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IOT Based Solar String Fault Detection System

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ABSTRACT: It's great to hear that solar energy is becoming more popular and that people are finding innovative ways to use it in both urban and rural settlements. However, there are also some challenges that come along with it, such as potential damage to the wiring and the need to protect the panels from animals and weather conditions.

The proposed method for real-time supervision and predictive fault diagnosis is an effective tool to reduce such challenges. By analyzing the voltage and currentvalues, the method can detect and isolate fault symptoms early on and alert the system to potential degradation before it leads to an irrecoverable failure. This type of predictive maintenance can help ensure the longevity and effectiveness of the solar panel system, while minimizing the risk of downtime or costly repairs.

It's important to note that proper installation and maintenance of solar panel systems are critical to their success. Working with experienced professionals who can ensure the proper installation and provide ongoing maintenance and monitoring can help address some of the challenges associated with solar energy and maximize the benefits.

KEYWORDS: solar, monitoring, fault diagnosis, irrecoverable failure.

I.INTRODUCTION

Solar energy is becoming increasingly important in the energy policies of many countries, including India. The low cost of solar energy is a major factor driving its adoption, and this trend is expected to continue as the cost of solar technology decreases further. The development of a predictive fault diagnosis algorithm for solar panels will help to improve the efficiency and reliability of solar installations, which in turn will contribute to the wider adoption of solar energy.

The Future of Solar Energy report considers photovoltaic and concentrated solar power technologies, which are expected to dominate solar-powered generation until at least 2050. The report aims to inform decision-makers in the developed world, particularly the United States, about the potential of solar energy to replace conventional sources of electricity. However, it is important to note that the cost of small-scale PV generation may still be prohibitive for many people in developing countries, although solar energy can still play a valuable role in providing access to electricity in these areas.

Overall, solar energy has enormous potential to help reduce our reliance on fossil fuels and move towards a more sustainable energy future. Continued investment in solar technology and research will be key to unlocking this potential and realizing the many benefits that solar energy can offer.

In this paper, the idea of using electronic sensors to safeguard solar panels and connected equipment is a good one. By monitoring the performance of the system, it is possible to detect any problems early and take corrective action before they become serious. The collection of day-to-day, month-to-month, and year-to-year readings will allow for the identification of trends and patterns in the system's performance, which can help to optimize its operation and maintenance.

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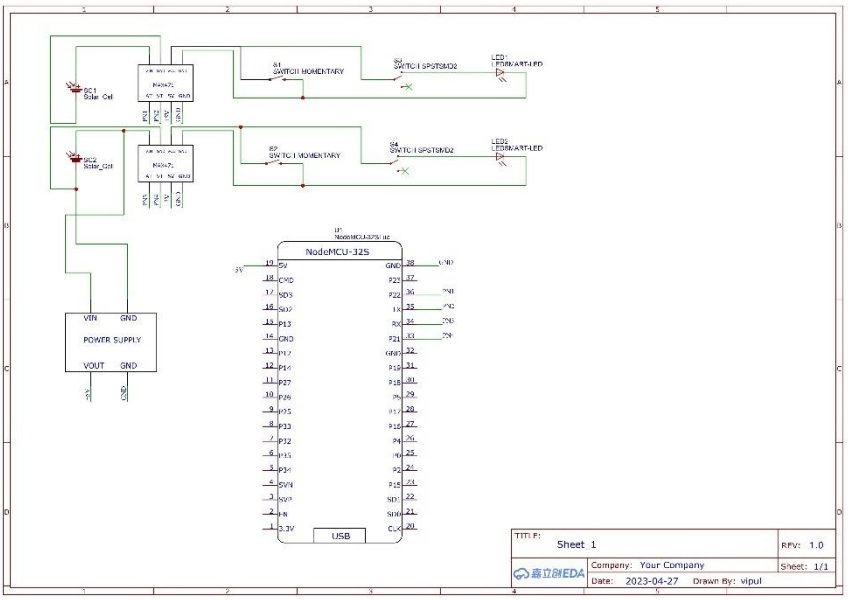
In addition, the use of predictive fault diagnosis algorithms can help to detect problems even earlier, allowing for proactive maintenance and repair. This can be especially important in remote or hard-to-reach locations, where it may be difficult or expensive to access the equipment for routine maintenance.

Overall, the efficient use of solar technology requires not only the use of high-quality components and systems but also careful monitoring and maintenance. The use of electronic sensors and predictive fault diagnosis algorithms can help to achieve this goal, by ensuring that the system is operating at peak efficiency and minimizing downtime due to equipment failures.

II.CIRCUIT DIAGRAM



III.SYSTEM WORKING

Solar panel or string is connected to the monitoring setup with the help of nut connectors as shown in circuit diagram. These nut connectors are further connected to the current &voltage sensor Max471 which is used to measure the value of current and voltage. Further, Max471 sensor is connected to push button switches. These push button switches are installed to generate the fault conditions i.e., open circuit fault (OC Fault) & short circuit fault (SC Fault) artificially to simulate the faulty conditions which will take place during live fault conditions. These push button switches are connected in series to LEDs which indicate the nature of the circuit i.e., whether circuit is closed, or open & it also indicates whether solar panels are getting enough heat which can be supplied to the load.

Now move to “MIT APP INVENTOR” Application. You can either scan the QR code given on the website of MIT APP INVENTOR or code provided by the website. You will see your project information displayed on the screen. There are various widgets available to monitor our project on various parameters as per our requirement. From the consumer’s perspective we have displayed the current & voltage readings of two strings of solar and the fault conditions of those two solar strings. Whenever a fault is developed or in this project whenever we develop fault artificially by pressing the push button the LEDs will go off which indicates fault is developed, and it will indicate the same on the display screen of the project. For updating the readings of voltage, current & nature of fault we are using the free server provided by “Thingspeak-IOT Analytics.” This server stores all the data of the above parameters and generates a graph which will eventually help the consumer to track the health of the solar panel system. It usually takes around a minute to update the most recent values in the server as it is based on a free channel provided to students for research & development of their IOT based projects.

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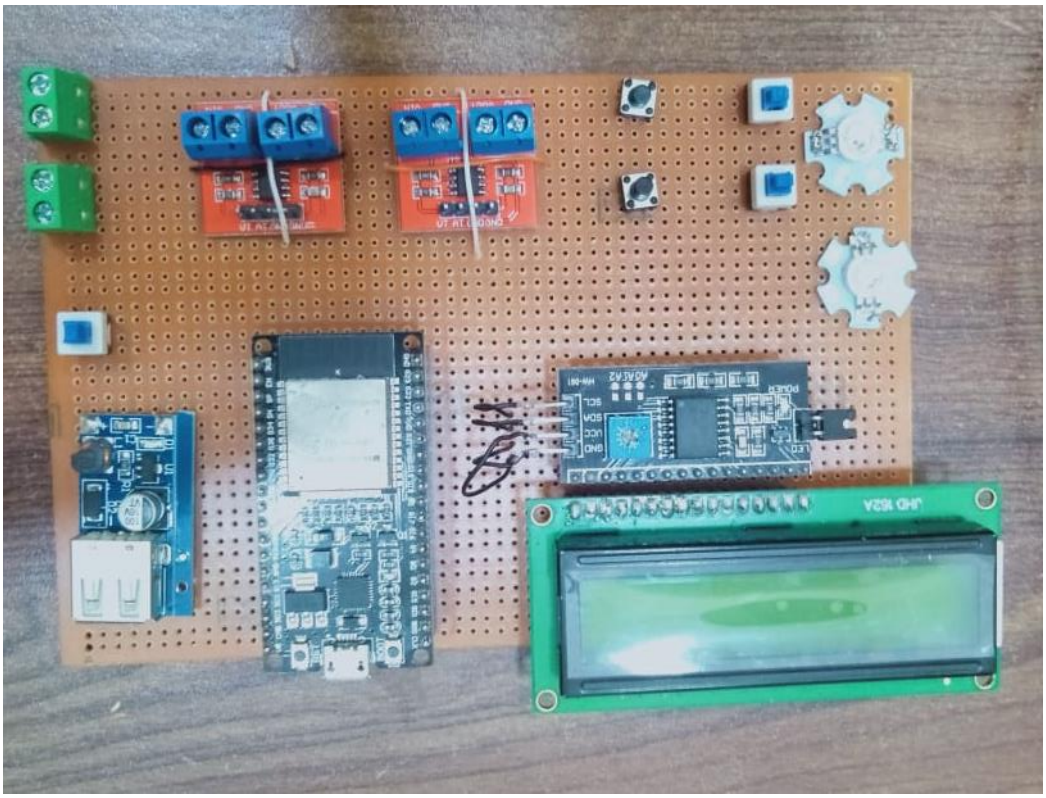
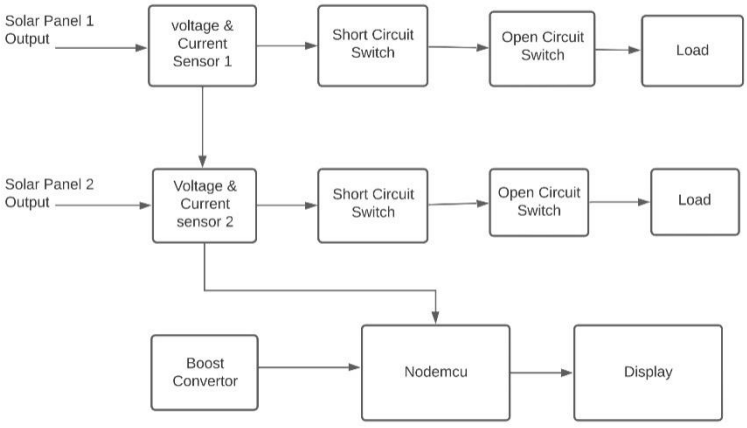


IV. BLOCK DIAGRAM



V. ADVANTAGES

• It allows us to monitor the solar string remotely with internet connection.

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• If a fault occurs, then we can manually or automatically (based on coding of the specific equipment) disconnect the main circuit which will prevent the damage of equipment.

• Use of solar energy is also helpful to reduce the effect of global warming as it is much greener compared to other energy sources.

• It helps to prevent damage to switchboard, or the necessary equipment connected via solar panel by early detection of faults occurrence in solar string.

VI. APPLICATIONS

• In cities, it is mainly used for heating water, street lighting & hallway lights in housing complexes.

• In villages, it is used as a source of power for electric motors which provides water supply to crops.

• In the manufacturing sector, it is used to provide the electric power for the lighting system of that manufacturing unit.

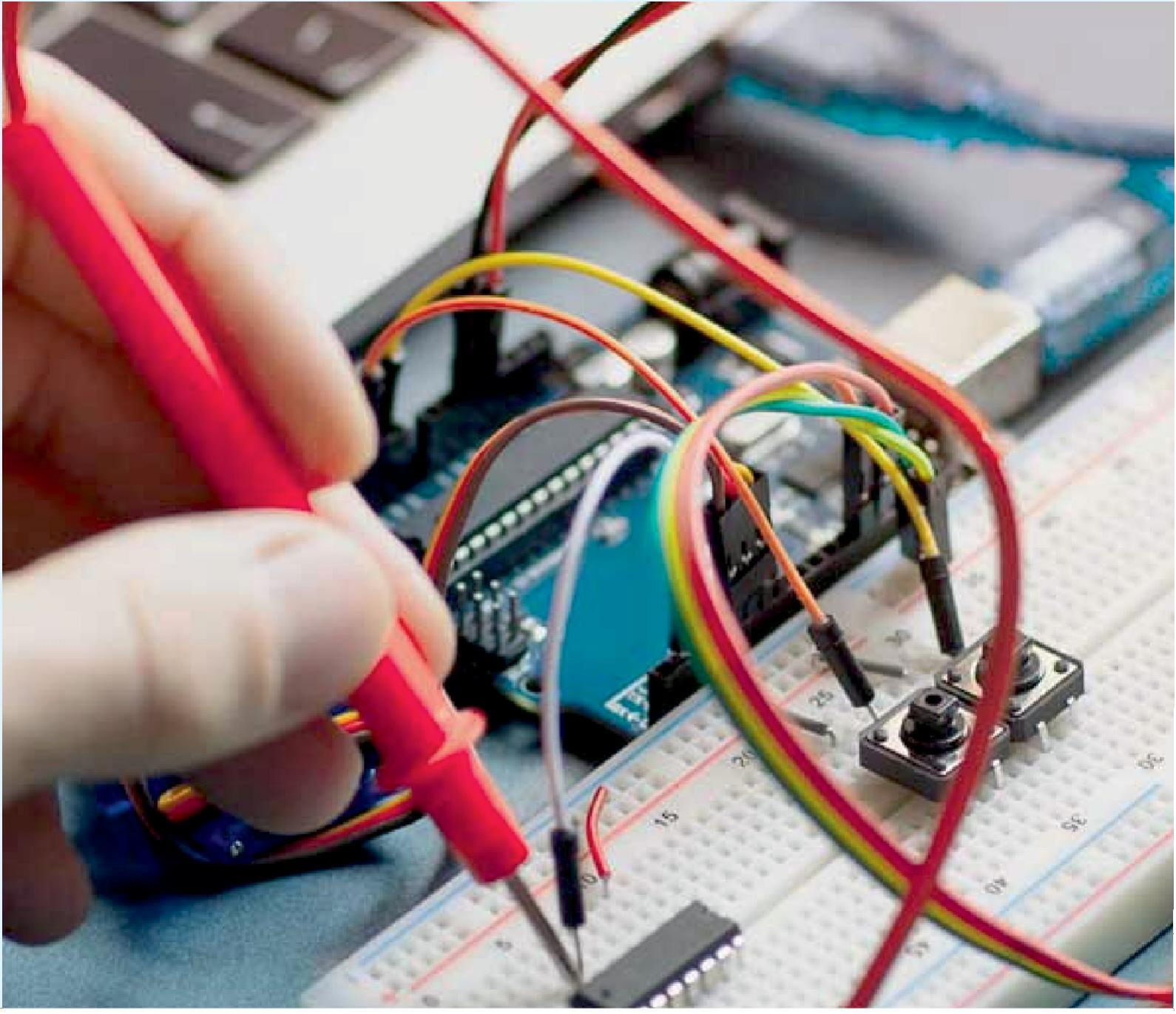
• Government also installs solar lights in places like gardens, jogging tracks, etc. They are mainly placed according to their exposure to the sun.

VII.CONCLUSION

The paper demonstrates the effective implementation of IOT Based solar string fault detection system. This project provides a security feature to solar connected systems to avoid large-scale damage to the equipment working on solar energy. It also provides an idea of effective use of computer technology in sync with electricalsystems.It provides a remote operation of solar strings via IOT based system through internet connectedapplications and sensing units which are present in this circuit. It also reduces the repair cost ofthe solar string as fault is identified in early stages and then power supply is restricted towardsthe equipment from solar panel.

REFERENCES

1. SolarPower Europe. EU Market Outlook for Solar Power 2019–2023; Tech. Rep.;SolarPower Europe: Brussels, Belgium, 2019.
2. Hiyama, T.; Kouzuma, S.; Imakubo, T. Identification of optimal operating point of PV modules using neural network for real time maximum power tracking control. IEEE Trans. Energy Convers. 1995, 10, 360–367.
3. Riley, D.M.; Venayagamoorthy, G.K. Comparison of a recurrent neural network PV system model with a traditional component-based PV system model. In Proceedings of the 2011 37th IEEE Photovoltaic Specialists Conference, Seattle, WA, USA, 19–24 June 2011; pp. 002426–002431.
4. Ducange, P.; Fazzolari, M.; Lazzerini, B.; Marcelloni, F. An intelligent system for detecting faults in photovoltaic fields. In Proceedings of the 2011 11th International Conference on Intelligent Systems Design and Applications, Cordoba, Spain, 22– 24November 2011; pp. 1341–1346.
5. Riley, D.; Johnson, J. Photovoltaic prognostics and heath management using learning algorithms. In Proceedings of the 2012 38th IEEE Photovoltaic Specialists Conference, Austin, TX, USA, 3–8 June 2012; pp. 001535–001539.
6. Platon, R.; Martel, J.; Woodruff, N.; Chau, T.Y. Online Fault Detection in PV Systems. IEEE Trans. Sustain. Energy 2015, 6,1200–1207.
7. Frank, P.M. Analytical and qualitative model-based fault diagnosis—A survey and some new results. Eur. J. Control 1996, 2, 6–28.
8. Madeti, S.R.; Singh, S. A comprehensive study on different types of faults and detection techniques for solar photovoltaic system. Sol. Energy 2017, 158, 161–185.
9. Jaffery, Z.A.; Dubey, A.K.; Haque, A. Scheme for predictive fault diagnosis in photovoltaic modules using thermal imaging. Infrared Phys. Technol. 2017, 83, 182–187.



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