M.Kumarasamy College of Engineering
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur - 639 113, TAMILNADU.

A Project Report

On

BATTERY CHARGER USING SCR AND 555 TIMER

Submitted by

ISWARYA P	**(927623BEE035)**
KARNIKA D	**(927623BEE039)**
KARUNYA SHREE S	**(927623BEE042)**
KAVIYA G	**(927623BEE043)**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
M. KUMARASAMY COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to Anna University, Chennai)
THALAVAPALAYAM, KARUR-639113.

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(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this report titled **"BATTERY CHARGER USING SCR AND 555 TIMER "** is the Bonafide work of **ISWARYA P (927623BEE035),KARNIKA D (927623BEE039) KARUNYA SHREE S (927623BEE042) , KAVIYA G (927623BEE043)** who carried out the work during the academic year (2024-2025) under my supervision.

SIGNATURE
SUPERVISOR
Dr.S.Banumathi M.E., Ph.D.,
Professor
Department of Electrical and
Electronics Engineering
M.Kumarasamy College of
Engineering, Karur

SIGNATURE
HEAD OF THE DEPARTMENT
Dr.J.Uma M.E., Ph.D.,
Professor & Head
Department of Electrical and
Electronics Engineering
M.Kumarasamy College of
Engineering, Karur

Submitted for Electron Devices and Circuits Project (TCPR) (EEB1204) viva-voce Examination held at M.Kumarasamy College of Engineering,Karur-639113 on …………..

VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To develop globally competent Electrical Engineers with expertise in education and cutting edge research technologies thereby contribute value to their career and society.

MISSION

M1: Knowledge: To bestow quality education in Electrical and Electronics Engineering and prepare the students for career development and higher studies.

M2: Skill: To Excel in Contemporary core and Interdisciplinary areas with Prime Research Facilities and Industrial collaborations

M3: Attitude: To augment student competency along with moral and ethical values through academics to serve the society

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 01 – Knowledge

To empower graduates with high standards of technical knowledge making them readily employable or well prepared for pursuing higher education to thrive in their career development

PEO 02 - Skills

To produce graduates with interdisciplinary skills who can contribute meaningfully to cutting-edge research and innovation in emerging areas, thereby making a significant impact on their respective industries and the global community.

PEO 03 - Attitude

To develop highly competent professionals who are also committed to uphold the highest standards of ethical conduct and moral consciousness in the society.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7:Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The following are the Program Specific Outcomes of Engineering Students:

PSO 01

To demonstrate proficiency in Core Electrical areas such as Electrical Circuits, Electromagnetic fields, Control Engineering, Instrumentation, Electrical Drives, Power System and Power Electronics to Solve Practical Engineering Problems.

PSO 02

To analyze, design and develop Electronic circuits and systems through insights acquired in Integrated circuits, Embedded systems, Analog and Digital Electronics.

PSO 03

To apply technical competency, management and interdisciplinary skills for developing socially acceptable solutions to complex emerging area problems and its applications

Abstract (Key Words)	Mapping of POs and PSOs
Battery Charger, SCR,555 Timer, Controlled Charging ,Overcharge Protection, LED Indicators ,Short-Circuit Protection.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8,PO9.PO10,PO11,PO12,PSO1,PSO2 ,PSO3.

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TABLE OF CONTENTS

ABSTRACT

This project focuses on designing an efficient and cost-effective battery charger using a Silicon-Controlled Rectifier (SCR) and a 555 Timer IC. The charger incorporates a simple yet reliable circuit that ensures controlled charging, making it suitable for lead-acid or similar rechargeable batteries. The SCR acts as a controlled switch to regulate the current flow to the battery, protecting it from overcharging and ensuring long-term durability. A 555 Timer is configured as a monostable multivibrator, providing precise timing control for turning the SCR on and off. This approach enables the charger to automatically stop charging when the battery reaches its full charge, preventing energy wastage and battery damage. The charger circuit also includes additional features such as short-circuit protection and LED indicators to display charging status. The design is compact, cost-effective, and highly efficient, making it ideal for applications in portable power supplies, automotive batteries, and renewable energy systems.This project demonstrates the application of basic electronic components in developing a practical solution to address common issues associated with battery charging, highlighting its significance in energy management and sustainability.

CHAPTER 1

INTRODUCTION

A mobile battery charger is an essential device that ensures the longevity and efficient charging of a mobile device. This project presents a reliable and cost-effective mobile battery charger circuit using a Silicon Controlled Rectifier (SCR) and a 555 Timer IC.

The SCR is employed to control the charging process, enabling the circuit to handle higher currents while maintaining safety and efficiency. The 555 Timer IC operates as an oscillator or pulse generator to regulate the charging duration and prevent overcharging, which enhances battery life.

This charger is designed to ensure stable current delivery, automatic cut-off, and user-friendly operation. The integration of SCR and 555 Timer IC makes the system highly efficient, compact, and suitable for a wide range of mobile batteries. This project offers an innovative approach to developing a charger circuit that balances simplicity, functionality, and cost-effectiveness.

CHAPTER 2
LITERATURE REVIEW

Paper 1: Rahil Imtiyaz, Mohammad Ismail – "Design of a Simple Mobile Battery Charger Using SCR and 555 Timer" (2021)

Inference: This paper focuses on a straightforward design for a mobile battery charger using a Silicon Controlled Rectifier (SCR) for efficient AC to DC conversion and a 555 timer IC to generate pulse-width modulated signals for controlling the charging cycle. The SCR ensures that high currents required for charging are handled effectively, while the 555 timer modulates the output to prevent overcharging by regulating the timing of the pulses sent to the battery. The design's key advantage is its low cost and simplicity, making it an ideal choice for educational purposes or prototype development. However, the study notes that while the system prevents overcharging by controlling the pulse duration, further optimization in terms of the frequency of these pulses and the SCR's gating mechanism could improve the overall efficiency and charging speed. The paper concludes that this configuration is practical for applications where a low-cost solution is paramount, though there is room for further refinement in terms of performance.

Paper 2:G.Tirumagal,B.Rajasekaran,M.S.S.Jaya – "SCR-Based Mobile Charger Circuit with Pulse Control" (2020)

Inference: In this paper, the authors delve into a charger design where the SCR and 555 timer work together to ensure that the battery is charged safely and efficiently. The SCR acts as a controlled switch that handles high current, while the 555 timer generates pulse signals that modulate the current flow to the battery. The pulse modulation is critical in preventing continuous current flow, which can lead to overheating or battery degradation. By delivering energy in short bursts, the charger design helps reduce the risks associated with overcharging and thermal runaway, which are common in lithium-ion and lead-acid batteries. The paper emphasizes that this design improves the safety and longevity of the battery, making it a suitable choice for mobile devices that rely on these types of batteries. The study concludes that pulse control via the 555 timer is an effective method for regulating battery charging, ensuring both efficiency and battery protection, with the added benefit of being relatively simple and cost-effective

Paper 3: Susmita Bhunia - "Energy-Efficient Charger Circuit Using 555 Timer and SCR" (2019)

Inference: This study focuses on the energy efficiency of a mobile battery charger that integrates an SCR with a 555 timer. The 555 timer is used to generate pulse signals that control the charging process, while the SCR allows the system to handle high currents required for fast charging. The primary goal of this design is to minimize energy consumption while providing efficient charging. The research highlights that by using the 555 timer to modulate the pulse width, the charger reduces power losses compared to traditional charging methods that rely on continuous current. This is particularly useful in applications where energy conservation is a priority, such as in off-grid systems or solar-powered devices. The paper concludes that this energy-efficient design is capable of delivering quick charging times without excessive power consumption, making it ideal for scenarios where power supply is limited, or energy conservation is crucial.

Paper 4: K.S.R.Anjaneyulu et al - "Analysis of Battery Charging Circuits with SCR and Timer ICs" (2018)

Inference: This paper compares various battery charging circuits that use SCRs in conjunction with timer ICs, such as the 555 timer. It evaluates these circuits in terms of charging speed, thermal stability, energy efficiency, and circuit complexity. The authors compare the SCR-555 timer combination to more sophisticated circuits that employ microcontrollers or specialized charging ICs. The study finds that while more advanced designs can offer superior performance, the SCR-555 timer configuration is an excellent compromise between simplicity, cost, and reliability. The SCR's ability to handle high current efficiently and the 555 timer's pulse modulation ensures that the battery charges in a controlled and safe manner, reducing risks such as overheating and overcharging. The paper concludes that this design is well-suited for low-power consumer devices, where safety, cost-effectiveness, and ease of implementation are more critical than rapid charging or advanced features. The simplicity of the circuit also makes it easy to implement in educational projects or prototype devices.

CHAPTER 3
PROPOSED METHOLOGY

3.1 BLOCK DIAGRAM:

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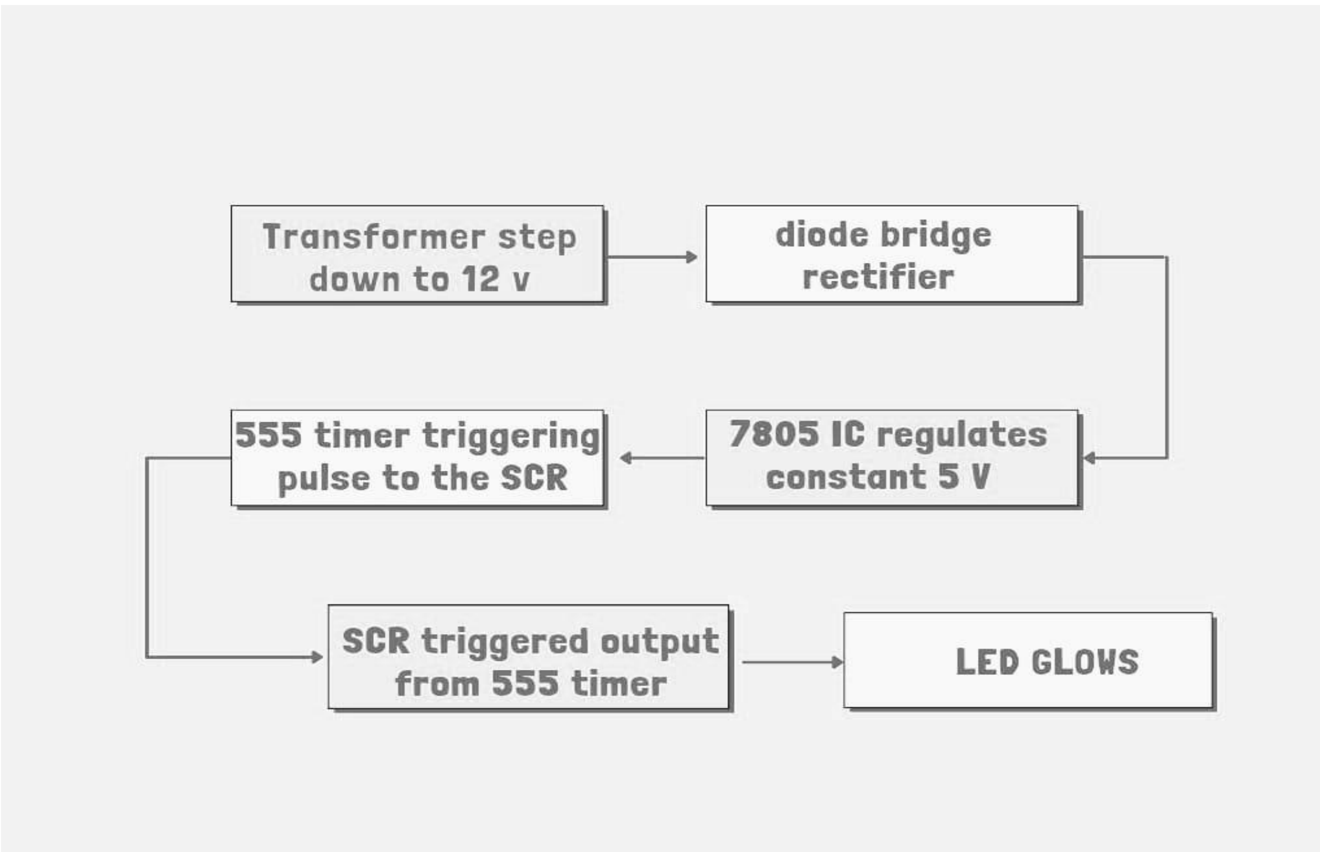


Fig:3.1 Block Diagram

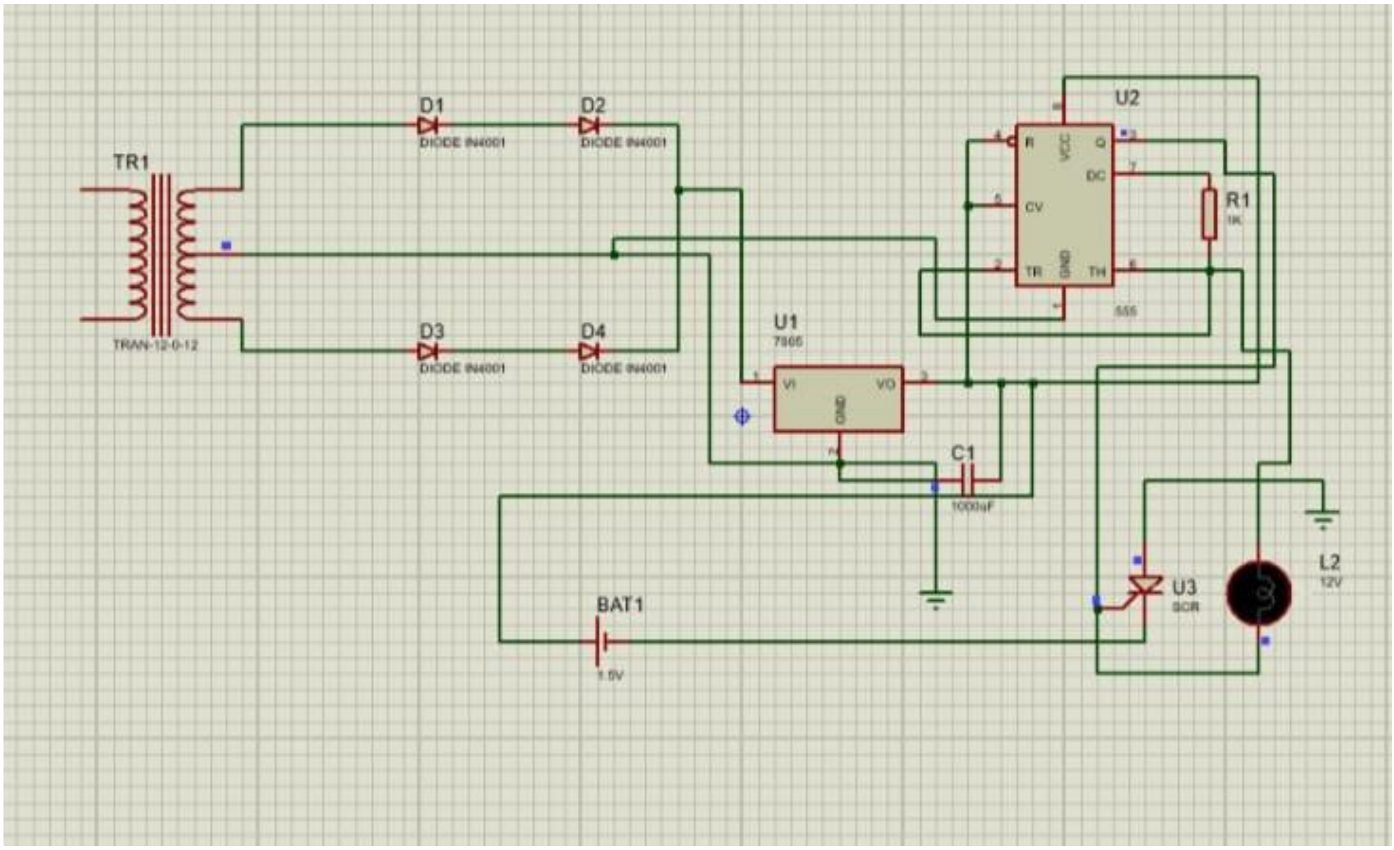
3.2 DESCRIPTION

- A Mobile Battery Charger using SCR (Silicon Controlled Rectifier) and 555 Timer is an efficient and cost-effective solution designed to safely charge mobile devices by controlling the flow of current to the battery. The SCR acts as a controlled rectifier, converting the AC input into DC, which is required for charging. It functions as a switch, allowing the current to flow only when triggered, thus ensuring that high current levels are handled safely without causing excessive heat or damage to the components. The 555 timer IC is configured in astable mode to generate periodic pulse signals, which regulate the timing of the charging process. By controlling the SCR with these pulses, the 555 timer ensures that the battery is charged in controlled bursts, preventing overcharging and reducing the risk of thermal runaway—a common issue in lithium-ion and lead-acid batteries.

- This pulse-width modulation approach provided by the 555 timer prevents continuous current flow into the battery, which would otherwise lead to overheating and reduced battery life. The intermittent pulses also help minimize energy losses, making the charger more energy-efficient. Additionally, the 555 timer's role in modulating the charging cycle ensures that the battery receives an optimal charge, thereby enhancing its lifespan and overall performance.

- The simplicity and low cost of the circuit make it ideal for educational purposes, prototyping, or low-budget charging applications, especially in environments with limited resources, such as renewable energy systems or off-grid locations. Moreover, the design's flexibility allows for easy adaptation to various types of batteries, making it a practical choice for different mobile devices. This charger not only provides a reliable and safe method for battery charging but also offers an efficient and economical solution for powering mobile devices.

3.3 CIRCUIT DIAGRAM



3.4 KEY CIRCUIT ELEMENTS AND DESCRIPTION

1. Silicon-Controlled Rectifier (SCR):

Description: The SCR is used to convert AC to DC, acting as a controlled switch. It regulates the current flow to the battery, ensuring it charges safely by preventing overcharging and managing the current.

2. 555 Timer IC:

Description: The 555 timer is configured as a monostable multivibrator to provide precise timing control. It generates pulses that trigger the SCR, controlling the on-off cycle of the charging current and preventing continuous charging.

3. 7085 IC:

Using a 7805 voltage regulator in a battery charger circuit with SCR (Silicon-Controlled Rectifier) and a 555 timer is a common way to regulate voltage and control the charging process. Provides a stable 5V output to power the 555 timer circuit or as a reference voltage.

4. Transformer:

Description: The transformer steps down the AC voltage from the power source to a lower, safer voltage suitable for charging the battery.

5. Resistors:

Description: Resistors are used to set the timing interval of the 555 timer and to limit the current flow through different parts of the circuit, ensuring the proper operation of the components.

6. Capacitors:

Description: Capacitors smooth out any voltage fluctuations and filter noise, helping maintain a stable DC output for charging the battery.

7. Diodes:

Description: Diodes are used for rectification to ensure current flows in one direction only (from AC to DC), and to protect the circuit from reverse voltage that could damage components.

8. LED:

Description: An LED is used to indicate the charging status, lighting up when the charger is active and potentially changing color or blinking when the battery is fully charged or if there is a fault.

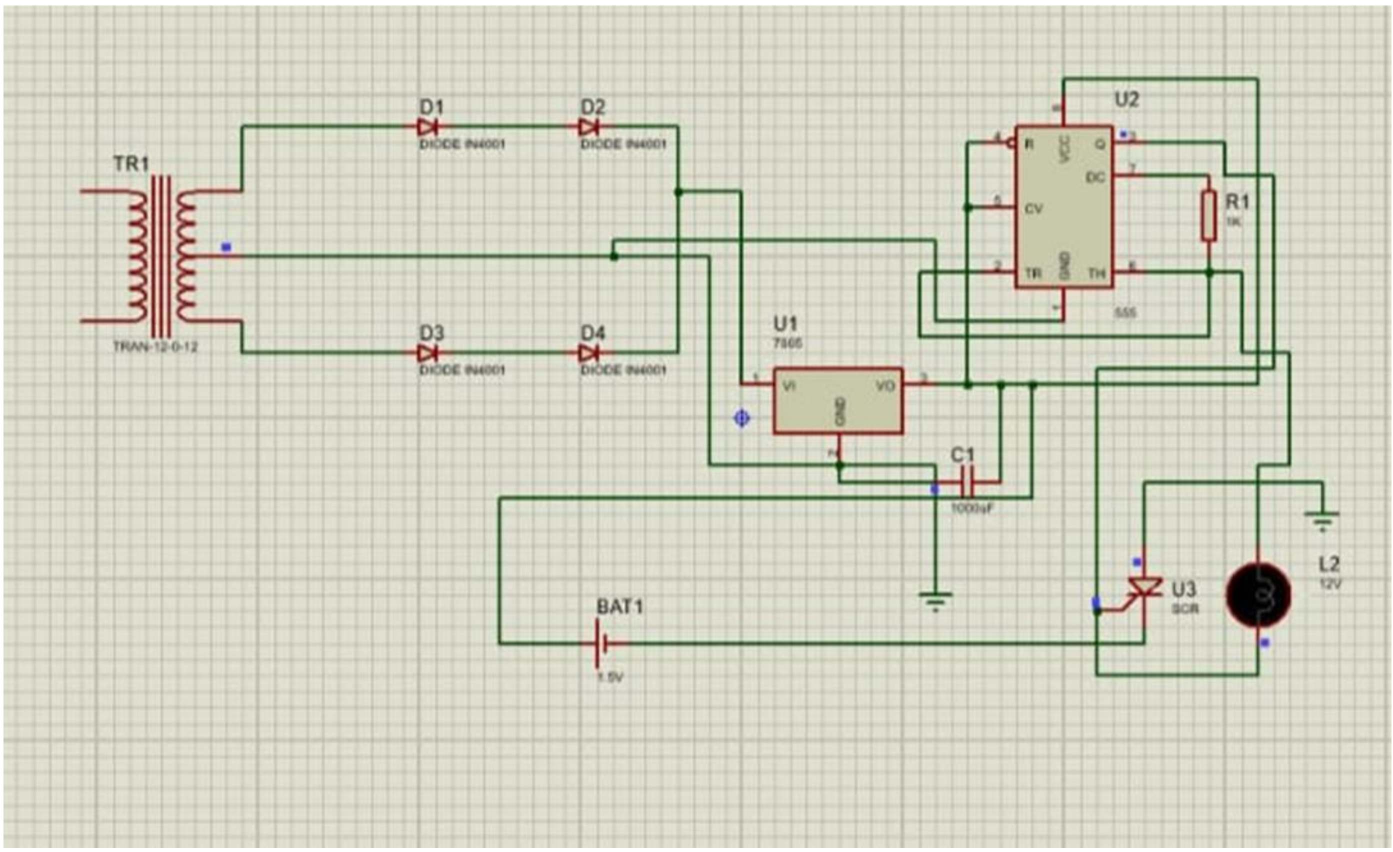
9. Battery:

Description: The battery is the load that is being charged by the circuit. It stores the energy delivered by the charger.

CHAPTER 4

RESULT AND DISCUSSION

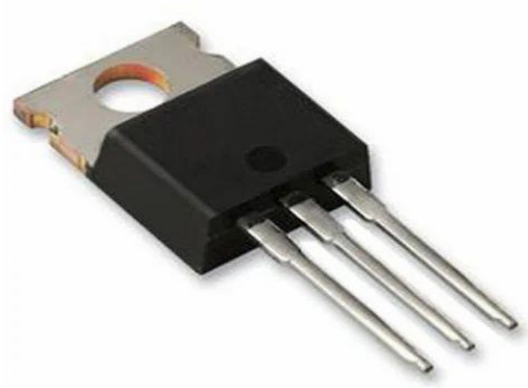
4.1. SIMULATION OUTPUT



4.2.HARDWARE COMPONENTS DESCRIPTION

SILICON CONTROLLED RECTIFIER:

The Silicon Controlled Rectifier (SCR) in a mobile battery charger is responsible for converting alternating current (AC) to direct current (DC), which is required for battery charging. It acts as a controlled switch, allowing current to flow in only one direction once triggered by a control signal from the 555 timer. The SCR efficiently handles high currents, ensuring safe and reliable power delivery to the battery. By modulating the current flow, it prevents overcharging and protects the battery from overheating, making it an essential component in maintaining the safety and efficiency of the charger.



555 TIMER IC:

The 555 timer IC is a versatile and widely used integrated circuit that can operate in various modes, including monostable, astable, and bistable. In the context of a mobile battery charger, the 555 timer is typically used in astable mode to generate a continuous series of pulses. These pulses are used to control the triggering of the SCR, regulating the flow of current to the battery. The 555 timer’s ability to create precise time intervals makes it essential for modulating the charging process, preventing overcharging.

TRANSFORMER:

In a mobile battery charger using SCR and 555 timer, the transformer is used to step down the high-voltage AC (alternating current) from the power source to a lower, safer voltage suitable for charging the battery. It provides the necessary AC input to the circuit, which is then rectified by the SCR to convert it into DC (direct current) for battery charging. The transformer ensures that the circuit operates within the required voltage range, protecting both the charger and the device being charged.

LED:

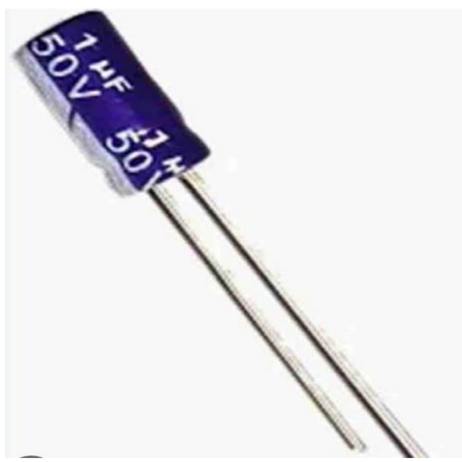
In a mobile battery charger using SCR and 555 timer, the LED typically serves as an indicator to show the charging status. It lights up when the charger is powered on and actively charging the battery. The LED may also change color or blink to indicate different stages of the charging process, such as when the battery is fully charged or if there is a fault in the charging circuit. This provides a simple and effective visual cue to the user, enhancing the usability of the charger.

RESISTOR:

In a mobile battery charger using SCR and 555 timer, resistors are used to control the current flow and set the timing intervals for the 555 timer. They help determine the pulse width and frequency of the timer's output, which regulates the charging cycle. Resistors also limit the current through certain components, preventing them from overheating or being damaged, ensuring safe and efficient operation of the charger circuit.

CAPACITOR:

In a mobile battery charger using SCR and 555 timer, capacitors are used to smooth out voltage fluctuations and filter noise in the circuit. They help stabilize the power supply by storing and releasing electrical energy, ensuring a steady flow of current to the battery. Capacitors also assist in maintaining the proper timing for the 555 timer, contributing to the accurate pulse modulation that regulates the charging process.



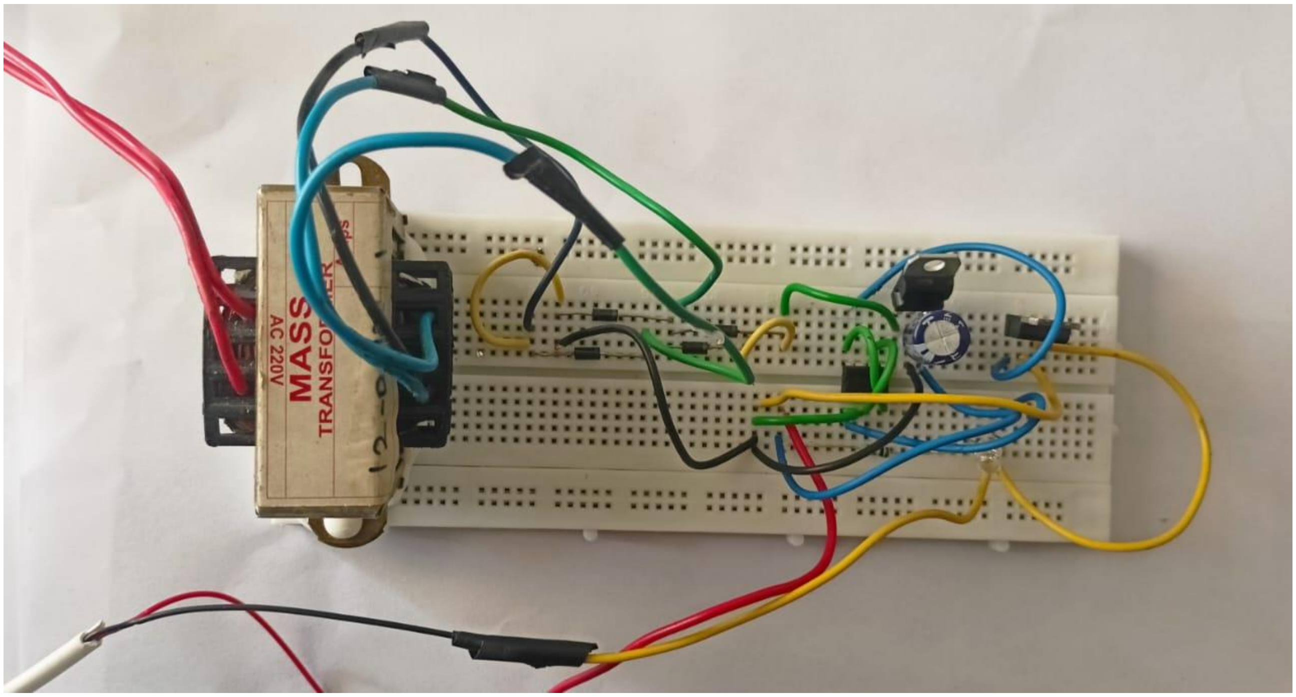
DIODE:

In a mobile battery charger using SCR and 555 timer, diodes are used for rectification and protection. The rectifying diode ensures that the current flows in only one direction, converting the AC input from the transformer into DC for charging the battery. Additionally, diodes protect the circuit from potential reverse voltage, preventing damage to components like the SCR and the battery. This ensures safe and efficient charging operation.

7805 IC:

Using a 7805 voltage regulator in a battery charger circuit with SCR (Silicon-Controlled Rectifier) and a 555 timer is a common way to regulate voltage and control the charging process**.** Provides a stable 5V output to power the 555 timer circuit or as a reference voltage.

4.3 HARDWARE EXPERIMENTAL SETUP



CHAPTER 5
CONCLUSION

In conclusion, a mobile battery charger using SCR and a 555 timer offers a simple, cost-effective, and efficient solution for charging batteries. The SCR effectively handles high currents by converting AC to DC, while the 555 timer modulates the charging process through pulse-width modulation, ensuring safe and controlled charging. This design helps prevent overcharging, reduces the risk of overheating, and extends the battery's lifespan. The system's low cost and straightforward implementation make it suitable for educational projects, prototypes, and basic charging applications. However, further improvements can be made to enhance efficiency, support different battery types, and integrate smart charging features for better performance and user convenience.

FUTURE SCOPE:

- Improved Charging Efficiency: Enhance the design for faster and more efficient charging by optimizing pulse-width modulation and reducing power losses.

- Smart Charging Features: Integrate microcontrollers or specialized ICs to implement multi-stage charging, adaptive charging rates, and automatic cutoff when the battery is fully charged.

- Battery Type Compatibility: Expand the design to support a wider range of battery types (e.g., lithium-ion, nickel-metal hydride) with automatic adjustment of charging parameters.

- Energy Harvesting: Add energy harvesting features like solar charging to make the system more eco-friendly and suitable for off-grid or renewable energy applications.

- Compact Design: Develop more compact and portable designs to make the charger more user-friendly and suitable for mobile use.

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