"EDUCATION OF HUMAN POWER FOR TECHNOLOGICAL EXCELLENCE"

SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGINEERING AND TECHNOLOGY

For the MAJOR PROJECT-I

In

Electrical Engineering Department

Project Report

By

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(An Autonomous Institute of Govt. of Maharashtra)

CERTIFICATE

This is to certify that the project entitled **“Automatic Load sharing Transformer with Cutoff system”** in the partial fulfillment of the “Major Project-1, 4th year” for Shri Guru Gobind Singhji Institute of Engineering and Technology, Vishnupuri, Nanded. This bonafide work carried and completed under guidance and supervision of our guide Prof. C.W.Jadhao duringacademic schedule 2023-2024.

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DECLARATION

We hereby declare that we have formed, completed, and written the Report entitled **"Automatic Load sharing Transformer with Cutoff system"** It has not previously submitted for thebasis of the Major Project-1 for 4th year course.

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ABSTRACT

The "Automatic Load Sharing Transformer with Cutoff System" represents a pioneering solution in the field of power distribution and grid protection. This comprehensive report explores the intricacies of this system, delving into its design, functionality, and the wide-ranging benefits it offers. At its core, the system employs advanced load sharing algorithms and a proactive cutoff mechanism to ensure optimal power distribution, enhance grid reliability, and prevent damage caused by faulty transformers. The report sheds light on the working principles, benefits, and real-world applications of this innovative technology, offering insights into its potential to revolutionize the management of electrical grids. With a focus on system optimization, safety, and resource efficiency, this report underscores the transformative impact of the "Automatic Load Sharing Transformer with Cutoff System" in ensuring reliable and resilient power distribution across a variety of critical applications.

ACKNOWLEDGEMENT

We express our sincere gratitude to Prof. C.W.Jadhao of Electrical Engineering dept. for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

We would like to place on record our deep sense of gratitude to Dr. V.G.Asutkar head of Electrical Engineering Department for his generous guidance, help and useful suggestions.

Lastly, we would like to thank all our friends and library staff members whose encouragement and suggestion helped us to complete our project. We are also thankful to all those persons, who have contributed directly or indirectly in the completion of this project.

Thank you!

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CHAPTER 1 INTRODUCTION

1.1Background

Traditional power distribution systems suffer from imbalanced load distribution, inefficiency, and a lack of real- time fault detection, which can lead to grid instability and equipment damage. The "Automatic Load Sharing Transformer with Cutoff System" was developed to address these issues. It combines load-sharing technology and a proactive cutoff mechanism to optimize load distribution, enhance reliability, and improve safety in power grids. This innovation reflects the evolution of power distribution technology in response to increasing demands for efficiency, sustainability, and grid modernization. This report will explore the system's components, workingprinciples, benefits, and applications in more detail.

1.2 Objective

1. Efficient Load Distribution: To ensure the efficient distribution of electrical load across multiple transformers, thereby preventing overloads and underutilization, and improving resource utilization.
2. Enhanced Reliability: To enhance the reliability of power distribution systems by minimizing the riskof transformer failures and power interruptions through load sharing and fault detection.
3. Safety and Equipment Protection: To proactively detect and disconnect faulty transformers, safeguarding the integrity of the electrical grid and preventing potential equipment damage.
4. Cost Reduction: To reduce maintenance costs by prolonging the lifespan of transformers through evenload distribution and preventive measures.
5. Adaptability: To demonstrate the adaptability and applicability of the system in various sectors, including electrical substations, industrial power distribution, and critical infrastructure, ensuring a broad range of practical use cases.
6. Performance Assessment: To assess the system's performance in terms of load distribution efficiency,fault detection, and response times, thereby quantifying its impact on grid efficiency.
7. Real-World Relevance: To showcase the system's real-world relevance through case studies and examples, highlighting successful deployments and practical outcomes in power distribution and grid management.

CHAPTER 2 System Overview

The core of this system involves a combination of load sharing technology and a cutoff mechanism.

The Load Sharing Technology consists of load monitoring sensors and control algorithms. It continuously monitors the electrical load across multiple transformers and calculates the most balanced distribution of power. This results in optimal resource utilization, as no transformer is underutilized or overburdened.

The Cutoff Mechanism is responsible for ensuring system safety. It monitors key electrical parameterssuch as voltage, current, and frequency. If a transformer malfunctions or operates outside safe limits, the cutoff system swiftly disconnects it from the grid. This proactive approach helps in preventing further damage to the grid.

CHAPTER 3 Circuit Diagram and Working

3.1 WORKING FUNCTION OF THE SYSTEM

Here, used Two Transformer 12V, 750mA, 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the AC output of secondary of 230/12V step-down transformer.

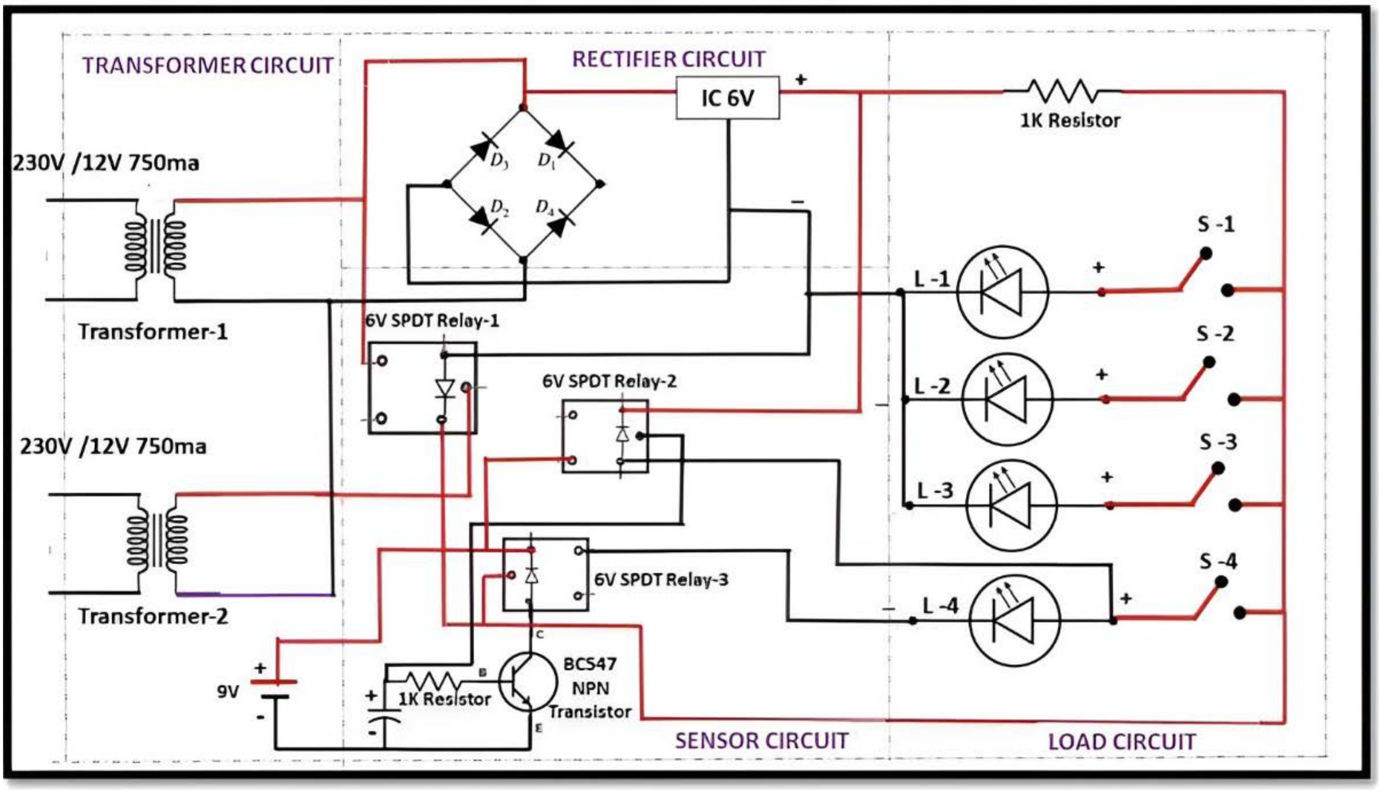


Fig. 3.1 Circuit Diagram

In this project we are using the 4 loads (L-1, L-2, L-3, L-4), 4 loads are connected in parallel through Transformer and one more Transformer connects in parallel with sensor circuit. And last load also connected through transformer with the help of sensor circuit, which will connect and disconnect the load by sensing the current. And we are using the 4 switch (S-1.5-2,5-3,5-4) which will connect in series with each load, and we are using R-1 resistor for protection of 3mm LED Light load.

Both Transformer are stepdown transformers and we called main transformer; transformer has its own load handling capacity. (750mA) In case of a normal operation the transformer takes the load but as the load is beyond the rated capacity of main transformer, then Parallel operation starts. if beyond both transformers rated capacity then extra load is disconnected automatically. Load switching network is provided to ON/OFF the load on the transformers which is connected to load bank. We are using the 4 switches for each load. Over current (750mA) and voltage(12V) set in the sensor circuit. As we keep the switch SI ON Then the load L1 Will be on, and 375 mA current will flow through transformer. And switch S2 ON then load L2 Will be on and 750 mA current will flow through the transformer then sensor sense the current and parallel operation start and we will on the S3 Switch the load L3 will be on and 1.125 A current will flow through the transformer, then we will on the last load L4 then current will increase the maximum set value of sensor circuit that time sensor will disconnect the extra load L4 within 5 sec. and transformer will be safe condition.

CHAPTER 4 System Components

4.1 PCB Board (Printed Circuit Board)

The PCB is a vital structural component that serves as the platform for mounting and interconnecting all the electronic components. It consists of a non-conductive base material with thin copper traces etched onto its surface. These traces form conductive pathways that allow electrical connections between the components. Soldered onto the PCB, the components are secured and electrically connected to one another, facilitating the system's functionality and reliability.

4.2 Step-Down Transformer (230V/12V - 750mA)

The step-down transformer is instrumental in ensuring a safe and compatible power source for the system. Inthis case, it converts high-voltage alternating current (AC) of 230V into a lower-voltage AC of 12V while providing a current capacity of up to 750mA. This voltage reduction is crucial for ensuring the safety of the circuit and matching the voltage requirements of the system's components.

4.3 Rectifier:

The rectifier plays a fundamental role in transforming the AC voltage output from the step-down transformer into a stable direct current (DC). Most electronic components within the system typicallyrequire DC voltage to function effectively. The rectifier ensures that the output voltage maintains a consistent polarity, providing a steady source of power.

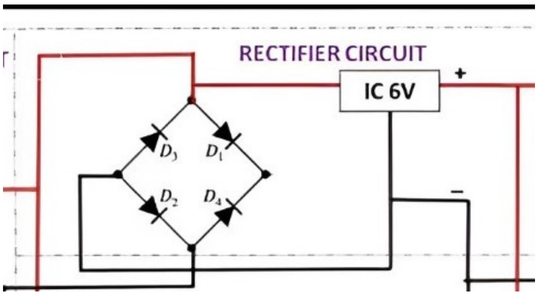


Fig. 4.1 Rectifier circuit

4.4 Sensor Circuit:

The sensor circuit encompasses various sensors, which are designed to collect data from the system's environment. These sensors may include temperature sensors, light sensors, or motion detectors, depending on the specific application. Their primary function is to convert environmental data into electrical signals that can be processed by the control circuit to make informed decisions ortrigger specific actions.

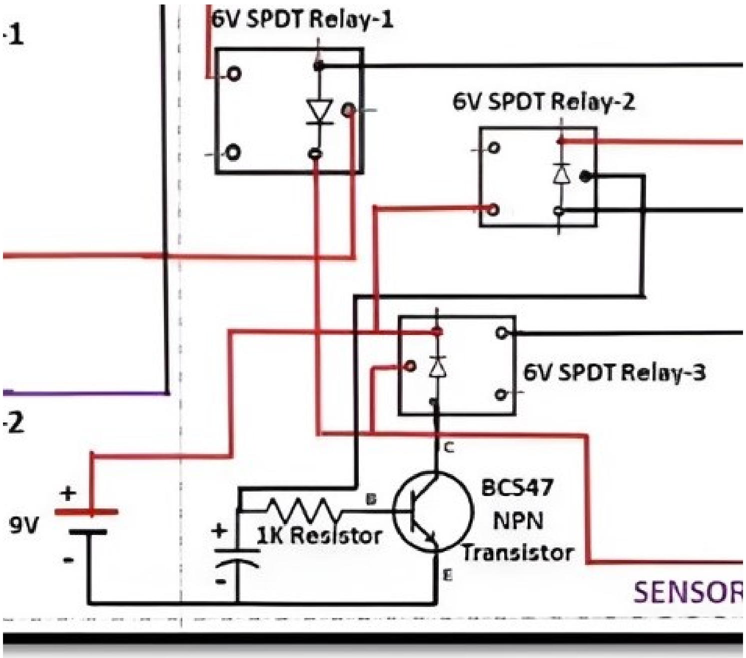
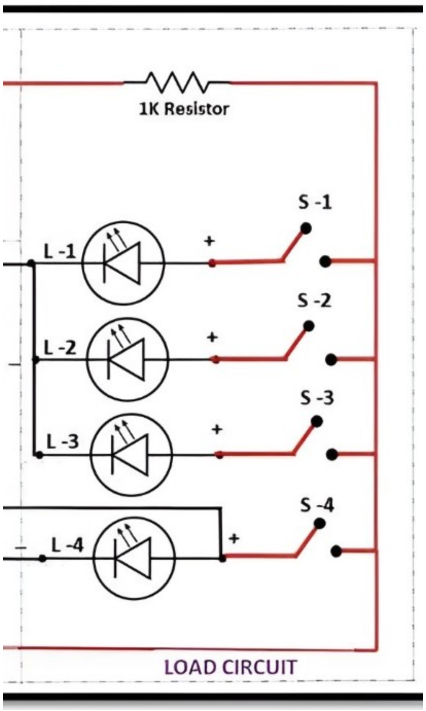


Fig 4.2 sensor circuit

4.5 Load Circuit:

The load circuit is the section of the system where the desired output or action occurs. In the context of an "Automatic Load Sharing Transformer with Cutoff System," this load circuit may include various components, such as switches, LEDs (Light Emitting Diodes), and relays, all of whichcan be used to control and monitor the system's output.



Fi 4.3 load circuit

4.6 Resistor:

Resistors are passive electrical components that play a crucial role in controlling the flow of electriccurrent within the circuit. They can be used to limit the current to LEDs or create voltage dividers within sensor circuits, ensuring that electrical parameters stay within the desired range.

4.7 LEDs as Load:

Light Emitting Diodes (LEDs) are semiconductor devices that emit light when an electric currentflows through them. In this context, LEDs can serve various purposes, such as providing visual indicators for the system's status, indicating fault conditions, or offering user feedback.

4.8 Diodes:

Diodes are semiconductor devices designed to allow electric current to flow in one direction only. They can serve various functions within the system, including rectifying AC to DC voltage, protectingthe circuit from reverse voltage, and isolating components from one another.

4.9 Pin Screw:

Pin screws, also known as terminal blocks, provide a convenient and secure way to establish electrical connections between the components and the PCB. These connectors simplify the process ofwiring and offer a method for ensuring that connections are firm and reliable.

4.10 Transistor:

Transistors are active electronic components often used for amplifying or switching electronic signals. Within this system, transistors may control the operation of relays, enabling them to switch high-power loads on or off, or they may be used to amplify signals from sensors to a level suitable forfurther processing.

4.11 Capacitor:

Capacitors are passive electronic components that store and release electrical energy in the form ofan electric field. They are commonly used in various parts of the circuit to filter out noise from powersupplies, smooth out voltage fluctuations, or assist in timing and signal processing.

4.12 Relay:

A relay is an electromechanical switch used to control high-power circuits with a low-power signal.It plays a crucial role in the "Automatic Load Sharing Transformer with Cutoff System" by allowing low-voltage control signals to manage high-voltage and high-current loads. This functionality enables the system to safely and reliably control or isolate power to specific components or loads, contributingto safety and overall functionality.

4.13 Switches:

Switches are manually operated electrical devices that interrupt or complete the electrical circuit.

Within the system, switches are used for user interactions, allowing manual control over specific functions or components. Depending on the design, switches can initiate actions, configure settings, orturn specific elements on or off.

4.14 Jumping Wire:

Jumping wires, commonly known as jumper wires, provide a means for making direct electrical connections between components on the PCB. They are crucial for customizing and modifying the circuit's connections, enabling you to bridge connections between components, join traces, or troubleshoot the circuit. Jumping wires offer flexibility and adaptability in designing and configuringthe circuit as needed.

CHAPTER 5 Cutoff System

The cutoff system integrated into the "Automatic Load Sharing Transformer with Cutoff System" isa vital safety mechanism designed to ensure the reliability and safety of electrical grids. Comprising fault detection sensors and a swift-acting cutoff mechanism, it continuously monitors key electrical parameters, instantly responding to any deviations or anomalies by disconnecting the faulty transformer from the grid. This rapid and proactive approach safeguards against equipment damage, prevents fault propagation, enhances grid resilience, and finds crucial applications in electrical substations, industrial power distribution, and critical infrastructure protection, ensuring the uninterrupted availability of electrical power during critical operations and contributing significantly to the overall reliability of power distribution systems.

5.1 Functionality of the Cutoff System:

5.1.1 Real-time Monitoring:

The cutoff system operates in real-time, continuously monitoring the electrical parameters in the grid. This ongoing vigilance ensures that any deviations or anomalies are detected as they occur.

5.1.2 Fault Detection:

As part of its core function, the fault detection sensors constantly compare the measured electrical parameters with predefined safety limits. If any parameter exceeds these limits or exhibits erratic behavior, it signals a potential fault in the system.

5.1.3 Swift Response:

When a fault is detected, the cutoff mechanism reacts promptly. It disconnects the faulty transformer from the grid within milliseconds, preventing any further propagation of the fault. This rapid response is vital for safeguarding the overall stability of the electrical grid.

5.1.4 Safety and Equipment Protection:

The primary purpose of the cutoff system is to ensure the safety of the electrical grid and connected equipment. By isolating the faulty transformer, it prevents further damage to the grid and protects othercomponents from the consequences of the fault.

5.1.5 Grid Resilience:

By isolating the fault quickly, the cutoff system enhances the resilience of the electrical grid. It minimizes the impact of disruptions and helps the grid recover more swiftly from faults or disturbances.

5.2 Applications of the Cutoff System:

The cutoff system finds application in various sectors and scenarios, including:

5.2.1 Electrical Substations:

In electrical substations, the cutoff system is essential for ensuring the integrity and stability of the power distribution network. It prevents faults or disturbances from spreading and causing widespread power outages.

5.2.2 Industrial Power Distribution:

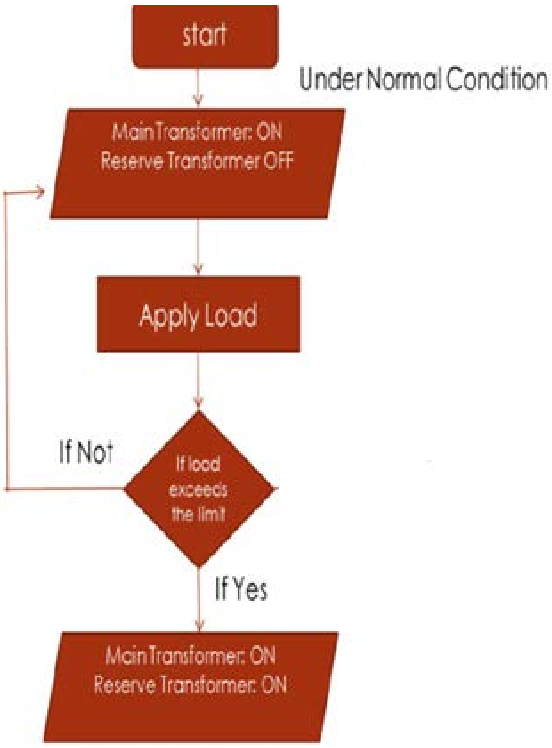
Industries with multiple transformers rely on the cutoff system to protect their equipment and maintaincontinuous operations. It helps avoid costly downtime and equipment damage.

5.2.3 Critical Infrastructure Protection:

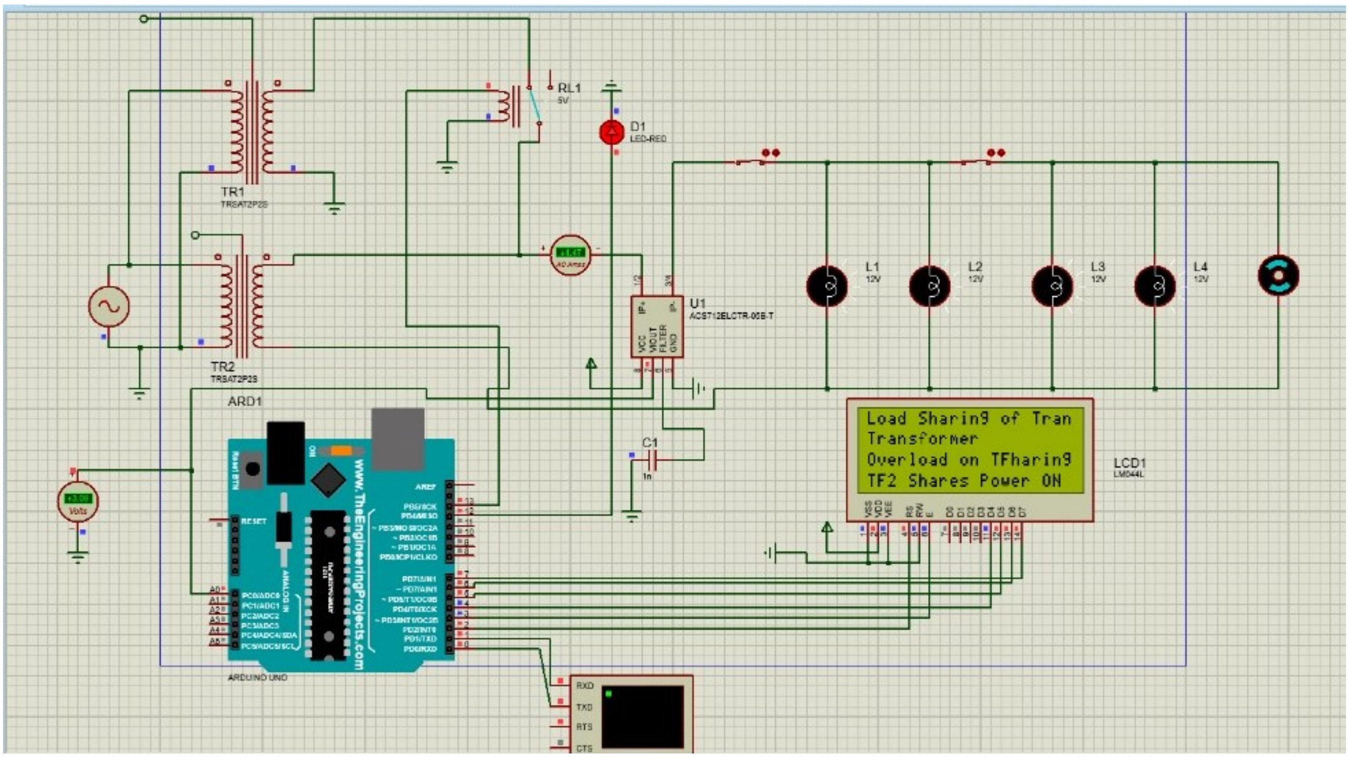
Facilities such as hospitals, data centers, and communication hubs use the cutoff system to ensure uninterrupted power supply, especially during critical operations. It helps maintain the highest level ofgrid reliability and safeguards against potential equipment failures.

CHAPTER 6 Proteus Simulation

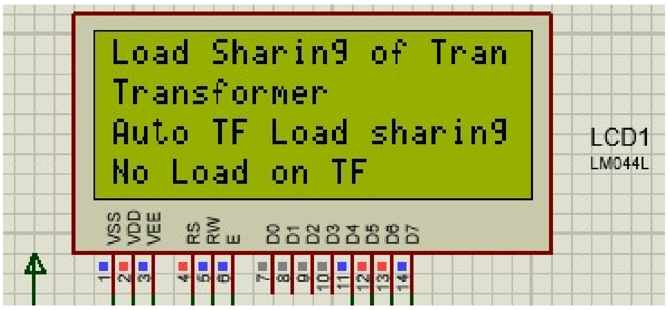
6.1 Flowchart



6.2 Simulation Circuit



6.3 Results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Transformer
Auto TF Load sharing
No Load on TF
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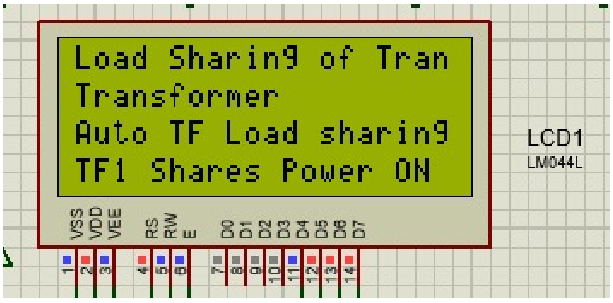
LM044L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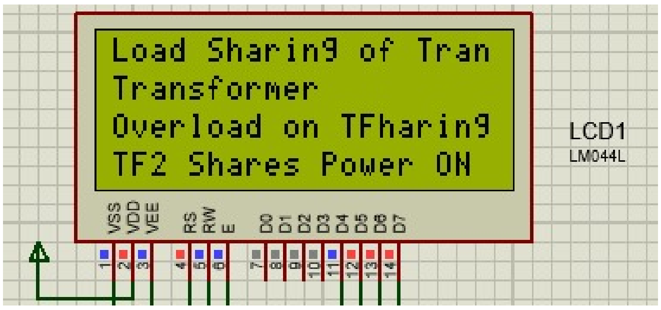
Load Sharing of Tran
Transformer
Overload on TFharing
TF2 Shares Power ON
LCD1
LM044L

CONCLUSION

In conclusion, the transformer safety cutoff system plays a critical role in ensuring the reliable and safe operation of transformers in various applications, from power distribution to industrial processes. This device isdesigned to protect transformers and surrounding equipment from potential hazards and prevent catastrophic failures. It acts as a last line of defense by disconnecting power sources or isolating the transformer when abnormal conditions, such as overloading, short circuits, or excessive temperature, are detected. The transformercutoff system enhances overall system reliability and minimizes downtime, preventing costly damage and potential safety risks. Its implementation is a crucial aspect of modern power systems and industrial operations, providing peace of mind and safeguarding both equipment and personnel.

Future Scope

1. The future scope of our project is mainly in substation.
2. There is a need for the operation of an extra transformer at substations, particularly during peak hours, to meet the additional load requirement.
3. Under severe loads, our project automatically connects the transformer. As a result, there is no need to run both transformers at full power, especially during off-peak hours. As a result, electricity is intelligently shared with the transformer in parallel.

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