

SOLAR POWERED SYSTEM-ON-CHIP FOR METEOROLOGICAL DATA STATION

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Abstract: The main objective of this research project is to design a Raspberry Pi-powered weather station which gives the current state of weather report according to the location to calculate the temperature, humidity, wind speed and wind direction. Here the climate data is gathered from a temperature sensor and that data is relayed to the cloud. The data is analyzed from the collected data in real-time. This autonomous combination of hardware, software and networking is being referred to as IoT. Here Pi is controlling all components for sensor measurements of weather station like relative humidity, RTC, wind speed, wind direction, ambient temperature, barometric pressure, ultraviolet sensors. Hardware technologies enabled us to measure air temperature, pressure and humidity. In this research work the wind speed, rainfall, current temperature, humidity and barometric pressure is calculated. The main purpose of this design is to find the variations in temperature which enables us to take precautionary measures for lives and belongings.

Keywords: Internet of things, Real Time Clock (RTC), Raspberry Pi, Anemometer.

1. Introduction

Being in the era of frequent natural calamities, the need for preparedness is essential. One cannot stop them without happening yet can reduce loss. The earlier human senses it the better preparedness can be achieved. By using raspberry, the area constraint can be achieved successfully. Connecting it to the network and using made easy also cost-effective and availability of memory are big advantages. Internet of things (IoT) technologies progress is in peaks in its trend now. By incorporating this accessing multiple resources online is quicker and

easier. Since the power produced by it is by solar there will not be any chances of running out of power for any service [1]. Battery backup is also provided for the system by storing the data to the cloud it is possible to understand the movements of environment changes. The bigger the data size the easier to understand the trend. Ultimately predicting the event will be more accurate and earlier. Size of the system is such an advantage worth mentioning. Since every equipment is of small size it is very easy to install in any small firm or house. The information can be made available to appear in mobile device hourly based on the requirement. Of course, the data is presented in the cloud to access anytime anywhere. With the proposing system, the consumer can estimate temperature, rainfall and pressure [2]. Using the algorithms with increasing of data can give the most accurate results[3].

2. Literature Survey

2.1. Monitoring System of a Weather Station via IP

An item that is being implemented by many in the world is an extensive range of objects that are connected and communicating cheaply with each other in day to day activities across the world -"the Internet of Things". The electronic devices will generate the data and with the help of the Internet, the possibility of interaction between devices is endless. These devices can be data sources, end-user devices, sinking to cloud etc [3].

2.2. Raspberry pi Based Laser Spot Detection

This paper focused the use of Raspberry Pi for the location of the laser spot utilizing Open CV library. To catch the information, a Web-Camera associated with the

USB port of Raspberry Pi is used. In view of the little size of Raspberry Pi, the module could be mounted on the weapon for laser shooting. Contrasted with the current laser shooting, this strategy has the advantages of adaptability in laser shooting system, where the shooter could move the weapon uninhibitedly with no limitation of the camera link association. The framework will prepare the assignment interfacing to the camera that could be an expert by the Raspberry Pi mounted on the weapon. The exploratory result demonstrates the proposed framework would distinguish the laser spots under the different foundations, lighting conditions, and shooting separations successfully. The handling rate of 18 fps could be utilized for continuous usage [4].

3. Modules of Proposed Work

3.1. Installation of the Raspberry Pi

The SD card is to be inserted into SD card reader. Extractions of the zip file of the raspbian operating system using windows extractor are done and copy the files are copied to the card. SD card connector in USB port is utilized and thus the SD card is launched. [5].

3.2. Data Acquisition from Sensor

Data acquisition is the way towards inspecting alerts that measure genuine physical situations and altering over the subsequent specimens into computerized numeric traits that can be controlled y way of the PC.

1. Sensors or transducers that will convert one form of energy to another form.
2. The signals from the hardware resources are changed into electrical signals or computerized variables which can be displayed on the computer.
3. The converters are equipped for changing over sensor signs to advanced qualities.

3.3. Cloud data manipulation

Cloud Messaging APIs offer an extensive variety of informed choices and capacities. To help you fabricate a stage to comprehend what you can do with GCM APIs, this page portrays essential segments of GCM messages and records probably the most usually utilized message alternatives.

4. Description of Sensors

4.1. Anemometer

An anemometer is a sensor which is used for analyzing the wind speed and wind direction. The working

principle of anemometer it has arms that are connected to the rod. When the wind blows the cups that are attached to the vertical rod it will start rotating[4]. The sensor that will count the numbers of turns it is rotated and it will convert the physical form of energy to electrical form and it will be transmitted. The signal that is used calculated the speed of the wind.

4.2. Humidity Sensor

A humidity sensor (or hygrometer) distinguishes measures and reports the relative stickiness noticeable all around. It accordingly measures both dampness and air temperature. Relative stickiness is the extent of honest to goodness dampness recognizable all around to the most astounding measure of dampness that can be held at that air temperature. The more smoking the air temperature is, the more dampness it can hold. Dampness sensors use capacitive estimation, which relies on upon electrical capacitance. Electrical point of confinement is the limit of two close-by electrical transmitters to make an electrical field between them. There are two types of sensors they are resistive based and thermal conductivity based in thermal conductivity based it refers changes in heat to change in temperature and in resistive based it uses two different salt ions changes in salt ions displays the result[5].

4.3. Temperature Sensor

A temperature sensor is a device this device is classified into two different types of thermocouples and resistance temperature detectors. The temperature sensors define that the two different metals with two different mediums that will display the results of electrical signals. In thermocouples, they are two different materials of metal wires and two different mediums one junction is cold and one junction is hot [6].

4.4. Thermocouples

The two wires are basic to interface a thermocouple to an electrical circuit be that these accomplice wires must be made using ambiguous metals from the thermocouple itself. Tallying wire conveyed using unmistakable materials, will make new measuring crossing focuses that will acknowledge wrong readings.

4.5. RTD

The changes in electrical resistance always will change with temperature. The RTD displays the highly accurate values. Here the constant current measures the resulting voltage drop to the materials the materials that are used in

RTD are platinum nickel and coppers. Any two different materials that are placed in two different medium changes result in the electrical signals[7].

4.6. Solar Panel

There are two different types of mediums they are a p-type semiconductor and an n-type semiconductor. Photovoltaic modules are similarly referred as solar panels. The most common semiconductor material is a silicon material. It has both p-type and n-type semiconductors. The p n intersection is shaped by putting p and n-type semiconductors by each other. The p-type with one less electron pulls in the surplus electron from the n-type to balance out itself. In this manner the power is dislodged and produces a stream of electrons, also called electricity.

4.7. Watchdog Timer

A watchdog is an electronic timer that is utilized to distinguish and recover from PC breakdowns. During ordinary operation, the PC consistently resets the watchdog timer to keep it from slipping by, or “timing out”. In the event that, because of an equipment fault or program mistake, the PC neglects to reset the watchdog, the timer will slip by and produce a timeout flag. The

timeout flag is utilized to start remedial activity or activities. The remedial activities ordinarily incorporate setting the PC framework in a sheltered state and reestablishing typical framework operation. The watchdog timer is generally found in inserted frameworks and other PC controlled gear where people can't without much of a stretch get to the hardware or would be not able to respond to shortcomings in an opportune way. In such frameworks, the PC can't rely on upon a human to reboot it on the off chance that it hangs; it must act naturally dependent. For instance, remote inserted frameworks, for example, space tests are not physically available to human administrators; these could turn out to be for all time impaired in the event that they were notable independently recover from issues. A watchdog timer is typically utilized in cases like these. The watchdog timer may likewise be utilized when running untrusted code as parts of a sandbox, to confine the CPU time accessible to the code and in this manner keep a few sorts of denial-of-service attacks.

5. Block Diagram

The block diagram of Block diagram of Raspberry Pi based Solar system with various components is given in Figure 1.

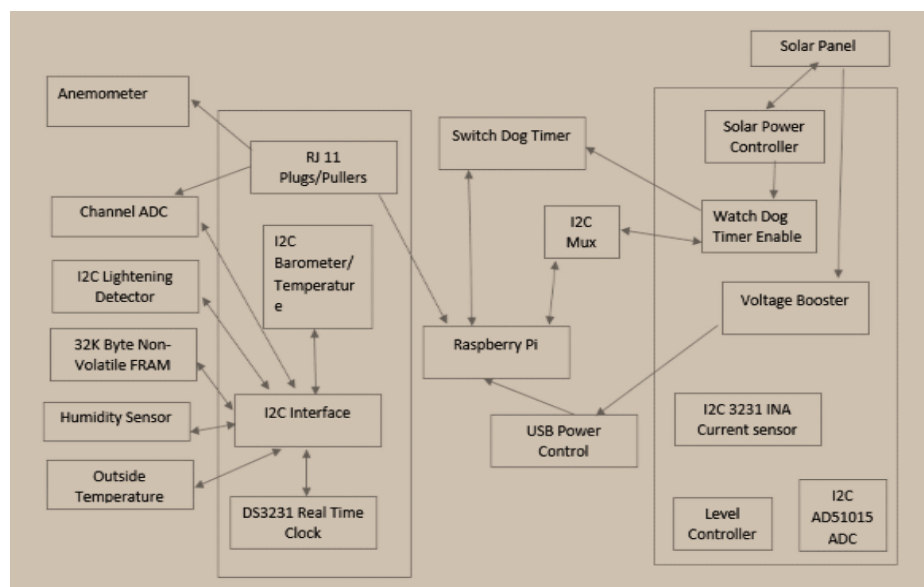


Figure 1. Block diagram of Raspberry Pi based Solar system.

From the daylight, the sun-powered board produces the power and that power is given to the Solar Power Controller. Sun oriented Power Controller will handle

the sun oriented boards, charge the battery and afterwards supplies 5volts to the Raspberry Pi and whatever remains of the power is used to drive all the

practical parts of the framework. It additionally contains sensors that will detect the current and voltage created by the Solar Panels, devoured by the batteries and Raspberry Pi. It additionally contains the equipment watchdog timer and the USB Power Control that really close off the ability to the Raspberry Pi. A watchdog timer is an electronic timer that used to recognize and recuperate from PC breakdowns. The Sensor Subsystem of Weather Pi utilizes a Raspberry Pi as the base unit and afterwards attachments to the distinctive sensors, for example, measuring wind speed, bearing by utilizing anemometer, inside and outside temperature and stickiness through RJ 11 plug and pullers. The Software Subsystem of Weather Pi keeps running with the assistance of Python dialect to the Raspberry Pi. It gathers the information, stored in a database, create charts [10].

6. Conclusion and Future Work

Finding the temperature, wind speed, window, rainfall and weight is done by utilizing Raspberry Pi. These results are overhauled for further examination that is shown in cloud utilizing dashboard. Could visualize the live values as they change in the dashboard. By figuring out the past consequences of climate we anticipate the eventual fate of the weather. And by utilizing Gas sensor it will recognize the harmful gasses. For better results, using radar the various period details can be displayed in the cloud.

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