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Solar-Powered Portable Mobile Phone Charger for Motorbikes

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Abstract: As mobile phones have become an essential part of our daily lives, the need for portable charging solutions has grown significantly, especially in situations where access to traditional power sources is limited. This abstract introduces a solar-powered portable mobile phone charger designed specifically for motorbikes. By utilizing solar energy, this compact charger offers a sustainable and efficient solution for charging mobile phones on the go. The charger integrates lightweight solar panels, a high-capacity battery, and user-friendly features to enhance convenience and durability. With multiple output ports and weather resistance, it provides a reliable charging option while promoting eco-friendly practices. This solar-powered mobile phone charger for motorbikes contributes to the advancement of green energy solutions and meets the growing demand for portable charging in outdoor environments.

Keywords: solar-powered charger, portable, mobile phone, motorbike, sustainable, efficiency, eco-friendly, convenience, durability, outdoor charging.

I. INTRODUCTION

In today's interconnected world, mobile phones have become an indispensable tool for communication, navigation, and accessing information on the go. However, the increasing reliance on mobile devices poses a challenge when it comes to ensuring a reliable source of power, especially in situations where traditional power outlets are scarce or inaccessible. . To address this issue, portable mobile phone chargers have emerged as essential accessories for users seeking to maintain their device's battery life while on the move. In [1] , N. Mohan, T. M. Underland and W. P. Robbins proposed a wide range of topics, including the basics of power electronics, power semiconductor devices, pulse-width modulation techniques, AC-DC conversion, DC-DC conversion, DC-AC conversion, resonant converters, and power supplies. They also discuss various applications of power electronics in areas such as motor drives, power quality, renewable energy systems, and electric vehicles. In [2], H. Andrew and M. Antonio proposed a charger design specifically tailored for the DC House Project. The project likely focuses on providing direct current (DC) power solutions, and this paper explores a cell phone charger as part of that effort. The paper may discuss the design considerations, functionality, and efficiency of the charger in the context of the DC House Project.

In particular, motorbike riders face unique challenges when it comes to charging their mobile phones during their journeys [3][4]. Traditional power outlets are not readily available, and relying on the limited capacity of the motorcycle's battery may not be sufficient for extended rides. To overcome these limitations and provide a sustainable charging solution, the integration of solar power technology into a portable mobile phone charger specifically designed for motorbikes presents an innovative and practical approach. In [3], The paper provides a concise overview of the historical development of photovoltaic cells. It likely presents key milestones, advancements, and significant contributions in the field of solar cell technology. The paper is aimed at students and provides a comprehensive yet brief understanding of the evolution of PV cells. In [4], N.Ali proposed a backpack equipped with a solar charging system. It likely discusses the design, functionality, and potential applications of the backpack in harnessing solar energy to charge electronic devices. The paper may also highlight the efficiency and convenience of this portable solar charging solution.

A solar-powered portable mobile phone charger for motorbikes harnesses the abundant and renewable energy of the sun to ensure continuous charging capabilities while on the road. [4] By utilizing lightweight and compact solar panels, the charger can be easily mounted on motorbikes without compromising the vehicle's aerodynamics. These solar panels convert sunlight into electrical power, which is then stored in a high-capacity battery integrated within the charger. In [5], C. T., S. G. and R. Ch. Babu proposed a unique mobile charger design that utilizes a coin and incorporates a solar tracking system. The paper likely discusses the integration of solar power and a coin-based mechanism to charge mobile devices, potentially exploring the efficiency, feasibility, and practicality of this charging system. The focus may also be on the innovative approach of utilizing solar tracking to optimize energy collection. In [6], k. Rohit, Y. Sameer, S. Dinesh

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and K. Bharat discusses the design and implementation of a solar mobile charger. It likely explores the use of solar power to charge mobile devices, highlighting the efficiency, practicality, and potential applications of the charger. The paper may also present findings or results related to the performance and effectiveness of the solar mobile charger.

The solar-powered charger offers several advantages over conventional charging methods. Firstly, it provides a sustainable and eco-friendly solution by tapping into renewable solar energy, reducing dependence on non-renewable energy sources and minimizing carbon emissions [7]. Secondly, it offers increased convenience and independence to motorbike riders, eliminating the need to rely on traditional power outlets or the limited capacity of the motorcycle's battery. With a portable design, riders can charge their mobile phones anywhere, anytime, without compromising their journeys [4].

The charger's design incorporates user-friendly features such as a clear interface displaying real-time solar energy conversion and battery status information. Multiple output ports cater to various mobile phone models and charging cable options, ensuring compatibility and convenience for users with different devices. Furthermore, the charger is built to withstand the challenges of outdoor environments, with weather-resistant and durable construction that can endure vibrations and other demands of motorbike rides [7]. In [7], A. A. Hussain, N. G. Beza, G. Hasan and K. A. Ahmed proposed a portable solar charger specifically designed for mobile phone devices. The paper likely discusses the design features, including controlled charging current, to optimize the charging process. It may also focus on the efficiency, usability, and practicality of the portable solar charger for mobile phone devices. In [8], C. Subah discusses a solar-based system for charging mobile phones. It likely explores the design, functionality, and feasibility of the solar charging system, emphasizing its potential as an eco-friendly and sustainable solution. The paper may also touch upon the performance and benefits of utilizing solar energy for mobile phone charging.

By integrating solar power technology into a portable mobile phone charger for motorbikes, this solution not only meets the growing demand for on-the-go charging but also promotes sustainable energy practices and raises awareness about renewable energy sources. With keywords such as convenience, sustainability, efficiency, and durability, this solar-powered charger offers motorbike riders a reliable and environmentally friendly option to keep their mobile phones powered during their adventures.

II. MOTIVATION

The motivation behind developing a solar-powered portable mobile phone charger for motorbikes stems from several factors that address the unique needs and challenges faced by motorbike riders.

- **Limited Access to Power Outlets**: Motorbike riders often embark on long journeys through remote areas where access to traditional power outlets is scarce or non-existent. Having a reliable charging solution that harnesses solar energy allows riders to stay connected and powered up regardless of their location.

- **Sustainability and Eco-Friendliness**: The environmental impact of conventional energy sources is a growing concern. By utilizing solar power, the charger reduces reliance on non-renewable energy and contributes to a greener and more sustainable future. It promotes eco-friendly practices among motorbike riders, aligning with their passion for exploration and preserving the environment.

- **Independence and Convenience**: Motorbike riders value the freedom and independence that comes with their mode of transportation. However, the limited battery life of mobile phones can be a hindrance. A solar-powered portable charger offers riders the convenience of charging their devices wherever there is sunlight, eliminating the need to rely on external power sources or interrupt their journeys.

- **Safety and Communication**: Mobile phones play a critical role in rider safety, serving as communication devices and navigation tools. Ensuring that phones remain charged allows riders to make emergency calls, stay connected with loved ones, and access navigation apps for route guidance. A solar-powered charger provides a reliable power source to keep riders connected and enhance their overall safety.

- **Promoting Renewable Energy Adoption**: Integrating solar power technology into everyday devices like mobile phone chargers raises awareness and promotes the adoption of renewable energy sources. By showcasing the practicality and effectiveness of solar-powered solutions, motorbike riders can inspire others to embrace clean energy options in their daily lives.

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III. PROPOSED METHODOLOGY

The method used in realizing this device is in terms of modular design and implementation and carried out in the laboratory in the year 2016. This system consists of units and blocks which make up the entire solar charging device. Figure 1 shows a well simplified block diagram of the system

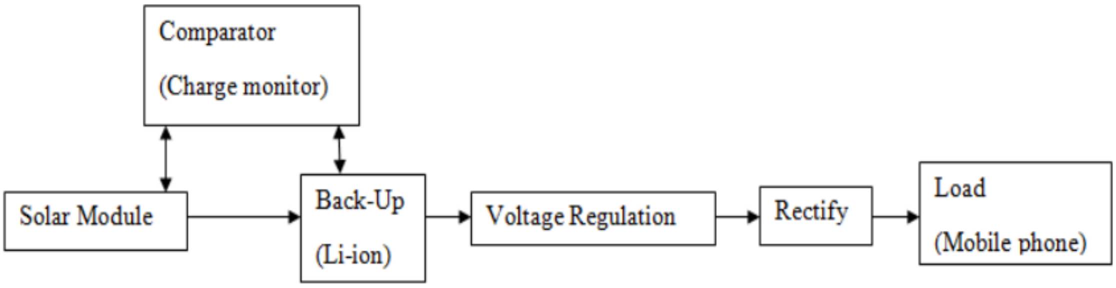

Fig. 1 BLOCK DIAGRAM FOR THE PORTABLE SOLAR MOBILE PHONE CHARGER FOR BIKES

The power source of this system is solar radiation that is converted into electricity by a solar panel. The supply received from the solar panel's output is a DC. DC-DC conversion using a power electronic converter called a chopper is used to provide the regulated power to the backup for storage. It is the backup that in turn charges the mobile phone. The backup system consists basically of two lithium ion batteries. Figure 2 shows the Flowchart.

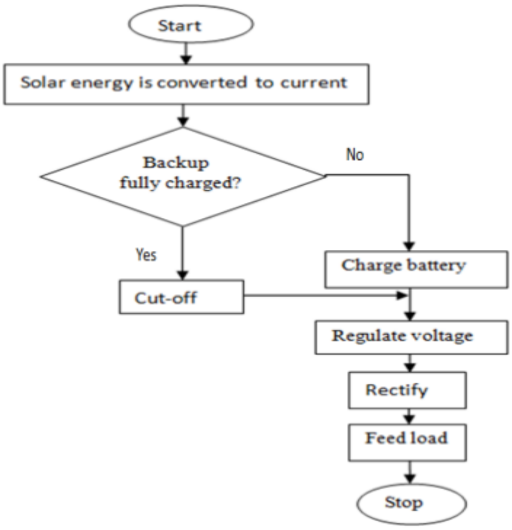

Fig. 2 FLOWCHART OF THE PORTABLE SOLAR MOBILE PHONE CHARGER

1. Design and Conceptualization:

In the initial phase, the design requirements and constraints of the solar-powered portable mobile phone charger for motorbikes are identified. This involves understanding the specific needs of motorbike riders, such as lightweight design, aerodynamic integration, and compatibility with different phone models.

2. Solar Panel Technology Selection:

Various types of solar panel technologies are evaluated and compared, considering factors such as efficiency, size, weight, and durability. The selection is based on the specific requirements of the motorbike charger, including maximizing energy conversion and optimizing space utilization.

3. Battery Capacity and Integration:

The capacity of the integrated battery is determined based on factors like power requirements, charging speed, and size constraints. The selection of suitable battery technology is crucial to ensure optimal energy storage, longevity, and safety.

4. Charger Circuitry and Control:

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The development of the charger circuitry involves designing an efficient power management system that regulates the charging process, controls the energy flow between the solar panels and the battery, and provides the necessary voltage and current outputs for mobile phone charging. Safety features like overcharge protection and temperature monitoring are also incorporated.

5. Prototype Construction and Testing:

A functional prototype of the solar-powered portable mobile phone charger is constructed, incorporating the chosen solar panel technology, battery, and circuitry. The prototype is rigorously tested for performance, durability, and reliability. Real-world testing is conducted to evaluate the charger's functionality in varying environmental conditions and during motorbike rides.

6. Usability Evaluation:

User testing is conducted to assess the usability and convenience of the charger. Feedback from motorbike riders is collected to evaluate factors such as ease of installation, portability, user interface, and compatibility with different mobile phone models. User feedback is valuable for identifying potential improvements and enhancing user experience.

7. Performance Evaluation:

The performance of the solar-powered charger is evaluated in terms of energy conversion efficiency, charging speed, battery capacity, and durability. Measurements and analysis are conducted to assess the charger's ability to harness solar energy effectively and provide reliable and consistent charging capabilities for mobile devices.

- **SOLAR PANEL TECHNOLOGY SELECTION**

In the development of the circuit we use the mono crystalline 12V solar panel , There are three type of solar panel technology , In that we have used this one because it has more efficiency and they are produced from pure silicon.

Fig. 3 12V 12 WATT SOLAR PANEL

- **BATTERY AND THEIR CAPACITY**

Here we have used three Li – ion battery which is of having the 3.7V 2000mAh with Charge Protection. Maximum safe discharge current 4400mA (2C) Maximum charging voltage 4.2V Maximum charging current 1000mA.

Fig. 4 Li-ion battery

- **5V STEP DOWN DC BOOSTER**

This mini DC-DC step-down voltage converter module supports 6-24V voltage input and 5V 3A output with input polarity reverse protection and output overvoltage protection, short circuit protection.

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It adopts synchronous rectification technology to ensure ultra-high power conversion up to 97.5% to take full use of your input power. On-board female type A USB port with identification circuit perfectly fit for smartphones as well as it can be useful to power or recharge any electronic gadget which required 5V input power up to 3A

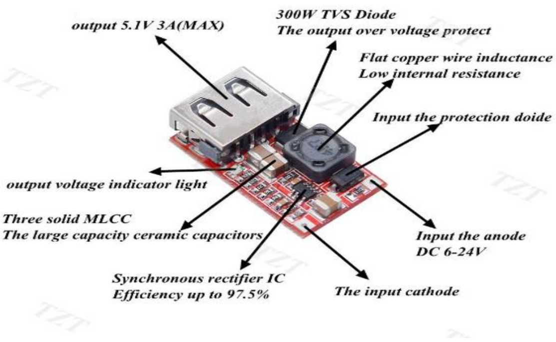

Fig. 5 5V STEP DOWN DC BOOSTER

- **12V MOBILE CHARGER CIRCUIT WITH AUTO CUT OFF & ON**

12V Battery Charger Circuit With Auto Cut OFF & ON and real time voltage display (PCB Automatic), this automatic charger will save your battery from over charge with built in over charge protection system which increase your battery life, and you can precisely calibrate the circuit by using a variable resistor on PCB.

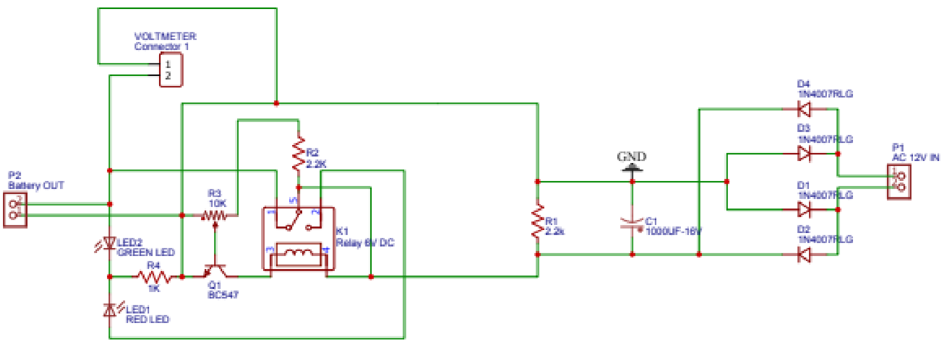

Fig. 6 12V MOBILE CHRGER CIRCUIT WITH AUTO CUT OFF & ON

A 12V battery charger circuit with auto cut-off and auto cut-on is designed to charge a 12V battery from a power source while automatically disconnecting and reconnecting the charging process based on the battery's voltage level. Here's a detailed explanation of how this circuit works:

Power Input: The circuit receives a power input, typically from a 12V DC source such as a solar panel. This power input provides the necessary voltage and current for charging the battery.

Voltage Regulation: The incoming power is regulated using a voltage regulator circuit to maintain a stable and constant voltage output. This ensures that the battery receives the correct charging voltage. Common voltage regulators used in 12V battery chargers include linear regulators and switching regulators.

Relay Basics: A relay is an electromechanical device consisting of a coil and one or more sets of contacts. When current flows through the coil, it creates a magnetic field that activates the contacts, allowing them to switch between open and closed positions.

Auto Cut-Off Function: To implement the auto cut-off feature, a voltage sensing circuit measures the battery voltage. When the battery voltage reaches a predetermined threshold indicating it is fully charged, the control circuit sends a

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signal to the relay coil, energizing it. This causes the relay contacts to open, interrupting the charging current flow from the power source to the battery. The relay acts as a switch to disconnect the charging current.

Auto Cut-On Function: If the battery voltage drops below a certain threshold indicating discharge or usage, the control circuit sends a signal to de-energize the relay coil. This allows the relay contacts to return to their closed position, reestablishing the charging current flow from the power source to the battery. The relay acts as a switch to reconnect the charging current.

Charging Indicator: Some 12V battery charger circuits include an indicator, such as an LED, to display the charging status. The indicator may turn on during charging and turn off when the battery is fully charged.

- **BATTERY LEVEL INDICATOR**

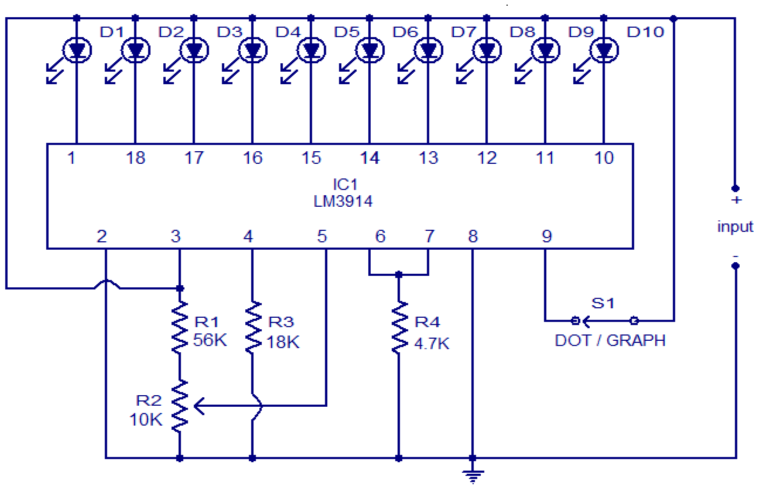

FIG. 7 12V BATTERY LEVEL INDICATOR

A 12V battery level indicator using the LM3915 is a circuit that displays the charge level of a 12V battery using the LM3915 integrated circuit. The LM3915 is a versatile analog display driver IC that can drive a series of LED segments to indicate the voltage or level of a signal. Here's a detailed explanation of how the circuit works:

Power Supply: The circuit requires a 12V power supply, which is typically provided by the battery being monitored. The positive terminal of the battery is connected to the positive rail of the circuit, while the negative terminal is connected to the ground.

LM3915 IC: The LM3915 IC acts as the main component of the battery level indicator circuit. It features a built-in voltage reference, voltage divider network, and 10 comparators.

Voltage Divider Network: The battery voltage is divided using a voltage divider network consisting of resistors. This network provides reference voltages to the comparators inside the LM3915, allowing it to compare the battery voltage with different threshold levels.

Comparator Thresholds: The LM3915 has 10 comparators, each representing a specific voltage threshold. These thresholds are set by the voltage divider network and can be adjusted based on the desired battery voltage range to be displayed.

LED Display: The output of each comparator is connected to an LED segment, typically a series of LEDs or a bar graph display. The number of LEDs used depends on the number of comparators enabled and the desired resolution of the battery level indicator.

LED Operation: As the battery voltage changes, the comparators inside the LM3915 detect whether the voltage exceeds the programmed thresholds. Based on the comparison results, the corresponding LED segments are turned on or off to indicate the battery's charge level.

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LED Brightness Control: The LM3915 IC also allows for brightness control of the LED display. By adjusting an external resistor or using a potentiometer, the LED brightness can be fine-tuned to suit the ambient lighting conditions.

Scaling and Calibration: The voltage divider network and the thresholds can be adjusted to scale the battery voltage to the desired range and calibrate the indicator for accurate readings.

By using the LM3915 IC and a series of LEDs, the circuit provides a visual indication of the battery's charge level. The LEDs light up in a sequential manner, representing the increasing charge level of the battery. As the battery voltage decreases, fewer LEDs are illuminated, indicating a lower charge.

- **FINAL CIRCUIT**

By cascading the 12V battery charger circuit , 12V battery level indicator and the 5V step down DC booster we get the final circuit which is of solar-powered portable mobile phone charger circuit .

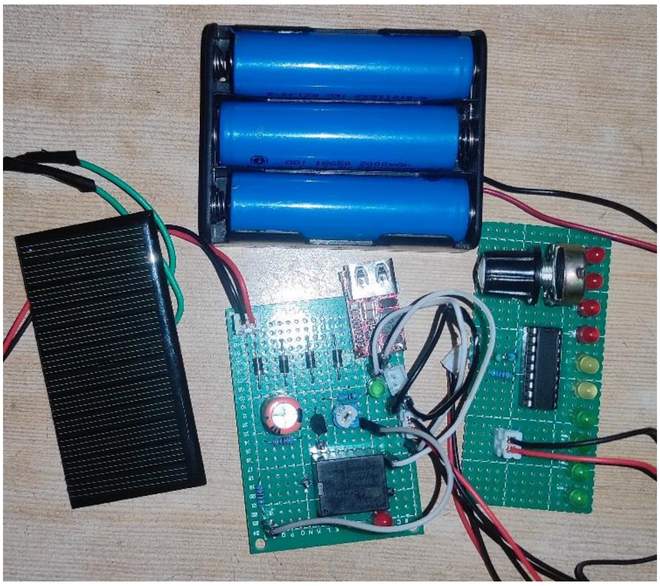

FIG. 8 FINAL CIRCUIT

Fig.8 shows the final circuit of the solar-powered portable mobile charging circuit where it takes the input of 12V constant from the solar panel and gives the output of same to the battery to charge and when the battery is charged the red led light will glow where it is indicated as charged and when the battery is low or below the 12V then the green led will glow and it is indicated as the charging status and according to the status of the battery the battery level indicator indicates using led where each led is indicated as the 10% and it glows according to the status of the battery.

The battery is charged using solar , where it takes 1 hour to charge the 0.30V in the battery and this calculation is based on practical observations and the final mobile charging from 0-100% it takes 1 ½ to 2 hours (it varies from one mobile to another mobile).

TABLE 1. FEATURES OF THE SOLAR-POWERED PORTABLE MOBILE PHONE CHARGER FOR MOTORBIKES

SL NO.	FEATURE	DESCRIPTION
1.	Charging Method	Solar power via photovoltaic panels
2.	Compatibility	Compatible with various mobile phone models
3.	Mounting Mechanism	Designed for easy attachment to motorbikes
4.	Charging Ports	Multiple ports for simultaneous charging of multiple devices
5.	Battery Capacity	Integrated rechargeable battery to store solar energy for later use
6.	Output Power	Sufficient power output to charge mobile phones efficiently

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7.	Durability	Designed to withstand outdoor conditions and vibrations associated with motorbike riding
8.	Portability	Compact and lightweight, enabling easy transport and use on the go
9.	Safety Features	Overcharge and short-circuit protection mechanisms
10.	LED Indicators	Status indicators for battery level and charging progress
11.	Additional Features	USB ports for charging other portable devices, such as GPS or action cameras
12.	Price	Cost-effective and affordable solution for motorbike riders

IV. RESULT AND CONCLUSION

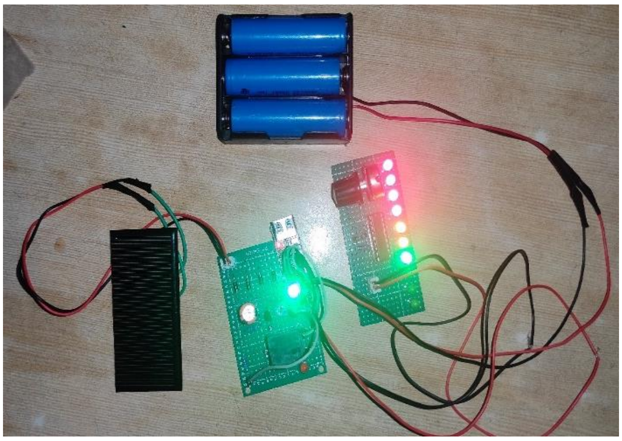

FIG. 9 70% BATTERY LEVEL AND IT IS IN CHARGING STATUS

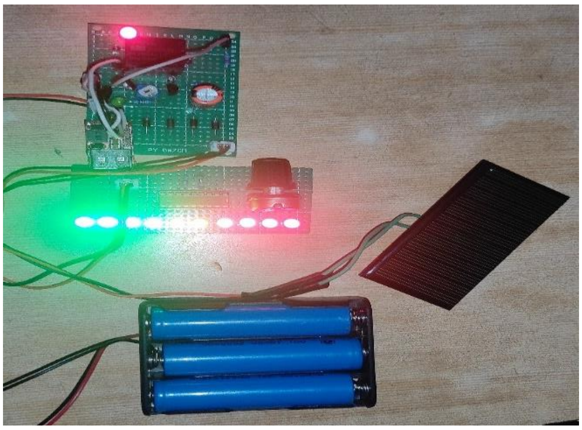

FIG. 10 100% BATTERY LEVEL AND IT IS IN FULLY CHARGED STATUS

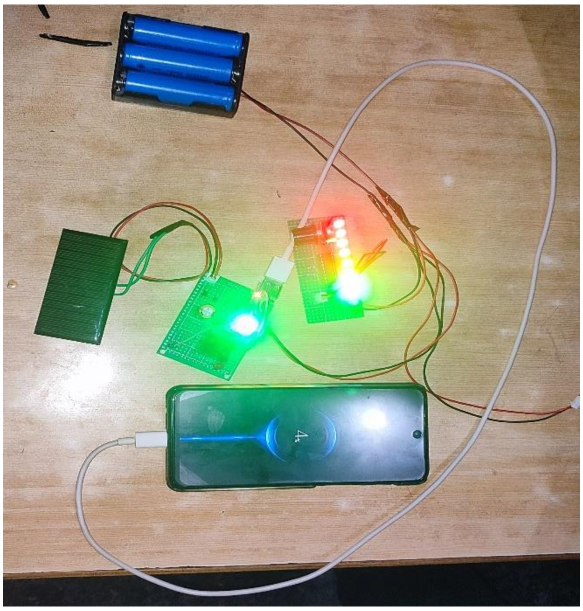

FIG. 11 98% BATTERY LEVEL AND THE MOBILE IS CHARGING FROM 4%

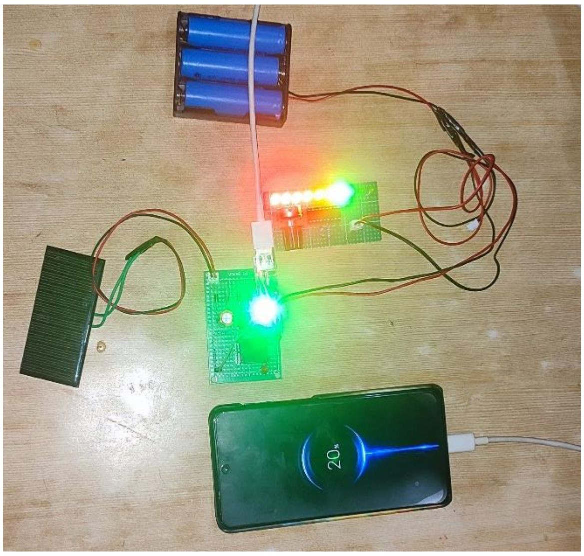

FIG. 12 80% BATTERY LEVEL AND THE MOBILE BATTERY PERCENTAGE IS 20%

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The solar-powered portable mobile phone charger for motorbikes provides a convenient and eco-friendly solution for charging mobile devices while on the go. By harnessing solar energy, it offers independence from traditional charging outlets and reduces reliance on conventional power sources. This portable charger demonstrates the potential of renewable energy in meeting the charging needs of motorbike riders, making it a practical and sustainable choice for mobile phone charging in outdoor and remote environments.

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