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# ARDUINO BASED SYSTEM TO MEASURE SOLAR POWER

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**ABSTRACT**

***The purpose of this project is to design and build a solar energy monitoring system that makes use of Arduino Board technology to accomplish its objectives. A number of parameters were assessed in this research, including thermal conductivity, light intensity, voltage conductivity, and current conductivity, among others. A temperature sensor was used to keep tabs on the temperature of the room. The intensity of the light was measured with the help of a light dependent resistor (LDR) sensor. Consequently, we employed a voltage divider to measure the voltage since the voltage generated by the solar panel is too high for the Arduino, which is functioning as the receiver in this experiment. To finish it, we used a current sensor module that was capable of detecting the current generated by the solar array to take a reading on the current. The Arduino was given these settings as input values, and the result was shown on a Liquid Crystal Display (LCD) screen on the computer. On the LCD display screen, the temperature, the light intensity, the voltage, and the current amounts are all shown in real time. In order to display the result on an LCD screen, the Arduino must transform the analogue input of a parameter to a digital output and then back to analogue. This project will also feature a design that will ensure that the device casing is portable and easy to move, amongst other things.***

***KEY WORDS: Solar photovoltaic, Measurement system, Light intensity, Temperature, Pressure, Voltage, Current***

## 1. INTRODUCTION

In response to rising demand for fossil fuels and coal, along with global climate change and harsh weather conditions, a number of nations have begun exploring alternative energy sources in order to reduce their reliance on fossil-based fuels. Solar energy is one of the most promising

renewable sources of energy that is currently being used to help the world meet its growing demand for electric power. Solar energy is one of the most promising renewable sources of energy that is currently being used to help the world meet its growing demand for electric power. Solar energy may be transformed directly into electricity via the use of photovoltaics. As an alternative, concentrated solar energy may be transformed directly into electricity via the use of concentrated solar energy technology. Small and medium-sized applications such as a calculator powered by a single solar cell to isolated residences powered by an off-grid rooftop PV system were among the first to make use of photovoltaics (PV) as a source of electricity. Due to the decline in the cost of solar energy, the number of grid-connected solar photovoltaic systems has climbed into the millions, and utility-scale solar power plants with hundreds of megawatts of capacity are now being built. Solar photovoltaics (Solar PV) are becoming a more economical and low-carbon technology for gathering renewable energy from the sun, and they are becoming more popular.

Arindam Bose and his colleagues contributed to this piece of art. In this paper, you will describe a hypothetical solar system that is designed with two sets of stepper motors, one light sensor, and a concave mirror in mind. Using a track for solar panels that is perpendicular to the ground, the purpose of this project is to boost the power gathering efficiency by 65 percent while maintaining the same footprint. When sunlight is transformed directly into electricity by solar cells positioned on the roof of a structure, this is referred to as a photovoltaic energy system (PV). In order to create an electric current that can be used to power electronic equipment, solar cells are made up of light-sensitive semiconductors, which utilise photon energy to dislodge electrons in order to generate an electric current. A photovoltaic module may be divided into two categories: monocrystalline solar modules and polycrystalline solar modules. At the other end of the spectrum of silicon crystals from polycrystalline solar cells, monocrystalline solar cells are built from a single silicon crystal and are thus more efficient in the vast majority of applications.

Please keep in mind that the amount of energy generated by a solar cell is strongly reliant on the weather conditions, namely the amount of solar irradiation and the temperature of the surrounding air. In recent years, changes in the energy sector have shown that the solar-energy business is one of the fastest-growing renewable energy companies in the world, with annual growth rates reaching 30%. (Adib and colleagues, 2015). Right now, there is a strong need for

remote monitoring and control technology for solar-energy applications, and this demand is projected to rise even more in the future.

**Types of Solar Plates:**

| Solar Cell Type | Efficiency Rate | Advantages | Disadvantages |
|---|---|---|---|
| Monocrystalline Solar Panels (Mono-SI) | ~20% | High efficiency rate; optimised for commercial use; high life-time value | Expensive |
| Polycrystalline Solar Panels (p-Si) | ~15% | Lower price | Sensitive to high temperatures; lower lifespan & slightly less space efficiency |
| Thin-Film: Amorphous Silicon Solar Panels (A-SI) | ~7-10% | Relatively low costs; easy to produce & flexible | shorter warranties & lifespan |
| Concentrated PV Cell (CVP) | ~41% | Very high performance & efficiency rate | Solar tracker & cooling system needed (to reach high efficiency rate) |

## 2. DEVELOPMENT AND IMPLEMENTATION

Block Diagram:

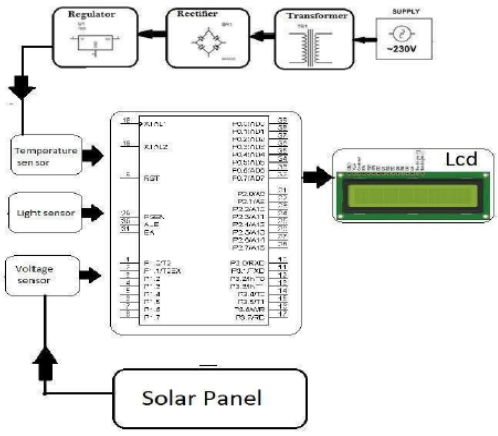



***FIG.2.1. BLOCK DIAGRAM***

**Purposed system:**

In order to display the result on an LCD screen, the Arduino must transform the analogue input of a parameter to a digital output and then back to analogue. This project will also feature a design that will ensure that the device casing is portable and easy to move, amongst other things. A good agreement was found between the measured parameters of the created device and those of typical standard measuring equipment, which allowed for the determination of the device's accuracy. As noted, the amount of energy produced by a solar photovoltaic panel is greatly dependent on the amount of solar radiation received and the temperature of the environment in which it is installed.

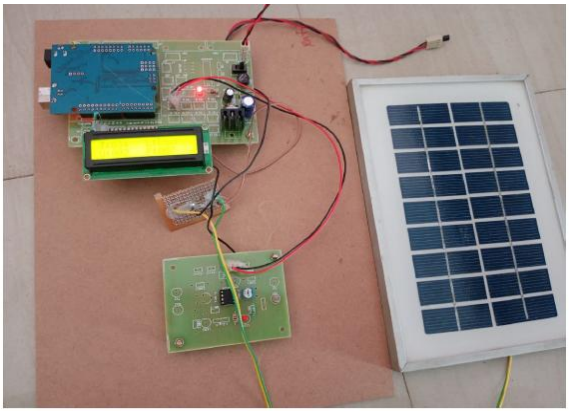
The following are the benefits and downsides of using Arduino:Using the AVR to complete a certain project you may have in mind is a terrific idea, especially if you can find the appropriate shield for it. In comparison to other microcontrollers, it is a poor tool for learning about microcontrollers in general, much alone the AVR. It is wonderful for obtaining rapid results, but it will not aid you in mastering microelectronics or computer programming techniques.

**Advantages:**

- It is not required to have a lot of previous knowledge in order to get started.
- Dependent on the number of shields necessary, the cost is rather low.
- It is possible to get a vast number of drawings and shields.
- There is no need for an external programmer or power source.
- Disadvantages:
- Inadequate understanding of the AVR microcontroller's capabilities.
- Making adjustments to drawings and shields may be difficult.
- There is no debugger included for scripts that are being executed.

• You will not get any expertise of the programming language C or of professional development tools.

**SCHEMATIC DIAGRAM:**



WORKING:

Arduino Based To Measure Solar Power has panels arranged in a certain configuration at a 45-degree angle in such a way that it may collect solar radiation with high intensity from the sun with relative ease when it comes to its operation. In a process referred to as conversion, solar panels convert solar energy into electrical energy. This process has been addressed earlier. One of the objectives of this project is to use the most amount of solar energy feasible. A dark mode and a bright option are both available in this project, with the first being the default setting. The word "LIGHT" is shown on the LCD screen as a result of sunlight shining on the solar panel. When the LCD panel is in night mode, it displays Dark. When the sun goes down, it is conceivable that the voltage may increase. During the time that the gadget is in dark mode, the voltage will drop dramatically.

Problem Statement:

The availability of solar energy, which is directly proportional to its use, fluctuates significantly over time, posing a significant difficulty for solar energy users. Some resources become more or less available on a daily basis as a result of the day-night cycle and also seasonally as a result of the earth's orbit around the sun, depending on the time of year. It is necessary to construct the solar panel in such a way that it gets the most amount of light possible at all times in order to meet the difficulties outlined above.

## 3. RESULT

The Thar Desert in India is home to some of the world's most advanced solar generating plants, which are expected to generate between 700 and 2,100 gigatonnes (GW) of energy by 2050, ii). Aims of the Jawaharlal Nehru National Solar Mission (JNNSM), which was established by the government, include the production of 20,000 megawatts (MW) of solar energy by 2022 and the development of solar power plants. Gujarat's pioneering solar energy programme aims to generate 1,000 megawatts (MW) of solar energy by 2020, and the state's Rs. 130 billion solar power plan was announced in July 2009, with a goal of producing 20 gigatonnes (GW) of solar energy by 2020. Gujarat is also a leader in solar energy research and development. Beyond the aforementioned projects, around 66 megawatts (MW) of solar energy has been installed for a variety of applications in rural areas, with the bulk of the energy being used in solar lanterns, street lighting systems, and solar water pumps, among other things. A large-scale solar energy production programme has been established in India, which will not only fulfil the country's electricity generation demands, but will also make a substantial contribution to Green Energy Production, which will help in the mitigation of global climate change. It seems that we can generate a large quantity of energy with these solar power plants, according to the results of the measurements.

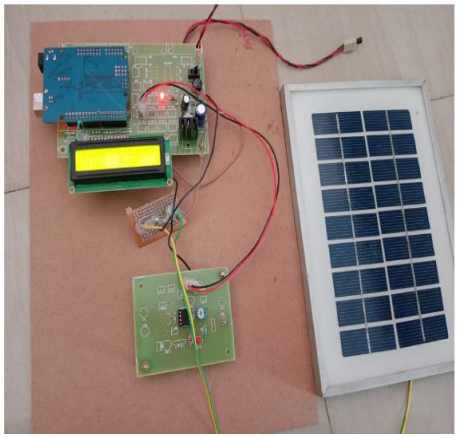


*FIG 3.1.1 SCHEMATIC DIAGRAM OF SOLAR POWER SYSTEM*

*FIG 3.1.3 WHEN SOLAR PANEL IN LIGHT MODE*

## 4. CONCLUSION

As a consequence, the project has accomplished all of its goals, which include monitoring solar panel metrics such as temperature and light intensity as well as voltage, current, and voltage variation, and then analysing the data. The LDR sensor was used to measure light intensity, the voltage sensor was used to measure voltage variations in the solar panel, and the current sensor module was used to measure current fluctuations. The temperature sensor, which detects temperature variations in its surrounding environment, and the LDR sensor were all used in conjunction to measure light intensity. It was the voltage sensor module that was used to measure the current parameter, which was the voltage change in the solar panel. As a result, it is vital to choose the most opportune place and time for solar energy to be used to effectively energise the power grid. With the help of the Proteus ISIS project, this project has designed and constructed an Arduino-based solar power parameter-measuring device that takes use of the optimised simulated parameter from that project. This device was then used to monitor the current, voltage, power, temperature, pressure, and light intensity generated by solar PV panels using the data collected from the panels themselves. It is possible that the system will gather data from solar panels, and that this information will be utilised to analyse the performance of solar energy generated in order to forecast future energy production needs. The results of the measurements indicated that the production of solar PV energy is highly dependent on the amount of sunlight received, the temperature, and the pressure of the surrounding air in the surrounding environment.

## FUTURE SCOPE

India has a tremendous amount of potential for the creation of renewable energy. Because of the country's geographical location, it is well suited for solar energy production. For one thing, India is a tropical country where solar radiation is received nearly constantly throughout the year, resulting in an annual total of around 3,000 hours of daylight on the ground. 5,000 trillion kWh of electricity is equivalent to more than 5,000 trillion kWh of natural gas. Almost the whole country of India gets 4-7 kWh of solar energy per square metre of land area, which is a significant amount of energy. This corresponds to around 2,300–3,200 hours of sunshine each year. States such as Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, and West Bengal, among others, have significant potential for harnessing solar energy as a result of their geographic location. Andhra Pradesh is the most solar-friendly state in the country. In rural areas, where solar energy has a big potential since the overwhelming majority of the population resides, there is a huge opportunity to promote the use of solar energy. Using solar energy to power their homes in rural areas may assist to reduce their dependency on fossil fuels and animal dung cakes. A number of large-scale projects have been proposed in India, including the ones listed below:

## APPLICANCES:

Its is used in solar water heating
Solar thermal power production
Solar drying of agriculture and animal products
Solar cooking
Solar green houses
Solar heating of buildings
Solar distillation

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