**A**

**Project Work-II Report**

**on**

# Automatic Solar Panel Cleaning Robot

***Submitted in Partial Fulfilment of the Academic Requirements of Degree***

**Bachelor of Engineering**

**in**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

**by**


| | |
|---|---|
| **M. Sri Charan Siddharth** | **2451-21-735-178** |
| **Gouni Sandeep** | **2451-21-735-315** |
| **Tukkapuram Rohit Chary** | **2451-21-735-317** |


**Under the Guidance of**

**Dr. B. Sarala**

**Professor, ECED**



**Department of Electronics and Communication Engineering**

**Maturi Venkata Subba Rao (MVSR) Engineering College**

**An UGC Autonomous Institute Nadergul P.O., Hyderabad - 501510**


**April 2025**

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# CERTIFICATE

This is to certify that the Project work "**Automatic Solar Panel Cleaning Robot**", being submitted by, **M. Sri Charan Siddharth, Gouni Sandeep and Tukkapuram Rohit Chary,** in partial fulfilment for the award of Bachelor of Engineering (BE) degree, with specialization Electronics and Communication Engineering (ECE), to the Department of Electronics and Communication Engineering, MATURI VENKATA SUBBA RAO (MVSR) ENGINEERING COLLEGE, an autonomous institution under OSMANIA UNIVERSITY, Hyderabad, is a record of the bonafide work carried out by him/her under my guidance and supervision.

**Signature of the Guide**

**Dr. B. Sarala**

**Professor, ECED**

**Head of the Department**

**Dr. G. Kanakadurga**

**Department of ECED**

**Signature of External Examiner**

# DECLARATION

We declare that this project report titled **Automatic Solar Panel Cleaning Robot** submitted in partial fulfillment of the degree of Bachelor of Engineering in Electronics and Communication Engineering is a record of original work carried out by us under the supervision of **Dr. B. Sarala**, and has not formed the basis for the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

| **Student Name:** | **Roll No:** | **Signature:** |
|---|---|---|
| **M. Sri Charan Siddharth** | **2451-21-735-178** | |
| **Gouni Sandeep** | **2451-21-735-315** | |
| **Tukkapuram Rohit Chary** | **2451-21-735-317** | |

## ACKNOWLEDGEMENTS

We sincerely express my heartfelt gratitude to my supervisor **Dr. B. Sarala, Professor, ECED** for their invaluable guidance, unwavering support, and insightful contributions throughout this Project work. The discussions we had greatly enhanced our understanding and played a crucial role in achieving our project goals.

We also extend my gratitude to **Dr. G. Kanaka Durga, Professor & Head of the Department**, and our **Principal, Dr. Vijaya Guntur**, for their continuous support, encouragement, and for providing the necessary resources to successfully carry out this project work.

Furthermore, we would like to acknowledge the faculty and staffs of the department for their direct and indirect assistance in making this project a success.

Lastly, we are deeply grateful to my parents for their unwavering support, encouragement, and blessings throughout this journey.

| | |
|---|---|
| M. Sri Charan Siddharth | 2451-21-735-178 |
| Gouni Sandeep | 2451-21-735-315 |
| Tukkapuram Rohit Chary | 2451-21-735-317 |

# ABSTRACT

This report presents the design and development of a fully autonomous solar panel cleaning robot aimed at enhancing the efficiency and longevity of solar energy systems. With the accumulation of dust and debris significantly reducing power output—by as much as 50% if left uncleaned for extended periods—this project addresses the critical need for a reliable maintenance solution in solar farms. The proposed robot employs advanced sensing technology and a water-assisted cleaning mechanism to operate independently, ensuring optimal performance of solar panels.

The solar panel cleaning robot is built around an Arduino microcontroller, which integrates multiple components such as infrared (IR) sensors for edge detection, a rain detection module for safety, and a cleaning mechanism featuring rotating brushes and a water pump. The robot is programmed to follow a boustrophedon cleaning path to ensure comprehensive coverage of the solar panel surface while avoiding potential hazards. Testing results demonstrated over 90% cleaning efficiency and reliable autonomous operation under various environmental conditions.

Implementation of the system involved the careful selection and integration of hardware and software tools. The Arduino platform facilitated seamless communication between sensors and motor drivers, allowing for real-time adjustments during operation. The use of cost-effective components ensured the project's accessibility for medium to large-scale solar installations. Additionally, the potential application of this robotic solution extends beyond just cleaning; it lays the groundwork for future integration with IoT technologies for remote monitoring and scheduling, further streamlining solar panel maintenance processes.

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# LIST OF ABBREVIATIONS

| Abbreviations | Definitions |
|---|---|
| IOT | Internet of things |
| IR | Infrared |
| PWM | Pulse Width Modulation |
| PV | Photovoltaic |
| LED | Light Emitting Diode |
| TTL | Transistor-Transistor logic |
| ICSP | In-Circuit Serial Programming |
| USB | Universal Serial Bus |
| SPI | Serial Peripheral Interface |
| I2C | Inter-Integrated Circuit |
| UART | Universal Asynchronous Receiver-Transmitter |
| DFU | Device Firmware Upgrade |
| AC | Alternating Current |
| FRC | Flat Ribbon Cable |
| TWI | Two-Wire Interface |
| AREF | Analog Reference |
| EEPROM | Electrically Erasable PROM |