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System to Measure Solar Power

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Abstract: *The solar-energy market is one of the most rapidly expanding renewable energy markets in the world. presently we have seen a significant increase in requests for measuring equipment for solar-energy applications. This presented work aims to measure solar energy through multiple sensor data acquisitions. A solar panel is used as it continues to track sunlight. Here, different parameters for a solar panel like light intensity, voltage, current, temperature are measured and measured data is sent to Arduino which is show them an on-LCD display. Nowadays, the Internet of Things (IoT) is a developing technology that connects things through a communication protocol and a cloud platform to make them smarter and more user-friendly. Basic characteristics such as current, voltage, irradiance, and temperature will affect the solar panel's efficiency. As a result, a real-time solar monitoring system is required to improve the panel's performance by comparing it to the experimental result and taking preventive action.*

Keywords: Solar Panel, Arduino Uno, Temperature Sensor, Current Sensor, Intensity Sensor

I. Introduction

Increasing fossil fuel prices, global warming, and harsh weather have compelled several governments to seek alternate energy sources in order to minimise their reliance on fossil fuels. Solar energy is one of the most promising renewable energy sources now in use to address rising electricity demand throughout the world. After wind energy, solar energy is the fastest growing renewable energy source for power generation. Solar energy is transformed into electricity. Solar cells absorb sunlight directly, while concentrated solar energy collects it indirectly. Solar photovoltaic (PV) energy systems use solar cells to convert photon energy from the sun into electricity. To conduct electric current, photon energy is used to knock out electrons in solar cells built of light-sensitive semiconductors. Solar panel cells are divided into two categories: monocrystalline and polycrystalline. Monocrystalline solar cells are created from a single silicon crystal and have a better efficiency than polycrystalline solar cells, which are made from numerous silicon crystals. The amount of energy created by a solar cell is heavily influenced by meteorological conditions, particularly solar irradiance and air temperature. Recent developments in the energy sector have revealed that the solar energy business is one of the world's fastest growing renewable energy markets. The demand for remote monitoring and control systems for solar energy applications is now on the rise. . Smart solar cells are more efficient, flexible, and lighter PV cells that have been developed as a result of advancements in solar cell technology. Electronics such as power optimizers, micro DC to DC converters, and condition monitoring devices are now embedded in solar PV modules by solar manufacturing companies. Monitoring and measuring solar PV parameters and site conditions is useful for evaluating the performance of existing solar systems, advanced system monitoring, and future generation forecast. It can also be used for problem solving, product development, and system maintenance, among other things. For condition monitoring and system performance assessment, solar systems require dependable data gathering methods for all electrical and climatic data. Collecting such data when installing cutting-edge technology in the field. For condition monitoring and system performance assessment, solar systems require dependable data gathering methods for all electrical and climatic data. Collecting such data is capital demanding when installing state-of-the-art equipment in the field, and there are reliability concerns about using satellite data instead of location data. The goal of this study is to create a low-cost Arduino-based solar power measurement system. Solar panel parameters such as incident light intensity, voltage, current, and temperature are successfully measured by the devised system.

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II. Sequence of Operation

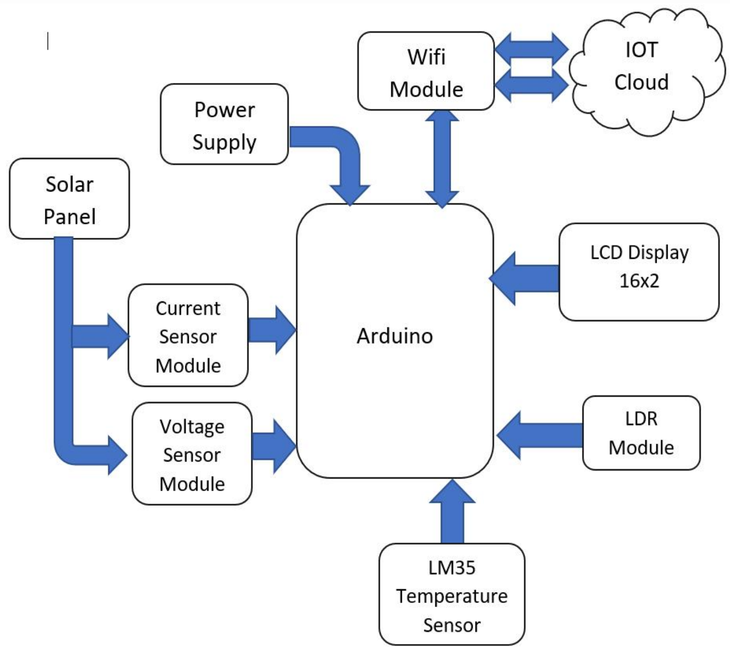

Figure: Block Diagram of system to measure solar power

2.1 Basic Components of System to Measure Solar Power

- Charger (230 – 12 v dc)
- Breadboard Power Supply
- I2C Converter
- Arduino Uno
- Current Sensor Module
- LM35 Temperature Sensor
- LED
- Wifi Module
- Solar panel
- LDR
- LCD

2.2 Software Required

1. Thinkspeakiot platform
2. Ardiuno IDE

III. Literature Review

Data loggers are frequently employed in all systems relating to technology, not just in the electronic realm. It is frequently used to collect data for a system that pertains to electrical and climatic factors due to its ability to store information for a long time. Data loggers have been utilised extensively in monitoring both parameters, particularly in the field of photovoltaic (PV) systems. It's ideal for PV systems since it can store a wide range of data for a prolonged period of time without requiring complete user scrutiny. In an Off-Grid PV system, a data logger is critical for logging all data because the system is placed in a remote area that is typically far from the utility grid. As a result, a user's constant supervision is not worthwhile solely to collect data for observation reasons.

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The capacity of data loggers to store data over time without constant supervision has made PV systems with data recorders an excellent pair. PV systems are now being acknowledged by Malaysia's higher authorities, as well as a few environmental and industrial organisations. Its technology has the potential to meet the world's energy needs in an environmentally friendly and renewable manner. As a result, the PV system requires a reliable data logging technique to save all electrical and meteorological data for monitoring and observation; a data logger appears to be required in this field.

IV. CONSTRUCTION

The power supply which is 5V is connected to Arduino power supply port. 3.3 v is given to wi-fi module. Pin. A1 of Arduino is connected to current sensor, Pin. A2 of Arduino is connected to voltage sensor, Pin. A3 of Arduino is connected to LDR sensor, Pin. A4 of Arduino is connected to temperature sensor module. All data is seen on 16x2 LCD Display Module. As this project had requirement for remote application also for that wi-fi module is connected to Arduino by Pin.D2 and Pin D1 is connected to wi-fi module through which we connecting to thingspeak where outputs are display in the form of graphical representation.

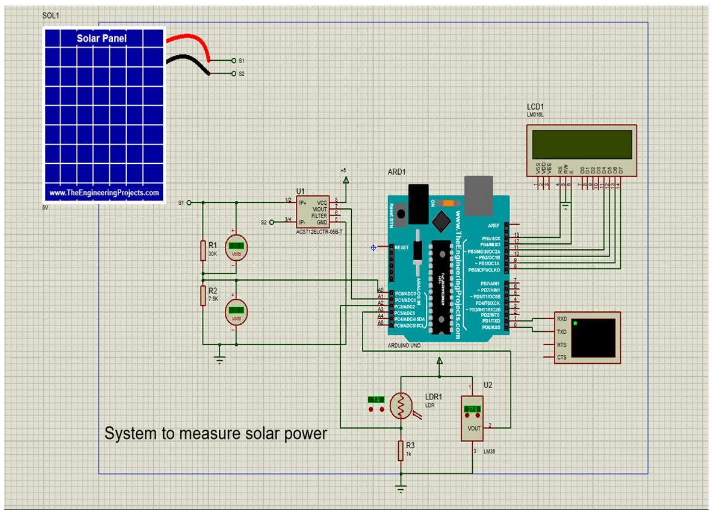
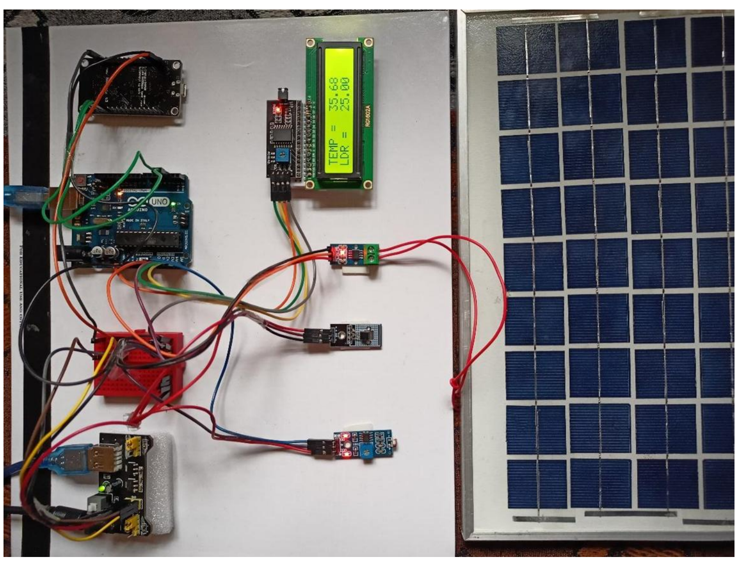


Figure: Schematic Diagram of system to measure solar power

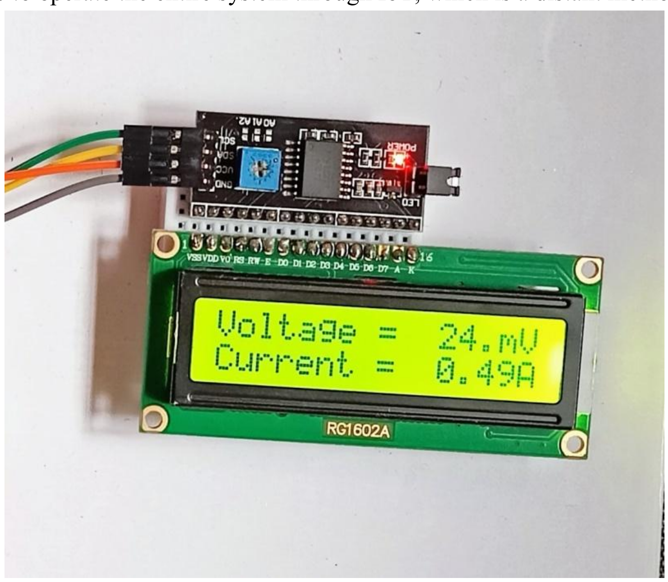
V. MAIN ASSEMBLY

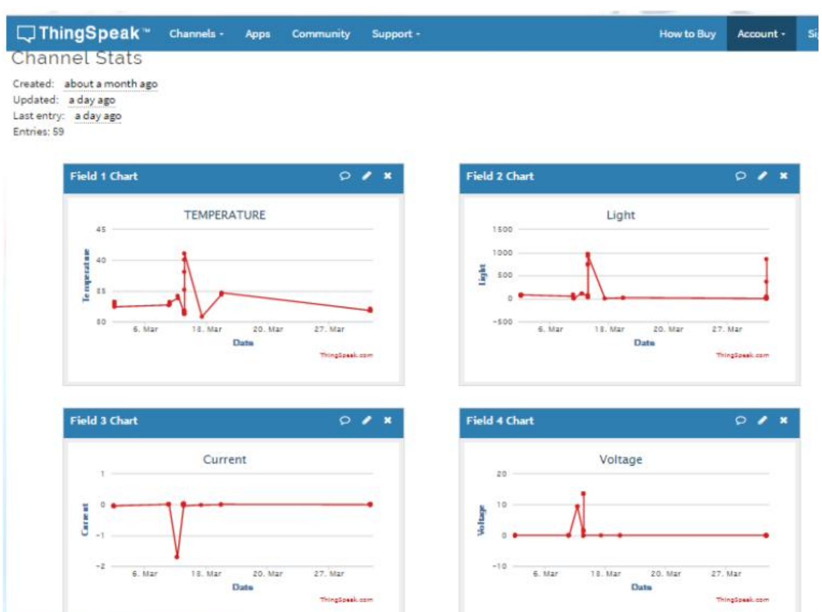


VI. RESULT AND ANALYSIS

In this project we measure solar parameters using different sensors acquisition with the help of IoT based system which is designed to get an optimum power output from the solar panels during these various changes occurred while performing project, like dust is accumulated on solar panel as well as natural difficulties are coming across while collecting the data. And A monitoring system is created so that if the solar panels fail, it will be displayed on the screen, and we can also collect information about the solar system to which the loads are connected. When the output falls below particular restrictions, it now presents these parameters to the user using an effective GUI, as seen in the figures below..

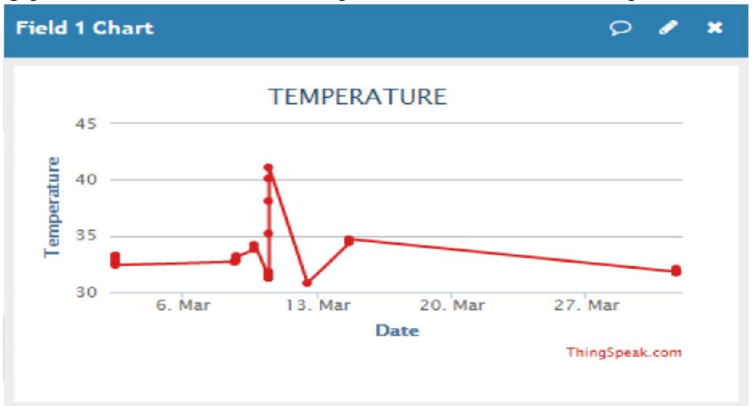
This technique works effectively within some criteria that we can see using this system, therefore a solar panel is utilised to keep track of the sun. Using IOT technology, several metrics such as light intensity, voltage, current, and temperature are presented on the LCD. We are currently receiving only information, which we can view on the cloud, but in the future, we will be able to operate the entire system through IoT, which is a distant method.



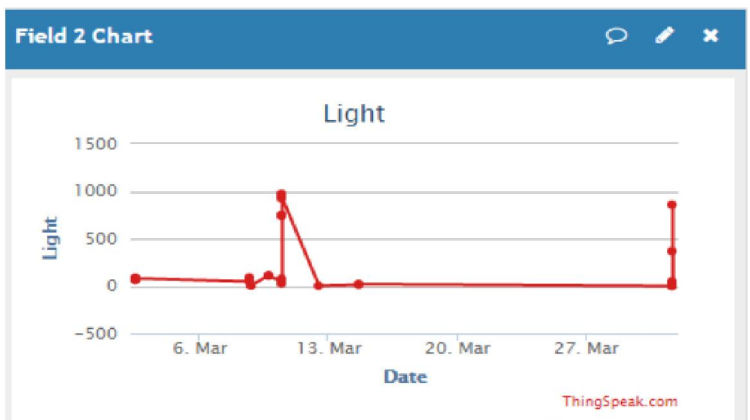


All parameters are displayed in this web interface. We can monitor our solar power by accessing this webpage. Graphs and tables are used to display these parameters.

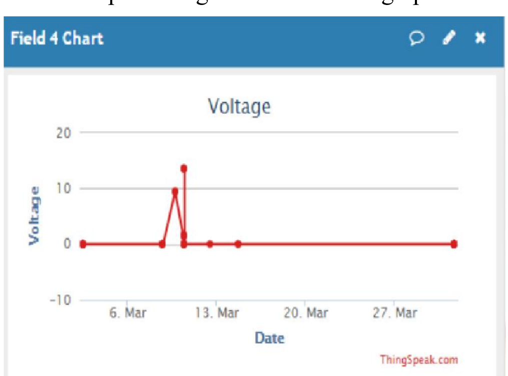
We'll provide this information in the form of a graph so that we can quickly see trends and values. We can monitor it from anywhere using Thingspeak, and if there is a network problem, we can also see all parameters on the LCD panel.

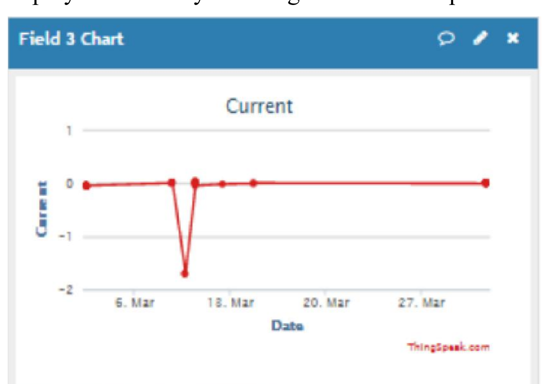


This is an image of a single field. This field displays a graph of temperature versus date. This temperature will be detected by the LM 35. Every 15 seconds, this channel is fed.



LDR values are plotted against time in this graph. This will display the intensity of sunlight on the solar panel.





This is the voltage graph. Solar panel voltage vs. time. A voltage divider circuit is used to detect this. Current is also checked in the same way.

VII. Conclusion

The Arduino-based solar energy parameter measurement system was designed and built using Proteus' optimized simulated parameters. The device was then used to collect solar current, voltage, temperature, and light intensity. This system can measure data from solar panels. You can use this data to assess the performance of solar energy produced to predict future energy production. Based on the measured data, it was observed that PV is directly dependent on solar irradiance and temperature.

VIII. References

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