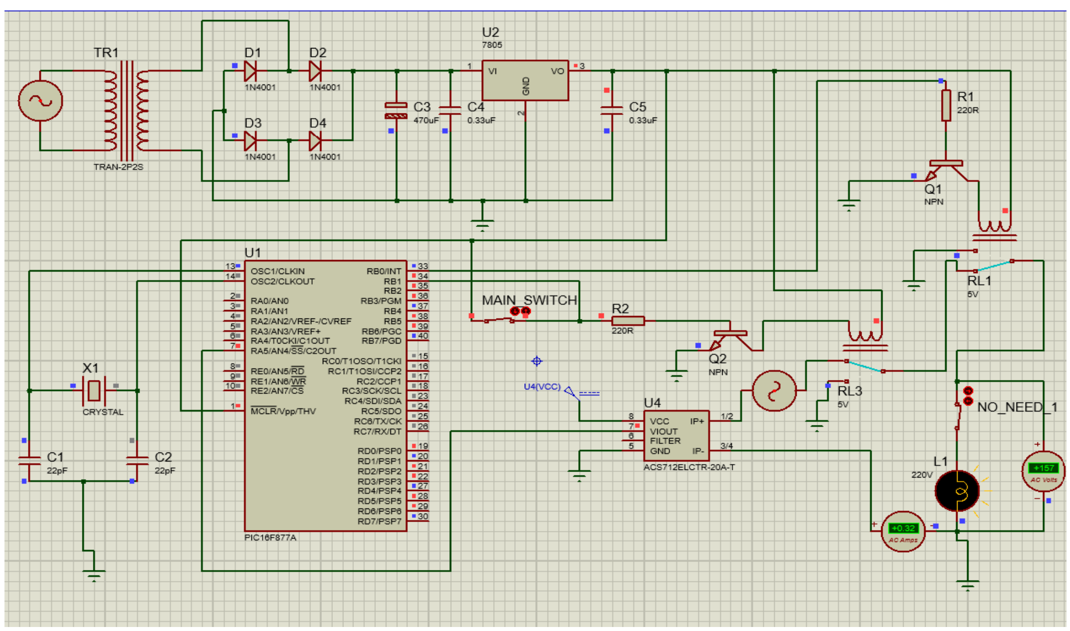

Fig 4.2B The main switch is ON

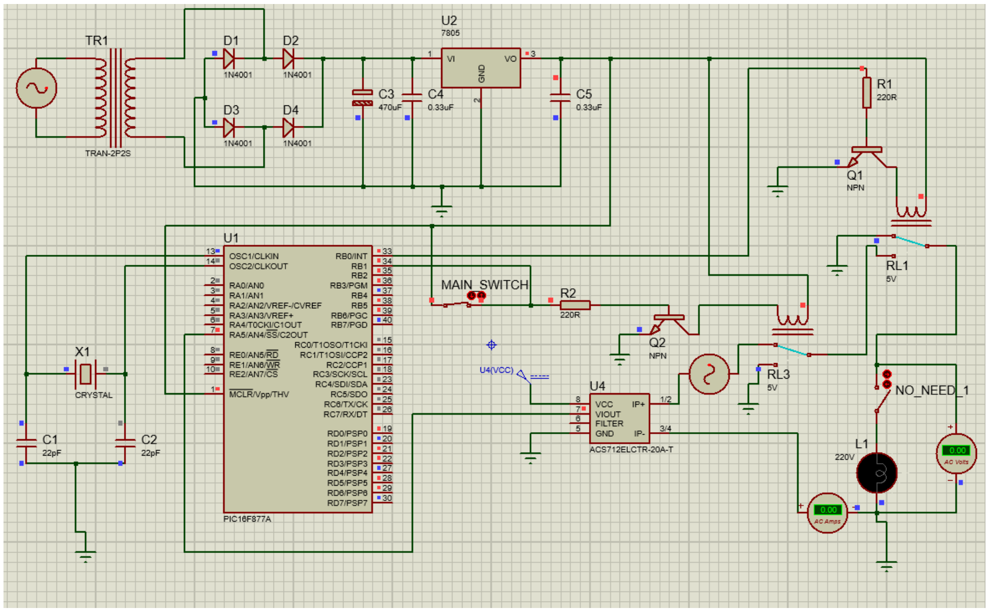

Fig 4.2C The main switch is ON and Load is not connected

1. Measure the AC current in the circuit using an ACS712 current sensor to determine the presence of a load.
2. Pass the value measured by the current sensor to a PIC16 microcontroller for processing
3. Use the ADC on the PIC16 to calculate the current value in the circuit.
4. Based on the calculated current value, operate two relays (R1 and R2) accordingly
5. If the current value in the circuit is zero, this can be due to one of two conditions:
    a. Load not connected
    b. Main switch turned off
6. The combination of the two relays will determine which of these two conditions is responsible for the zero current.
    a. If the load is not connected, R1 will continuously turn on and off to check for load connection.
    b. If the main switch is off, the entire circuit remains off, and the relays do not switch.
7. When the main switch is turned on:
    a. If the load is connected, the current will flow, and the circuit will function normally.
    b. b) If the load is not connected, the current in the circuit will remain zero, and R1 will continuously turn on and off to check for load connection.

8. Additionally, consider implementing a timeout mechanism to prevent R1 from continuously turning on and off if the load remains disconnected for an extended period

4.4 PCB Artwork

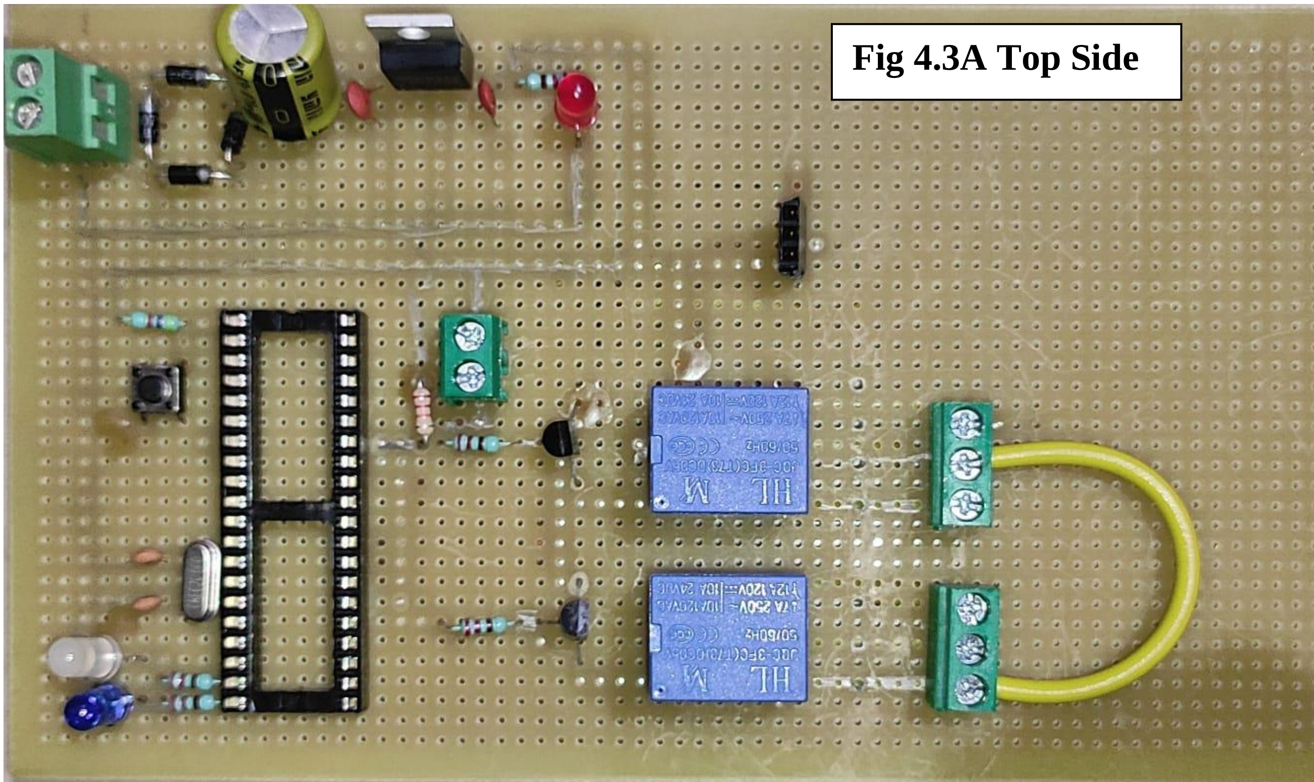

Fig 4.3A Top Side

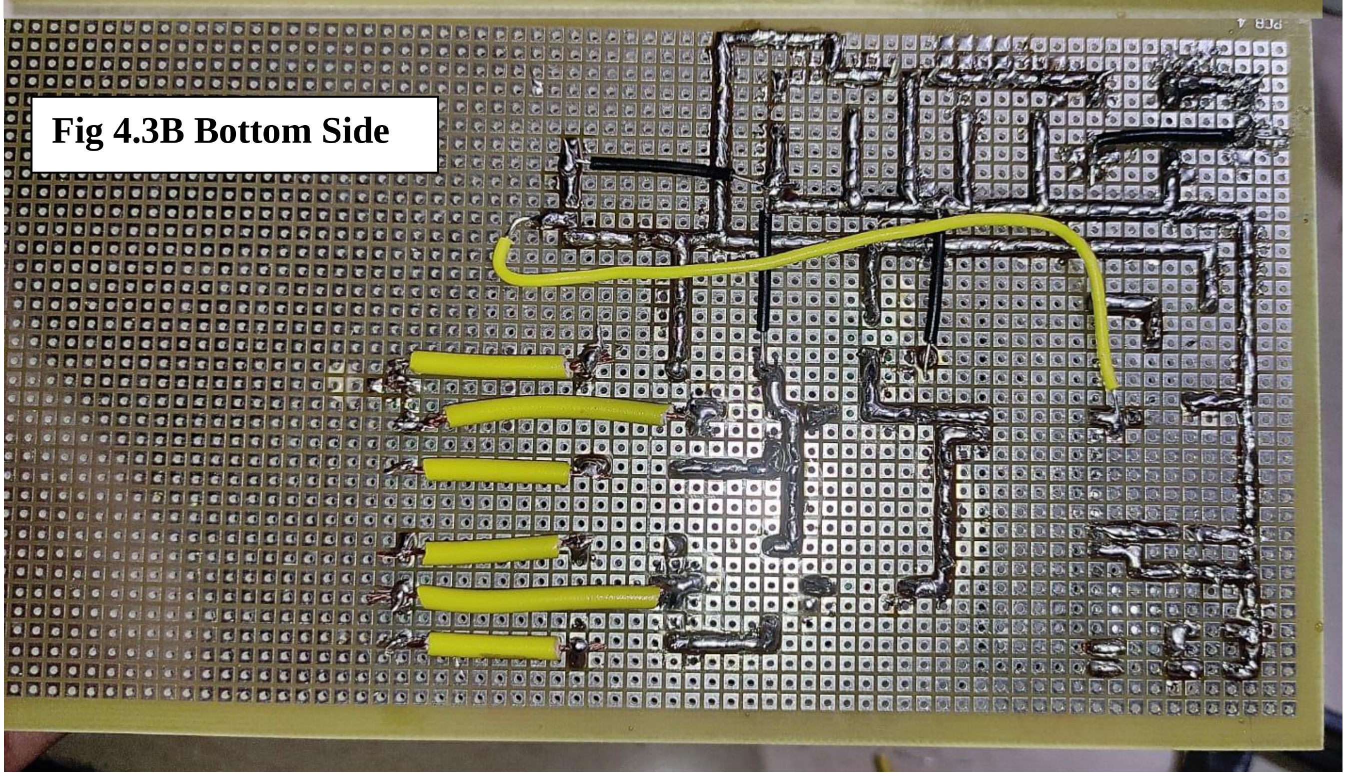

Fig 4.3B Bottom Side

4.5Layout Versus Schematic

The PCB design plays a crucial role in the electronic code locking system as it provides a physical platform to mount and interconnect various electronic components. The PCB design ensures proper signal routing, efficient power distribution, and overall system functionality. The PCB design process typically starts with creating a schematic diagram. The schematic captures the circuitry of the electronic code locking system, representing the components and their interconnections using standardized symbols. It serves as a blueprint for the PCB layout.

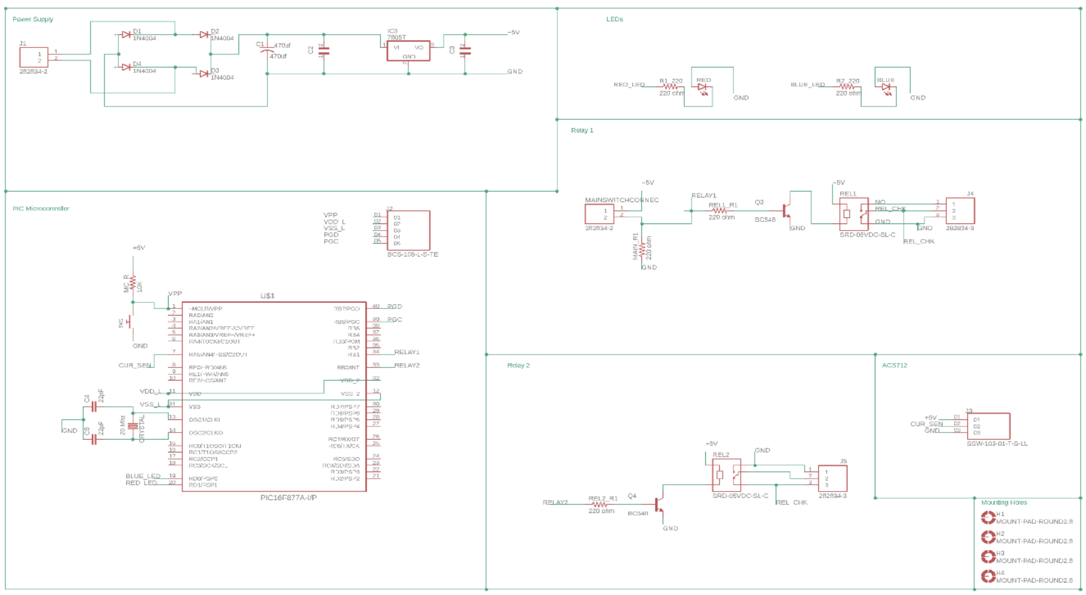

Fig 4.4A Layout Versus Schematic

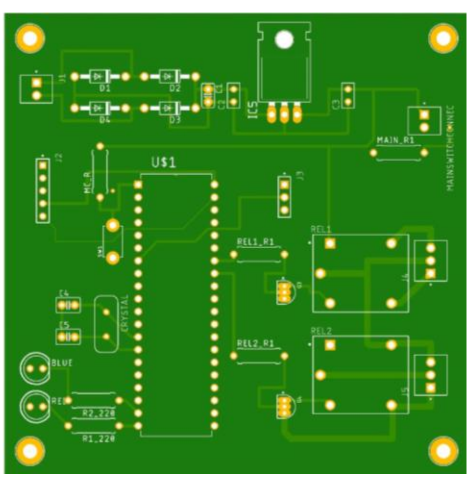

Fig 4.4B Top side

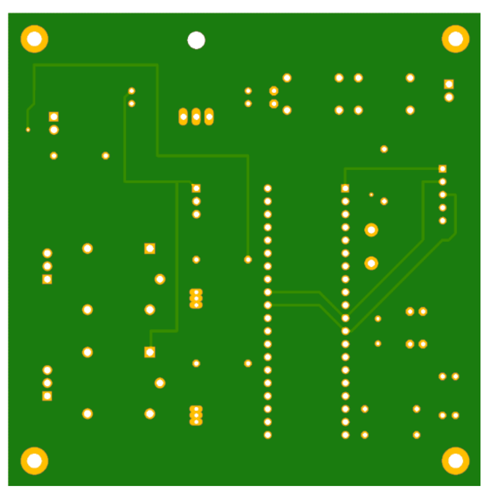

Fig 4.4C Bottom side

CHAPTER 5

RESULTS

Features	Description
Main Components	Automatic switch
Aim of the Project	Protect live terminals or wires
Operation	When the load is disconnected and the main switch is in the on mode, relays operate to make the voltage drop across terminals zero.
Indication	White LED indicates that the load is disconnected and the switch remains on.
Load Reconnection Detection	Relay controlled by PIC16 is used to check if the load is reconnected or not. This condition is also displayed using an LED.
Normal Condition	When the main switch is off, the circuit does not make any changes to the terminals.
Result	The design has been successfully implemented on a PCB and is working effectively.

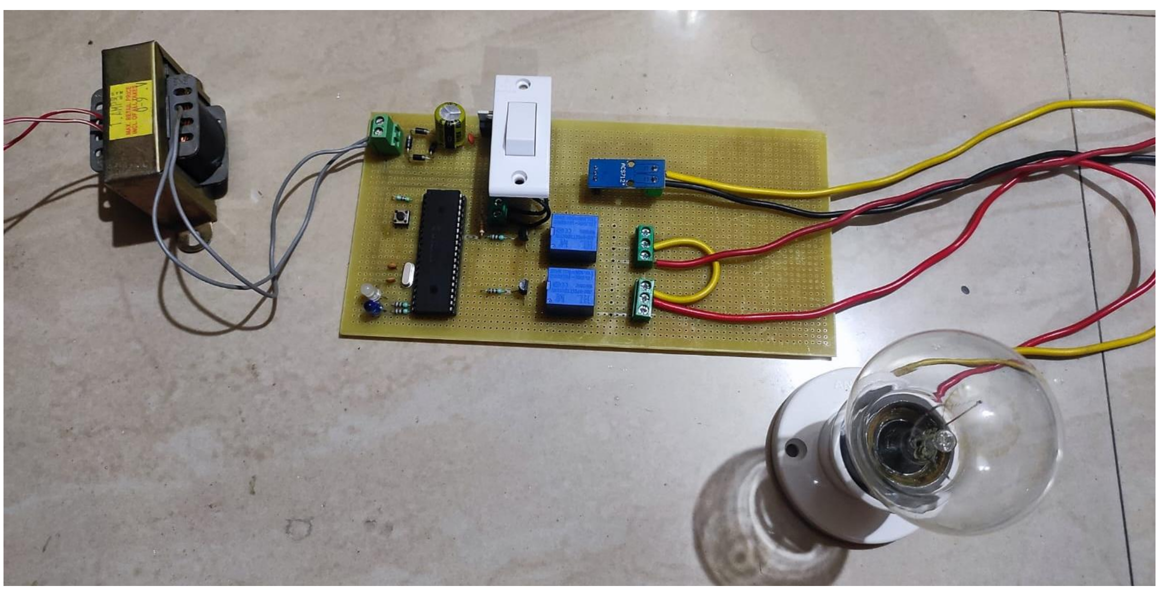

Fig 5.1 Result

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Electrical safety is a critical concern in households and other settings where AC power supplies are used. One crucial issue is the presence of high voltage at the terminals when the load is not connected, which can pose a significant risk of injury or damage. To address this issue, our project aims to develop an automatic switch that instantly reduces the voltage at the terminals when no load is detected in the circuit. By implementing this solution, we can enhance the safety of working with household AC power supplies.

The proposed solution involves incorporating an automatic switch as a relay within the circuit. This switch, controlled by a microcontroller and supported by appropriate logic, is designed to detect the absence of a load, and promptly reduce the voltage at the terminals. By doing so, the automatic switch mitigates the risk of electric shocks or potential damage that could occur if the high voltage were present in the absence of a load.

In addition to addressing the voltage reduction issue, our project also addresses another common problem encountered in electrical systems – moisture. We have successfully designed the circuit to prevent shocks in the main switch area that can be caused by moisture. This consideration adds an extra layer of safety and ensures that the switch functions reliably even in potentially damp environments.

In conclusion, the project endeavors to address the crucial issue of electrical safety by reducing high voltage at the terminals when the load is not connected. Through the implementation of an automatic switch, controlled by a microcontroller and designed to detect load absence, we aim to enhance the safety of working with household AC power supplies. With careful design, testing, and potential future advancements, this project has the potential to make a meaningful contribution to the field of electrical safety and improve the well-being of individuals and communities.

This design offers scalable solutions for enhancing safety in flood areas and other dangerous zones. By incorporating different rated components, the design can be adapted to meet specific requirements. One key feature is the enhanced fault detection system, where the microcontroller code includes advanced algorithms to automatically detect abnormal conditions like short circuits or ground faults, minimizing potential hazards. Furthermore, the design can be extended for implementation in industrial settings by scaling it up and incorporating features to handle higher voltage and current levels. This enables the automatic switch to contribute to improving electrical safety in factories, manufacturing plants, and other industrial environments.

CHAPTER 7
BILL OF MATERIALS

Table: 7.1 Bill of Materials

SR NO.	COMPONENTS	TOTAL	COST
1	1N4007 diodes	4	10
2	470uf 50 V electrolytic capacitor	1	5
3	IC LM7805	1	10
4	Led	3	6
5	220ohm resistor	5	5
6	4.7k ohm resistor	1	1
7	10k resistor	1	1
8	33 pf capacitor	2	2
9	0.1 uf capacitor	2	2
10	Push button	1	5
11	Crystal oscillator 20MHz	1	10
12	Bc548 transistor	2	10
13	5 V relay	2	30
13	3 pin pinch screw	2	10
14	2 pin pinch screw	2	10
15	Switch	1	10
16	ASC712 current sensor	1	175
17	Stepdown transformer secondary voltage 9V 1amp	1	210
18	100W bulb	1	180
19	Bulb socket	1	15
20	Zero PCB	1	20

CHAPTER 8

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