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IoT Application for Real –Time Monitoring of Solar, Wind Hydro System Based on Arduino

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ABSTRACT

IOT based Remote monitoring extends the effectiveness of the data logger in the areas deprived of electrical grid and traditional wired telecommunication networks. The data logger measures electric and climatic parameters (up to 14 parameters, expandable) with the required accuracy established by the HC-05 standard; to include 4G technology in it allowed the stand-alone PV and wind ,Hydro systems system monitoring remotely via web or via mobile application, all at low cost. An outdoor campaign of over 12 months under the harsh environmental conditions at multiple locations was performed to test the new datalogger under real and different conditions demonstrating the robustness and the reliability of the system.

KEYWORD: Hydro system, IOT., PV

1. INTRODUCTION

Internet of Things (IoT) is a technological advancement that connects computing devices, machines, and objects in everyday life with special identifiers and data transfer over a network without requiring human-to-human or human-to-PC communication. This technology facilitates data exchange between connected devices on a network. The internet enables users to access data and control devices from anywhere in the world.

The main goal of the Solar Power Monitoring System is to promote a data acquisition system that continuously appears remote energy yields. Electricity is required in today's world for heating, lighting, refrigeration, transportation systems, and all home appliances. The graph of energy consumption is increasing day by day, while the graph of energy resources is decreasing. So, in order to balance the electricity deficit, we are using renewable sources such as the sun, wind energy, and tidal energy to generate electricity that can be reused instead of non-renewable sources such as coal, natural gas, and fossil fuels, which are depleting on a daily basis. That is why solar power is referred to as an indestructible energy source. As a result, an IoT-based solar power monitoring system is being proposed to address the issues associated with electricity scarcity.In general, our country experiences relatively sunny days for approximately 7 to 9 months of the year, with partially cloudy skies the remainder of the time. This makes our country, especially the areas of Teknaf, Sutiakhali, Mymensingh, and Sunamganj,Cox-bazar prosperous in terms of solar power harnessing. Solar power plants must be monitored to ensure that they are producing the maximum amount of power.Because the range of the sun's radiation is not fixed and can vary depending on location, time, and climatic conditions, solar panels that are exposed to the sun must always be monitored.

The proposed system is an IoT-based solar power monitoring system. Solar cells, which are found in solar panels, convert sunlight into electricity in this system. We use a Node MCU Wi-Fi module, and sensors to measure current-voltage parameters, power, temperature, and light intensity. An IoT device is also linked to the sensors, allowing the displayed parameter to be monitored from any location using any available network.

2. RELATED WORK

2.1 Solar Efficiency Measurement Using Arduino (2018)

Author: Rasika Vishal Pujari

a measurement of solar energy using Arduino Board technology. In this research, four parameters that been measured are temperature, light intensity, voltage and current. The temperature was measured using temperature sensor. The light intensity was measured using light dependent resistor (LDR) sensor. The voltage was measured using the voltage divider because the voltage generated by the solar panel are large for the Arduino as receiver. Lastly for the current was 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 was display at the Liquid Crystal Display (LCD) screen. The LCD screen display output of the temperature, the light

intensity, the voltage and the current value. The purpose of Arduino to convert the analog input of parameter to the digital output and display via LCD screen. Other than that, this project also involve with a design to ensure that device case are easy to be carry around.

2.2 Helianthus-a Low Cost High Efficient Solar Tracking System Using AVR Microcontroller (2016)

Author: Arindam Bose

A solar tracking system is a generic term used to describe devices that orient various payloads toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices. This paper describes a potential solar system using two stepper motors, light sensor and a concave mirror. This method not only improves power collection efficiency by about 65% by developing a system that tracks the sun to keep the solar panel at perpendicular to its rays but also decreases the overall cost of production. This solar tracking system is designed, practically implemented and experimentally tested. The design details and the experimental results are shown

the solar panel maximum power point. In addition, the proposed system has the capability of the extraction of solar panel curves. Experimental results present that the proposed fuzzy techniques result in increasing of power delivery from the solar panel, causing a reduction in size, weight, and cost of solar panels in photovoltaic systems.

2.3 A survey of IoT cloud platforms (2017)

Author: P.P. Ray

Internet of Things (IoT) envisages overall merging of several “things” while utilizing internet as the backbone of the communication system to establish a smart interaction between people and surrounding objects. Cloud, being the crucial component of IoT, provides valuable application specific services in many application domains. A number of IoT cloud providers are currently emerging into the market to leverage suitable and specific IoT based services. In spite of huge possible involvement of these IoT clouds, no standard cum comparative analytical study has been found across the literature databases. This article surveys popular IoT cloud platforms in light of solving several service domains such as application development, device management, system management, heterogeneity management, data management, tools for analysis, deployment, monitoring, visualization, and research. A comparison is presented for overall dissemination of IoT clouds according to their applicability. Further, few challenges are also described that the researchers should take on in near future. Ultimately, the goal of this article is to provide detailed knowledge about the existing IoT cloud service providers and their pros and cons in concrete form

2.4 IoT embedded linux system based on Raspberry Pi applied to real-time cloud monitoring of a decentralized photovoltaic plant (2018)

Author: R. I. S. Pereira, I. M. Dupont, P. C. M. Carvalho

we propose, describe, implement and test the Renewable Energy Monitoring System (REMS), a new concept on data acquisition and transmission systems (DATS) applied to real-time cloud monitoring of a decentralized photovoltaic (PV) plant. To achieve this latest design, we went through various systems projects alongside the evolution of technology. From this practical experience and in agreement with Brazil’s policy of diversifying the electricity generation matrix, our proposal focuses on a multi-user remote system using Raspberry Pi and Internet of Things (IoT) concept. REMS is capable of sensing and modifying monitoring process management via remote firmware update through the developed Analog/Digital Converter Embedded System (ADCES) as well as communicating with a personal developed cloud server profile via RPi Embedded Linux System (ELS), thus not requiring a dedicated PC. The measured variables are PV voltage and current, ambient and PV module temperature, solar irradiance, and relative humidity

2.5 Remote monitoring of solar PV system for rural areas using GSM, V-F & F-V converters (2016)

Author: R. Tejwani, G. Kumar and C.S. Solanki

The health of the Solar PV systems should be monitored continuously for their better performance and maintenance. For PV systems installed at rural locations, remote monitoring capabilities provide the information in advance when system performance is degraded or is likely to fail. Based on this information, preventive maintenance can be carried out to improve the performance and life of the system, thereby reducing the overall operating cost.Advantages and disadvantages of several monitoring systems for rural application, based on the techniques of communication, such as, computer to computer communication (Ethernet), embedded system to computer (GSM) and embedded system to embedded system (GSM, GPRS) are discussed.A new technique is proposed as a solution to overcome the limitations of other techniques. The proposed technique uses GSM voice channel for the communication of data, in the form of analog signal between transmitter and receiver. In order to study and evaluate the performance of proposed technique, various experiments have been performed and impact of parameters like shape (sine, square and triangular), frequency (50 - 4000 Hz) and amplitude (0 – 6 V) of analog signal have been studied. It is observed that sine wave of frequency from 300 Hz to 3300 Hz with 4.5 V maximum amplitude can be sent on voice channel of GSM network with less than 1% error. This technique has low initial as well as operating cost. The GSM network is readily available in rural areas; this technique can be used easily.

3. PROPOSED SYSTEM

This proposed presents the process of solar tracking with the help of LDR sensors and attains maximum efficiency. Sensor unit sends information to the microcontroller which controls the speed and direction of the dc gear motor attached to the solar panel. The solar energy and wind,hydro energy stored in the battery and electric supply given to the load. If there is any detect in a particular solar cell it will send information to the microcontroller through voltage sensor which send the message to the LCD. share the information through IoT.

BLOCK DIAGRAM

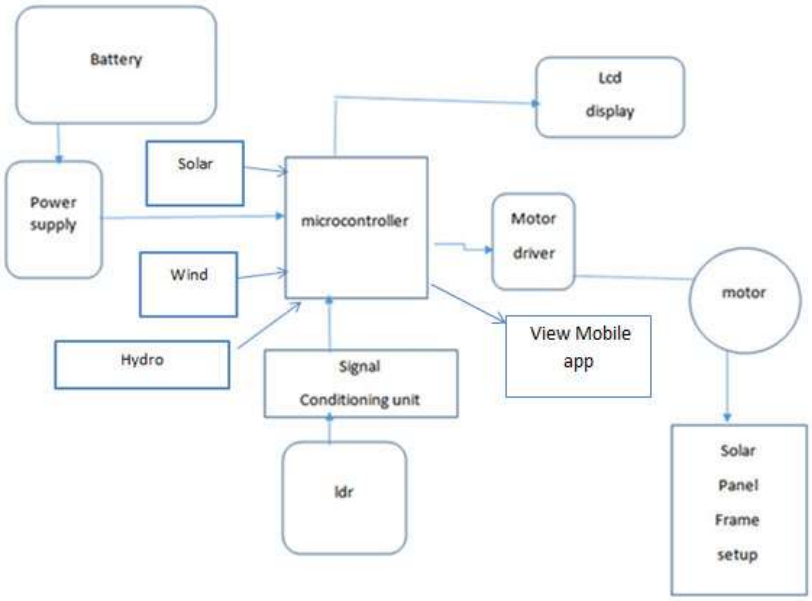
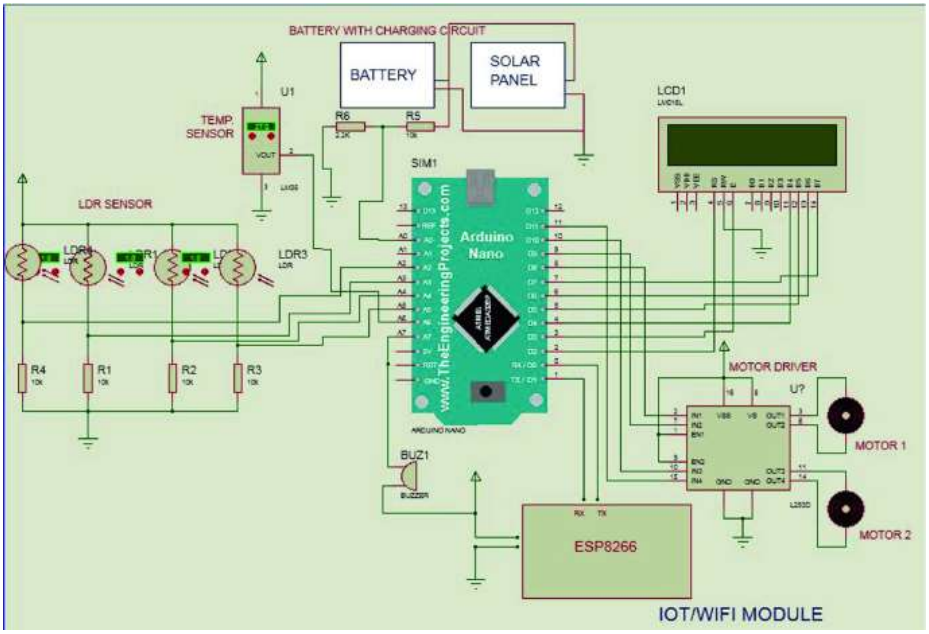


Figure: 1.2 block diagram

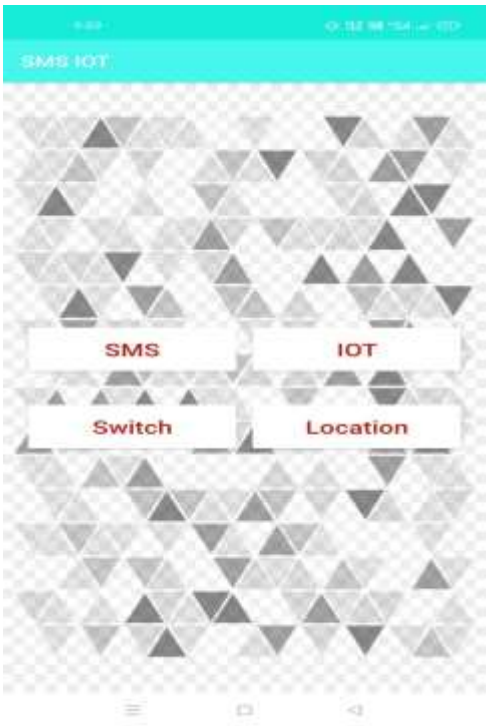
CIRCUIT DIAGRAM



WORKING OF PRINCIPLE

The designed project measures different solar cell parameters like light intensity, voltage, current and temperature by using multiple sensor data acquisition. The project uses a solar panel to monitor sunlight and Arduino board which has ATmega family microcontroller attached to it. The project

requires an LDR sensor for measuring light intensity, a voltage divider to measure voltage and a temperature sensor to measure the temperature. These measurements are then displayed by the microcontroller to a LCD screen. Thus this system allows user to effectively monitor solar parameters using this system Single axis trackers: -single axis solar trackers can either have a horizontal or a vertical axle. The horizontal type is used in tropical regions where the sun gets very high at noon, but the days are short.. Illustrates the Experimental setup of a solar power monitoring system based on IoT. This setup includes a HC-05 microcontroller, Sensors such as a Current sensor module, a Battery Charger module, a Battery, an LDR, adigital temperature sensor, and a solar panel and wind,hydro that measures parameters.The Node MCU is responsible for live streaming current, voltage, power, light intensity, and temperature, as well as sending sensor data to the server via the Wi-Fi module. The sensors are connected to the microcontroller (Node MCU), which is powered by an external power supply.The values of the sensors are read by NodeMCU, and the data is sent to the cloud server by this microcontroller. Extra power will be stored in the battery for later use via the Battery Charger Module. As a result, the user can monitor the above- mentioned parameter. The practical circuit setup of the proposed system



CONCLUSION AND FUTURE ENHANCEMENTS

CONCLUSION

Implementing Renewable Energy technologies is one recommended way of reducing the environmental impact. Because of frequent power cut it is important to use renewable energy and monitoring it. Monitoring guides the user in analysis of renewable energy usage. This system is cost effective. The system efficiency is about 95%.This enables the efficient use of renewable energy. Thus it is reducing the electricity issues.

FUTURE ENHANCEMENTS

The evaluation of the process can be further precise by monitoring the electricity usage with the energy consumed in the solar panel. And the process is analyzed by values rather than the hex-files generated in the system. And the result of the analysis system is stored in cloud rather in the centralized server, so that it can be accessed at any mean time of the user and reserved authority.

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