SOLAR ENERGY MEASUREMENT SYSTEM

K.G.Shravan[1], N.Swapna[2], M.Bharath Kumar[3], V.Padmaja[4]

[1,2,3]*Under Graduate Student, Dept. of Electrical and Electronics Engineering, GCET, Telangana, India,*

[4]*Assistant Professor, Dept. of Electrical and Electronics Engineering, GCET, Telangana, India*.

ABSTRACT:

This project aims to develop a measurement of solar energy using Arduino Board technology. In this research, three parameters measured are voltage, current and Maximum Power Point Tracking. The voltage is measured using the voltage sensor because the voltage generated by the solar panel are large for the Arduino as receiver. The current is measured using the current sensor module that can sense the current generated by the solar panel. These parameters as the input value for the Arduino and the output is sent to Thingspeak. Maximum Power Point Tracking, frequently referred to as MPPT, is an electronic system that operates the Photovoltaic (PV) modules in a manner that allows the modules to produce all the power they are capable of producing.ThingSpeak is an IoT analytics platform service that permitsus to collect, visualize and analyze live data streams in the cloud. ThingSpeak gives instant visualizations of the information posted by our devices to the ThingSpeak. The main controlling device of the whole system is an Arduino microcontroller. Solar panel, voltage sensor, current sensor, ESP8266 Wi-Fi module are interfaced to Arduino.

Keywords: *Arduino ,ESP8266 Wi-Fi module, Solar Panel, Thing speak.*

1. INTRODUCTION

The impacts of global warming are being felt across the globe. We have to reduce our dependence on fossil fuels and start using clean energy instead. Solar energy is an example of promising renewable sources that is presently being used in the world for meeting rising demands of electric power. This power is the conversion of sunlight into electricity, sunlight is collected either directly by using photovoltaics or indirectly using concentrations of solar energy. In this project a solar panel is used which keeps monitoring the parameters of the solar panel like the voltage, current and Maximum Power Point Tracking. Maximum Power Point Tracking, frequently referred to as MPPT, is an electronic system that operates the Photovoltaic (PV) modules in a manner that allows the modules to produce all the power they are capable of. MPPT is not a mechanical tracking system that "physically moves" the modules to make them point more directly at the sun. MPPT is a fully electronic system that varies the electrical operating point of the modules so that the modules are able to deliver maximum available power.

The main controlling device of the whole system is a Arduino microcontroller. Solar panel, voltage sensor, current sensor, ESP8266 Wi-Fi module are interfaced to Arduino. The microcontroller initially measures the voltage and current from solar panel and wind turbine without load connected. Also, the microcontroller measures the voltage and current from solar panel under load conditions. The Arduino microcontroller takes the decision of operating the load through PWM (Pulse Width Modulation) until the maximum voltage is obtained from solar panel without degrading the load performance. The values of voltage and current are to Thingspeak through Wi-Fi module. To perform this intelligent task, Arduino microcontroller is loaded with an intelligent program written using embedded 'C'.An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

2. BASIC CONCEPT OF EMBEDDED SYSTEMS

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical

parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today. Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. For example, air traffic control systems may usefully be viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites. (Each radar probably includes one or more embedded systems of its own.)

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Physically embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure. In general, "embedded system" is not a strictly definable term, as most systems have some element of extensibility or programmability. For example, handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them, but they allow different applications to be loaded and peripherals to be connected. Moreover, even systems which don't expose programmability as a primary feature generally need to support software updates.

3. COMPONENTS USED

1. ARDUINO Microcontroller: Arduino is an open source hardware/software programming platform based on microcontrollers. It has peripherals on a single chip. All the components are interfaced to Arduino.

2. Solar panel: A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect and convert them into electricity or heat. A 12V Solar panel is interfaced to the Arduino.

3. Voltage sensor: It is a sensor used to calculate and monitor the amount of voltage in an object. When the presence of voltage is detected, they give an output as analogue voltage signals, current levels, frequency.

4. Current sensor: ACS712 Current Sensor is the sensor that is used to measure and calculate the amount of current applied to the conductor. Itis a fully integrated, Hall-effect based linear sensor IC.

5. ESP8266Wi-Fi module: The ESP8266 Wi-Fi Module is a System on Chip with integrated TCP/IP stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 could be controlled from your local Wi-Fi network or from the internet.

4. BLOCK DIAGRAM

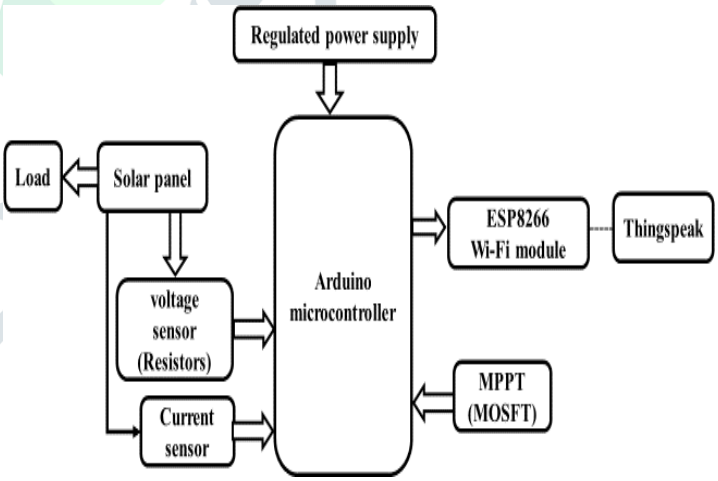
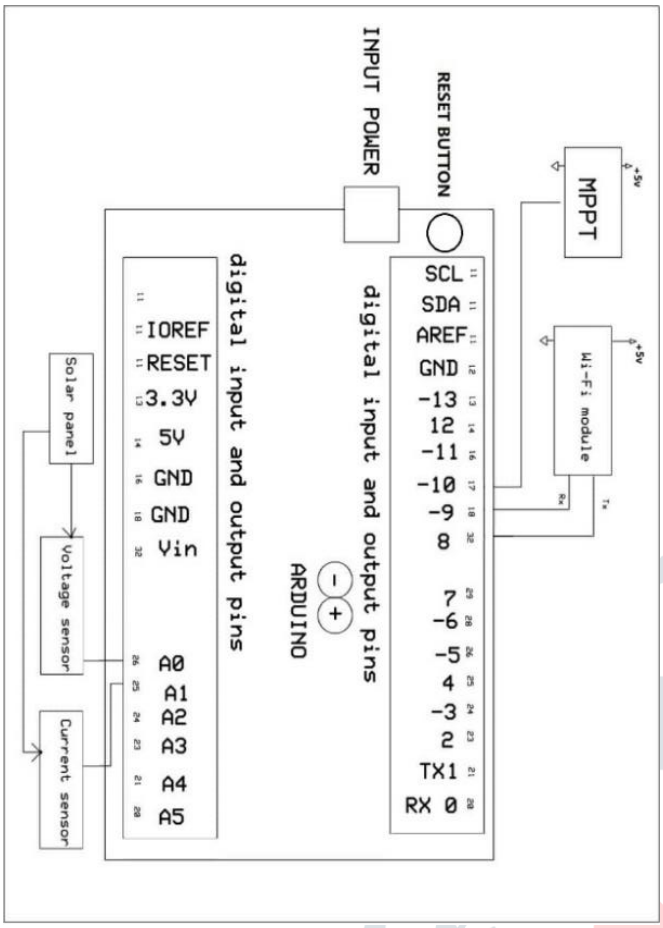


Fig1.Block diagram of Solar Energy Measuring System

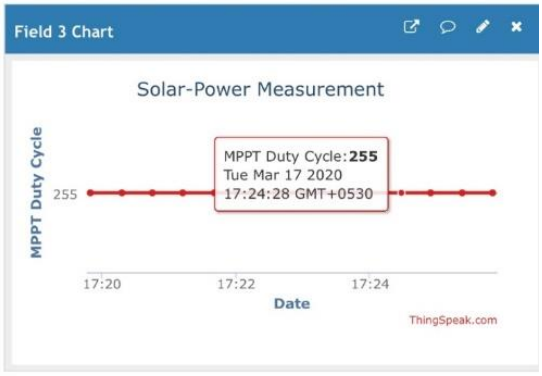
5. CIRCUIT DIAGRAM



6. WORKING

Solar panel, voltage sensor, current sensor, MOSFET, ESP8266 Wi-Fi module are interfaced to Arduino.The inputs from 12Vsolar panel is sent to current sensor and voltage sensor. The current sensor senses the current value and for displaying the power at maximum (MPPT) we use MOSFET. The Voltage sensor is also interfaced to the Arduino. The Arduino communicates with the user interface such as laptop and circuit board through the Arduino Software (IDE) and the USB port connected to the laptop. The code was uploaded to the Arduino through the IDE . Since Wi-Fi module is interfaced to Arduino, we obtain the live feed of output in the form of graph and this output is shown in Thingspeak IOT platform. Thingspeak is open source IOT platform that allows us to visualize and analyse live stream datas in the cloud.

7. RESULTS AND ANALYSIS



8. PICTURE OF THE PROJECT

9. FUTURE SCOPE

Use of solar energy can reducethe use of firewood and dung cakes by rural area people. They do not emit harmful gases that might be a reason for global warming impacts. Since majority of the population live in rural areas, there is muchscope for solar energy being used in these areas. This project can be used where there is population scarcity and less rainfall. The solar energy measuring MPPT can be useful to check the excessive usage of electricity and the time and duration of day when there is maximum solar generation. The live feed can be used for domestic as well as commercial purpose we can be keep an eye on how much solar energy is available and how much energy is being used by appliances and loads.

CONCLUSION

Our objective is to develop a measurement of solar energy using Arduino Board technology. In this research, the parameters that has been measured are voltage, current and maximum power point tracking. The voltage was measured using the voltage sensor because the voltage generated by the solar panel are large for the Arduino as receiver. Lastly the current was measured using the current sensor module that can sense the current generated by the solar panel. The project can be extended by GSM to voltage and current values through messages. The information or output data from measurement part shows the best position of the solar panel for effective usage.

REFERENCES

[1] A. R. N. Adilah, T. I. T. Nadzlin and A. J. M. Mahadi, "Development of solar efficiency monitoring system by using GSM technology," 2015 International Conference on Space Science and Communication, Langkawi.

[2]ChaitanyaJumaat, Siti & Othman, Mohamed. (2018). Solar Energy Measurement Using Arduino. MATEC Web of Conferences, matecconf.

[3] Singh, Prof Bharat Raj & Singh, Onkar. (2016). Future Scope of Solar Energy in India. SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology.

[4]"Programming Arduino Getting Started with Sketches".McGraw-Hill. Nov 8, 2011. Retrieved 2013-03-28