IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

SOLAR POWERED CREDIT BASED CHARGING SYSTEM

[1]Amith R Kulkarni., [2]Chandan K., [3]Chinmay Subhaschandra Bhat., [4]Supritha S., [5]Dr. Aswathappa P.
[1]Student, [2]Student, [3]Student, [4]Student, [5]Associate Professor and HOD
[1]Department of Electronics and Instrumentation Engineering,
[1]Bangalore Institute of Technology, Bengaluru, India

Abstract: A revolutionary paradigm change in the areas of energy conservation and consumption is represented by the Credit-Based Charging System. This creative strategy introduces a credit-based paradigm for charging electronic products, redefining how consumers engage with power networks. In this concept, the grid is powered by solar energy. They purchase credits in exchange, which they can use to charge their electric equipment. This concept not only encourages consumers to actively participate in energy creation and conservation, but it also cultivates a sense of environmental responsibility and sustainability. In addition to increasing the use of renewable energy sources, the Credit-Based Charging System gives people the power to actively participate in creating a more sustainable energy future.

***Index Terms* -** IoT, Raspberry Pi, Solar energy, Credit system

I. INTRODUCTION

A new paradigm in energy consumption and conservation is brought about by the Credit-Based Charging System, which incorporates a credit-based model for charging electronic items that are mostly powered by solar energy. By buying credits that may be used to charge electric gadgets, this creative system encourages consumers to actively participate in energy saving and the production of renewable energy. The concept increases the use of renewable energy sources and gives people the power to actively participate in creating a more sustainable energy future by encouraging sustainability and a sense of environmental responsibility. Fundamentally, the Credit-Based Charging System turns consumers into prosumers who contribute to a cleaner energy landscape by rewarding energy saving and the production of renewable energy. This fundamentally transforms traditional patterns of energy consumption. This system relies heavily on solar power, with panels placed in strategic locations to provide clean electricity and promote community involvement in net metering. In addition to fostering a sense of community involvement and environmental consciousness, this collective effort towards energy conservation and renewable energy generation also highlights the transformative potential of the Credit-Based Charging System in creating a more sustainable and eco-conscious society.Beyond only being a technological innovation, the Credit-Based Charging System embodies a revolutionary vision for a sustainable future. This model establishes the groundwork for an energy ecosystem that is more robust, environmentally friendly, and community-driven by utilizing solar energy and providing incentives for proactive energy conservation.

II. LITERATURE REVIEW

According to [1] In a 2018 study, Kaldellis and Kapsali delved into the successful incorporation of solar energy into microgrids. Their research focused on how well solar energy can be integrated into these small-scale power systems, examining both the efficiency and feasibility of solar-powered solutions. By analyzing the technical aspects of implementing solar energy, their work provides valuable insights for those considering adopting this renewable energy source.

According to [2] In 2019, Toporcov and Vrablec set their sights on credit-based charging systems, a concept gaining traction in the realm of sustainable energy financing. Their research explored the practicality and potential benefits of these systems. By examining credit-based charging, their work adds valuable knowledge to the ongoing development of methods for financing sustainable energy solutions.

According to [3] In a 2020 study, Marnay and Lasseter tackled the challenges and opportunities associated with designing scalable and adaptable microgrid systems. Their research aimed to improve understanding of the technical aspects that influence how well an energy system can grow and adjust to meet changing demands. By investigating scalability, their work lays the groundwork for designing efficient and versatile microgrids that can serve the needs of communities. These adaptable systems are crucial for effectively incorporating renewable energy sources and ensuring a reliable power supply.

III. PROPOSED SYSTEM

The system starts with an LDR sensor that detects changes in light intensity. An Arduino Uno is then used to modify the solar panel's orientation to maximize its exposure to sunshine. The battery provides the energy for charging the phone when it is connected in a closed circuit with a USB module and relay module. The Raspberry Pi is then configured to allow remote GPIO access. Using the 'RPi.GPIO' package, a server-side script that was created with the Flask Python framework manages GPIO interaction. An HTML page with a button to activate the GPIO pin is made. Users utilize a QR code to view the webpage once the Raspberry Pi's server-side software has finished running. By clicking the button on the website, a request is sent to the server, which toggles the GPIO pin that is attached to the relay module and, as a result, turns on or off the USB port.

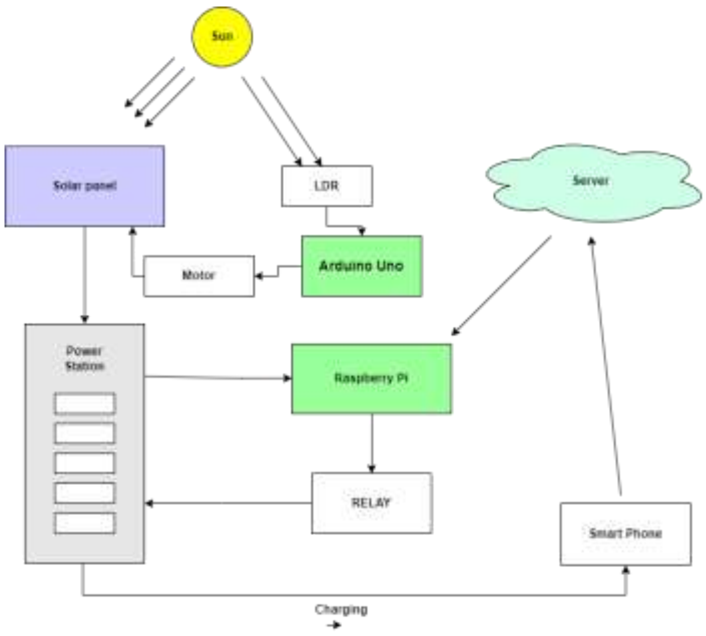


Fig. 1: Block Diagram

The quad-core ARM Cortex-A53 processor of the Broadcom BCM2837 SoC-powered Raspberry Pi offers flexible computing capabilities. It provides flexibility by supporting many Linux-based operating systems and providing HDMI, USB, GPIO, and Ethernet interfaces. It meets a variety of project demands with additional storage through MicroSD cards and customized RAM options. It is a widely accepted low-cost and easily accessible computer system, found in small-scale servers, home automation, and education. Applications for the credit card-sized computer are numerous and include media centers and coding initiatives. It is appropriate for embedded systems and Internet of Things applications due to its small size and low power consumption. The Raspberry Pi Foundation created it, and since then, it has been a mainstay of do-it-yourself projects and global education campaigns.

Fig. 2: Raspberry Pi

3.1 THE IMPERATIVE OF SOLAR ENERGY

Given the growing concerns about climate change and the increasing need for energy worldwide, renewable energy—especially solar power—is essential. In addition to worsening environmental degradation, which is typified by rising greenhouse gas emissions and climate change, the burning of fossil fuels binds countries to limited and unstable global resources. The quick switch to solar energy is a revolutionary response to today's problems. Once the cornerstone of economic development, fossil fuels have caused irrevocable damage to the environment by releasing carbon emissions and causing climate instability. The sun's copious and pure rays can be used to generate solar energy, an environmentally beneficial substitute that can lessen environmental impacts. Using the almost limitless potential of solar power to generate electricity without emitting harmful pollutants signals a change from the disastrous path of conventional energy.

3.2 ENHANCING EFFICIENCY WITH SOLAR TRACKING

By dynamically altering panel orientation to follow the sun's journey, solar tracking systems offer a disruptive approach to address the constraints of stationary solar panels. By maintaining this alignment continuously, energy harvesting efficiency is greatly increased, guaranteeing ideal exposure all day long. These systems automatically move panels to capture direct sunlight by detecting the sun's dynamic location. This allows for longer operating windows for energy generation, particularly in the mornings, evenings, and during seasonal transitions. Single-axis and dual-axis solar tracking systems are available; single-axis trackers track the sun's east-west movement, while dual-axis trackers provide elevation adjustment for accurate alignment. By optimizing panel exposure, both layouts improve overall system performance and energy harvesting efficiency.

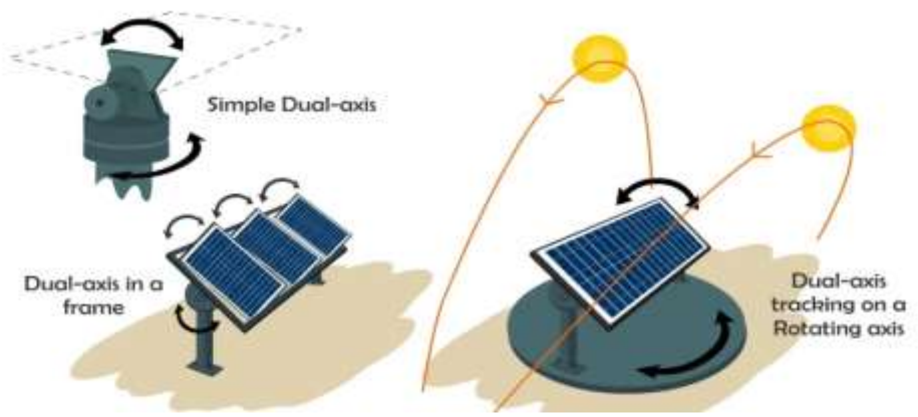


Fig 3: Rotating solar panel

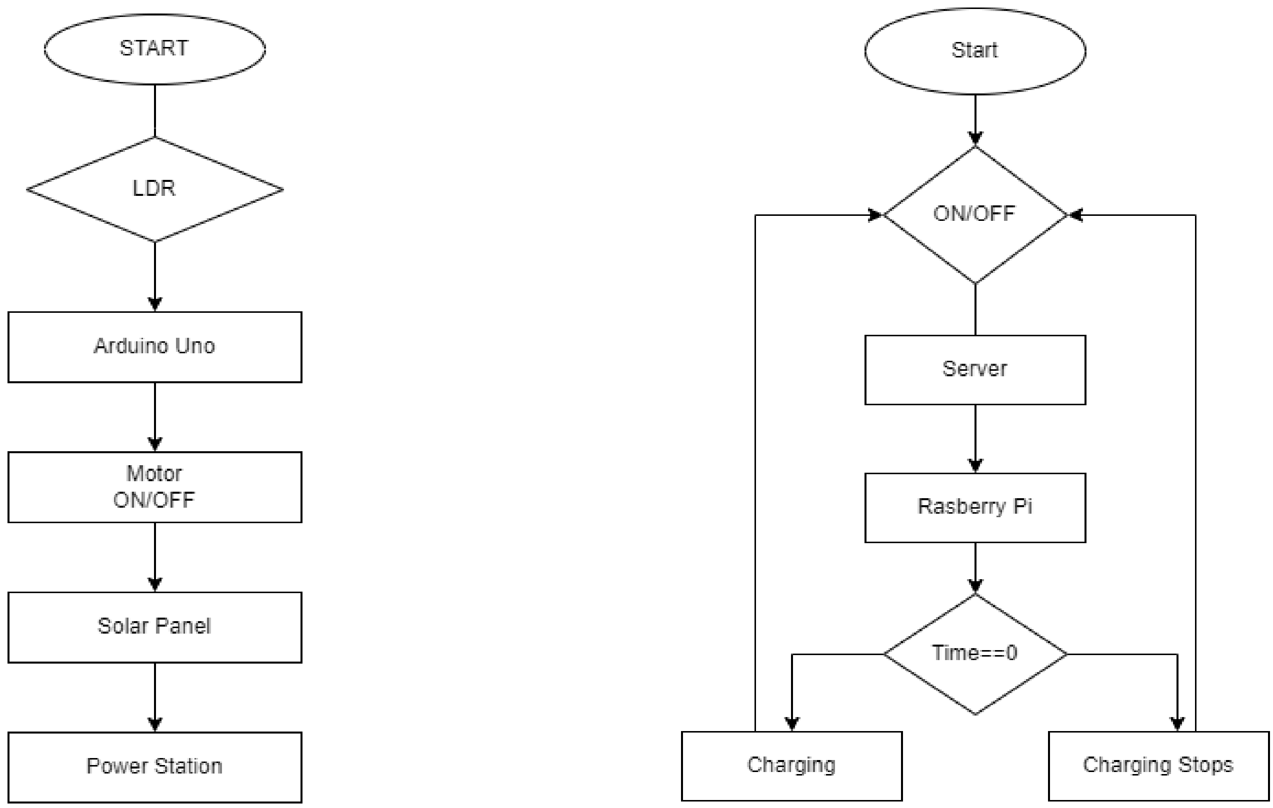
3.3. ILLUMINATING THE PATH TO SUSTAINABLE FUTURE

The emergence of solar power is a watershed moment in the history of energy, denoting a change in the production and use of electricity. This rise is a testament to technology innovation, human inventiveness, and sustainability. The efficiency and cost-effectiveness of solar energy have increased due to technological advancements in solar panels, making it a globally competitive energy source. Developing nations are embracing solar energy solutions to meet their energy needs, demonstrating how its democratization transcends developed nations. Solar microgrids are currently beneficial to remote settlements, promoting economic development and enhancing quality of life. The decentralized nature of solar power provides scalable energy solutions that go beyond the constraints of centralized grids and empower communities all over the world.

3.4 THE VISION OF SOLAR POWERED CREDIT BASED CHARGING

The combination of sustainability and user-friendliness is embodied in a solar-powered charging station with a pay-per-use mechanism. Integrated solar panels demonstrate a dedication to environmentally beneficial practices by using renewable energy to power modern equipment like laptops and phones. The station's user-friendly interface makes it simple to connect a device and makes payment via contactless or mobile apps effortless, guaranteeing a frictionless experience. It is pay-per-use, has adjustable pricing plans, and may be used for different user requirements and lengths of time. Paying customers helps to maintain the station while cutting down on carbon emissions and environmental impact. Well positioned in busy regions, it encourages community involvement in environmentally friendly activities. This project is a perfect example of how clean energy can be incorporated into daily living to meet both immediate needs and support larger sustainability initiatives.

IV. METHODOLOGY



Hardware Software

Fig. 2: Flowchart

Solar panels are installed at the charging stations to capture sunlight and convert it into electrical energy. Photovoltaic cells within the solar panels generate direct current (DC) electricity when exposed to sunlight which is stored in the battery. Users register for the credit-based system through a web portal. During the registration process, users may link their payment methods and preload credits onto their accounts. When a user initiates a charging session, the credit-based system authenticates the user's account. The system monitors the energy consumption during the charging process and deducts credits from the user's account based on the amount of energy supplied. The system continuously monitors energy production from solar panels, energy consumption during charging, and user credit balances. Real-time analytics may be employed to optimize energy distribution and ensure efficient utilization of solar resources. Users receive notifications about the progress of their charging sessions, credit balances, and any relevant system updates through the mobile app. Periodic reports may also be generated to provide users with insights into their energy usage and cost savings.

V. CONCLUSION

In summary, an inventive solar-powered charging system is the result of the integration of multiple parts, including the Raspberry Pi, relay module, and LDR sensor. Through a closed circuit mechanism, this system ensures that gadgets are charged efficiently while optimizing energy creation through the effective harnessing of sunlight. The solution provides smooth control and monitoring capabilities by leveraging a user-friendly Flask and HTML interface and offering remote access via the Raspberry Pi. Using solar energy is an example of a sustainable power generation strategy that encourages energy efficiency and environmental responsibility. The integration of technology and renewable energy concepts in this comprehensive solution highlights a dedication to promoting sustainable habits in energy conservation and consumption.

ACKNOWLEDGMENT

Any successful endeavour's satisfaction and ecstasy would be incomplete without acknowledging the people who made it possible and whose unwavering guidance and support made the endeavour's successful. For his constant assistance and guidance throughout the project, we are incredibly appreciative to Dr. Aswathappa P., Associate Professor and Head of the Department, Department of Electronics and Instrumentation Engineering, B.I.T.

REFERENCES

[1] A. R. Holdway, A. R. Williams, O. R. Inderwildi and D. A. King, "Indirect Emissions from Electric Vehicles: Emissions from Electricity Generation", Energy & Environmental Science, vol. 3, pp. 1825-1832, 2010.

[2] A. R. Bhatti, Z. Salam, M. J. B. Abdul Aziz, K. P. Yee, R. H. Ashique, "Electric vehicles charging using photovoltaic: Status and technological review", Renewable and Sustainable Energy Reviews, vol. 54, pp. 34-47, Feb. 2016.

[3] R. Figueiredo, P. Nunes, and M. C. Brito, "The feasibility of solar parking lots for electric vehicles", Energy, vol. 140, pp. 1182-1197, Dec. 2017. [4] G.R. C. Mouli, P. Bauer, and M. Zeman, "System design for a solar powered electric vehicle charging station for workplaces", Applied Energy, vol. 168, pp. 434–443, Apr. 2016.

[4] M. Brenna, A. Dolara, F. Foiadelli, S. Leva, and M. Longo, "Urban Scale Photovoltaic Charging Stations for Electric Vehicles", IEEE Trans. Sustainable Energy, vol. 5, no. 4, Oct. 2014.