WWW.IJRPR.COM

**International Journal of Research Publication and Reviews**

Journal homepage: www.ijrpr.com ISSN 2582-7421

# A REVIEW PAPER ON MPPT SOLAR CHARGE CONTROLLER USING ARDUINO

***Akansha Bhosale[#1], Dhananjay Chaure[#2], Rutuja Vanarase[#3], Prof. Dr. Devidas D. Dighe[#4]***

@ Electronics and Telecommunication Department, Savitribai Phule Pune University

[1]akanshatukaram.bhosale@matoshri.edu.in (Author)

[2]dhananjay.chaure@matoshri.edu.in (Author)

[3]rutujadeepak.vanarase@matoshri.edu.in (Author)

[4]devidas.dighe@matoshri.edu.in (Guide)

ABSTRACT:

This project presents the design and implementation of a Maximum Power Point Tracking (MPPT) Solar Charge Controller using Arduino microcontroller. The aim is to Enhancing the effectiveness of capturing solar energy by dynamically Fine-tuning the operational point of the photovoltaic panels to the maximum power output. The MPPT algorithm is implemented through Arduino programming, allowing real-time tracking of the solar panel's maximum power point. The system incorporates sensors to measure solar panel voltage and current, enabling continuous monitoring of the environmental conditions. The Arduino calculates the optimal operating point and controls the charging process to extract maximum power from the solar panels. The hardware setup includes a buck-boost converter to regulate the charging voltage and manage the energy flow to the battery.

**Keywords: -** MPPT Controller, Solar Charge Controller, Solar energy, PV Panel.

## INTRODUCTION

The MPPT (Maximum Power Point Tracking) Solar Charge Controller using Arduino is a sophisticated electronic system designed to optimize the efficiency of solar energy harvesting in photovoltaic (PV) systems. This project aims to enhance the performance of solar panels by dynamically adjusting the operating point to extract the maximum power from the solar array under varying environmental conditions. By integrating an Arduino microcontroller into the MPPT charge controller, we enhance the system's capabilities for monitoring, data logging, and user interface. Arduino's flexibility and extensive community support make it an ideal platform for developing smart and customizable solar charge controllers. This project aims to empower enthusiasts, researchers, and renewable energy advocates to build their MPPT Solar Charge Controller using readily available components and the Arduino development environment. Through the exploration of MPPT algorithms, solar energy fundamentals, and Arduino programming, this project provides a hands-on opportunity to contribute to the sustainable energy revolution. Join us on this journey to unlock the full potential of solar power through the synergy of MPPT technology and Arduino innovation. the MPPT Solar Charge Controller using Arduino project offers an intelligent and efficient solution for maximizing solar energy utilization, making it a valuable addition to renewable energy systems. It provides a practical understdanding of MPPT algorithms, solar energy harvesting, and microcontroller-based control systems.

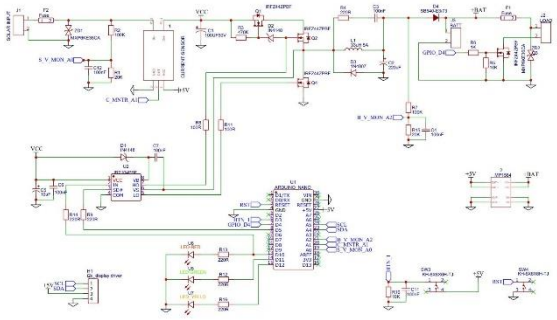
## PROBLEM STATEMENT

Solar energy is an abundant and renewable source of power. To harness the maximum energy from solar panels, it is essential to operate them at their maximum power point. This requires an efficient Maximum Power Point Tracking (MPPT) solar charge controller. The conventional charge controllers often do not optimize the power output from the solar panels, leading to suboptimal energy harvesting. Therefore, the challenge is to design and implement an MPPT Solar Charge Controller using Arduino to enhance the efficiency of solar power systems.
Solar photovoltaic (PV) systems offer an environmentally friendly and sustainable source of electrical energy. It develop a robust MPPT algorithm that can accurately track the maximum power point of the solar panels under varying environmental conditions, such as changes in sunlight intensity and temperature.

## LITERATURE SURVEY

1. Explore the fundamentals of maximum power point tracking (MPPT) techniques, highlighting their importance in maximizing solar panel efficiency.
2. Explore sensor integration techniques for accurate measurement of solar panel voltage, current, and temperature, and their impact on controller performance.
3. Examine existing studies that showcase the use of Arduino platforms in renewable energy applications, including solar energy systems.
4. Analyze the benefits of Arduino's programmability, real-time processing, and sensor interfacing capabilities in MPPT implementations.
5. Compare the performance of different MPPT algorithms in terms of efficiency, tracking speed, and accuracy under varying environmental conditions.

## IMPLEMENTATION DESIGN



## FEATURES

1. MPPT algorithm implementation: Implement an efficient MPPT algorithm to track and maximize the power output from the solar panels, ensuring the system operates at the optimal voltage and current levels.
2. Arduino-based control: Utilize an arduino microcontroller for control and data processing. Arduino's flexibility and ease of use make it a suitable choice for this project.
3. Real-time data monitoring: Implement a real-time monitoring system that displays critical data such as input voltage, output voltage, charging current, battery status, and solar panel output power on an lcd or led display.
4. Battery charging and management: Include a battery charging algorithm that optimally charges the connected battery, considering factors like battery type (lead-acid, lithium-ion, etc.) And state of charge (soc).

## CONCLUSION

The development and implementation of an MPPT solar charge controller using Arduino have been successfully achieved in this project. The main goal of the project is to enhance the performance of solar panels by dynamically adjusting the operating point to extract the maximum power from the solar array under varying environmental conditions. The hardware implementation involved the integration of Arduino as the microcontroller,

sensors for measuring solar panel voltage and current, and the necessary power electronics for controlling the charging process. The Perturb & Observe (P & O) algorithm was employed for as the MPPT algorithm, Consistently fine-tuning the operational stance to ensure max power extraction from the solar panels. Through rigorous testing and experimentation, the designed MPPT solar charge controller Illustrated its capacity to proficiently monitor the optimal power output amidst changing environmental factors.. In conclusion, this project has successfully demonstrated the feasibility and effectiveness of implementing an MPPT solar charge controller using Arduino. The knowledge gained from this project contributes to the ongoing efforts in developing efficient and sustainable energy solutions.

## ACKNOWLEDGEMENT

We would like to extend our heartfelt gratitude to all those who contributed to the successful completion of the Project MPPT Solar Charge Controller using Arduino. Firstly, We express our deepest appreciation to our project guide Prof. Dr. Devidas D. Dighe for their invaluable guidance, unwavering support, and insightful feedback throughout the entirety of this endeavour.

REFRENCES

1. G.C hsieh, C.Y. Tsai, and H.I. Hsieh, “photovoltaic power-increment aided incremental- conductance maximum power point tracking controls,” in proc. IEEE PEDG, pp. 542-549, aalborg,denmark,2012. https://www.academia.edu/31781532/A_Major_Project_Report_on_MPPT_BASED_BATT ERY_CHARGING_USING_SOLAR_ENERGY

2. G.C. Hsieh, S.W. Chen, and C .Y. Tsai, “interleaved smart burp PV charger for lead acid batteries with incremental conductance MPPT,” in proc. IEEE ECCE, phoenix, pp. 3248- 3255,2011. https://doi.org/10.26634/jic.4.1.3777

3. M. Gradella, J. Rafael, E. Ruppert,” comprehensive approach to modeling and simulation of photovoltaic arrays”, IEEE trans. Power electron. Vol. 24, no. 5, may 2009. https://www.sciencepublishinggroup.com/article/10069113

4. Jack Purdum, W8TEE, and Dennis Kidder, W6DQ "Arduino Projects for Amateur Radio" by Jack Purdum, W8TEE, and Dennis Kidder, W6DQ This book offers insights into Arduino-based projects, including how to interface Arduino with solar panels and batteries. https://www.academia.edu/41503314/Arduino_Projects_for_Amateur_Radio

5. Reddit's Arduino Community Reddit has a vibrant Arduino community where you can find discussions, project showcases, and helpful tips. https://www.reddit.com/r/arduino/

6. The DIY World The DIY World's YouTube channel features solar power and off-grid living projects, offering practical insights and demonstrations. https://www.youtube.com/user/TheDIYworld

7.