

Data Logging System for Solar Power Plant

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Abstract— Data logging system for solar power plant plays a vital role to analyze the performance of plant and future research. The objective of the project is to analyze the data and to create a database in computer. The data logger is used to monitor and collect the data such as temperature, power generation, radiation, using arduino and creating database in computer. The data's are collected from sensor like temperature sensor, LDR, VI sensor. Sensors plays a major role in data logger, which takes a reading and sent the data to arduino. An arduino processes the data and displays it in LCD, also the data's are stored in computer with the help of WIFI. The collected data's can be used to analyze the performance of solar power plant. One of the primary benefits of using data logger is that it can able to automatically collect data on a 24hour basis. In this project, temperature sensor (LM35), LDR, voltage and current sensor are interfaced with arduino and created a database on system for temperature, radiation, voltage and current.

Key words: Temperature Sensor (LM35), LDR, Arduino, WIFI, VI Sensor

I. INTRODUCTION

A data logger is an electronic device capable of storing a number of measurement. It is used to monitor and collect the data such as temperature, power generation, radiation using arduino and creating database in computer. Battery powered it accept sensor inputs, sampling and saving the data at a predetermined frequency. Most of the data loggers interface with a personal computer and utilize software to activate the logger and view/analyze the collected data. The logger records each measurement and stores it in memory along with the date and time. Data loggers are typically compact, battery-powered devices equipped with an internal microprocessor, data storage, and one more sensor. Different types of data logger are

Stand-alone data logger

Web-based data logging system

Wireless data nodes

Bluetooth low energy data logger

The data logger is an invaluable tool to collect and analyze experimental data, having the ability to clearly present real time analysis with sensors and probes able to respond to parameter that are beyond the normal range available from the most traditional equipment. The difference between various data loggers are based on the way the data is recorded and stored. The type of information recorded is determined by the user i.e. whether temperature, relative humidity, light intensity, voltage, therefore it can automatically measures electrical output from any type of transducer and log the value. The data logger works with sensor to convert physical phenomena into electronic signals such as voltage or current. The electronic signals are convert into binary data. The binary data is then easily analyzed by software and stored on memory.

II. BLOCK DIAGRAM

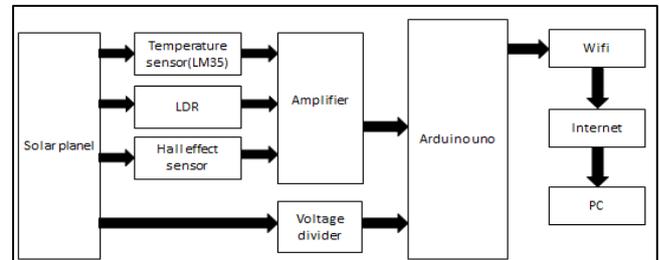


Fig. 1: Block Diagram

In this, LM35 is used to measure the temperature. The LDR and VI sensor are used to measure the solar radiation and voltage & current. The output of the sensors are given to arduino uno and it has inbuilt ADC. The sensors are interface with Arduino. The collected data's are analysed and to create database with the help of wifi. Data logger is interface with a computer and use software to activate the data logger and view/analyze the collected data. The output of the data logger can be observed through the mobile or pc.

III. COMPONENT DESCRIPTION

A. Solar Panel

A solar cell is a device that converts the energy of sunlight directly into electricity by the photovoltaic effect. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the light source is unspecified. Assemblies of cells are used to make solar panels, solar modules, or photovoltaic arrays. Photovoltaic are the field of technology and research related to the application of solar cells in producing electricity for practical use.

B. Arduino Uno

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The sensor are interfaced to the arduino. It can process the data and to create a database on computer with the help of wifi.

C. Temperature Sensor (LM35)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration

or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55 to $+150^\circ\text{C}$ temperature range. Low cost is assured by trimming and calibration at the water level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. The LM35 is used to measure the temperature of solar panel.

D. LDR

A photoresist or LIGHT DEPENDENT RESISTOR or cadmium sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor. A photoresist or is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. The light dependent resistor is used to measure the radiation and send to arduino.

E. Current Sensor

1) Hall Effect Sensor

A Hall Effect sensor is a transducer that varies its output voltage in response to a magnetic field. Hall Effect sensors are used for proximity switching, positioning, speed detection, and current sensing applications.

F. Voltage Sensor

In electronics, a voltage divider (also known as a potential divider) is a simple linear circuit that produces an output voltage (V_{out}) that is a fraction of its input voltage (V_{in}). Voltage division refers to the partitioning of a voltage among the components of the divider. A simple example of a voltage divider consists of two resistors in series or a potentiometer. It is commonly used to create a reference voltage, and may also be used as a signal attenuator at low frequencies.

G. WI-FI

A Wi-Fi-enabled device, such as a personal computer, video game console, smartphone or digital audio player, can connect to the Internet when within range of a wireless network connected to the Internet. Fi provides service in private homes and offices as well as in public spaces at Wi-Fi hotspots set up either free-of-charge or commercially.

Organizations and businesses, such as airports, hotels, and restaurants, often provide free-use hotspots to attract or assist clients. Enthusiasts or authorities who wish to provide services or even to promote business in selected areas sometimes provide free Wi-Fi access. As of 2008 more than 300 city-wide Wi-Fi (Muni-Fi) projects had been created. As of 2010 the Czech Republic had 1150 Wi-Fi based wireless Internet service providers. Routers that incorporate a digital subscriber line modem or a cable modem and a Wi-Fi access point, often set up in homes and other buildings, provide

Internet access and internetworking to all devices tuned into them, wirelessly or via cable. With the emergence of MiFi and WiBro (a portable Wi-Fi router) people can easily create their own Wi-Fi hotspots that connect to Internet via cellular network.

H. LCD Display

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

IV. WORKING

In this project consist of temperature sensor (LM35), LDR, WIFI, Arduino UNO, LCD display, VI sensor. An Arduino forms the heart of the system. The sensors are used to measure the data from the solar panel such as temperature, radiation, current and voltage. Arduino processes the data and the values are displays in LCD.

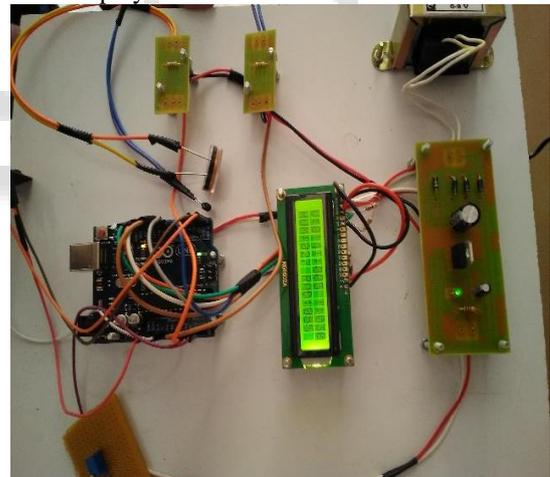


Fig. 2: Hardware Setup

The collected data's are stored in computer with the help of WIFI. Data logging can be carried out 24 hour a day, 365 days of the year.

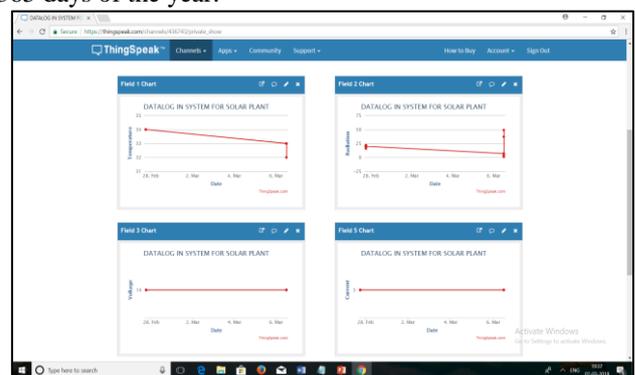


Fig. 3: Database

V. CONCLUSION

In this project, it is concluded that the design implementation of temperature, radiation, voltage and current measurement of solar plant have completed. The values are displays in PC. This method is very suitable for data logging in experimental and plant monitoring.

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