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RENEWABLE POWER SOURCE WEATHER STATION

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Abstract:

Due to huge significance of climatic changes in various field, weather forecasting and monitoring plays a big role in day to day life. These atmospheric changes like temperature, pressure, and humidity are critical elements to be checked regularly as they can help to either plan activities like agriculture, likelihood of raining, or they can warn and protect human life from serious issue that can happen including floods and extreme heat. There are numerous instruments and online applications that are able to monitor and give weather forecasting information, yet these methods do not provide accurate weather readings at a local area but instead they give readings of the nearby station where they receive the information. This paper gives an outstanding solution of monitoring weather conditions accurately at a local area, by utilization of electronic sensors and equipment like DHT11 for sensing of the data and display them on the LCD screen.

Keywords: PowerStation, weather forecasting,

Introduction

Renewable Power Source Weather Station is the framework which gives exact estimation of the weather conditions like humidity and temperature of your local surroundings [4].

The system is ecologically friendly and does not cause any damage to the environment nor produce ozone harming substances, this is achieved by utilization of renewable energy [2] which is solar energy.

This model is designed to be portable and modern by the means of using wireless transmission of the signal.

The system exploits the functions of two types of Arduinos [1] named Arduino UNO and Arduino Nano, which each Arduino is connected with the Radio Frequency (RF) sensors for the wireless transmitting and receiving of data from one Arduino to another. The readings will be displayed through the 16 x 4 LCD display.

The measurement of data was accurately done by a DHT11 [2] sensor, which reads temperature and humidity of the surrounding area

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Existing Methods

There are many existing methods which are available for weather forecasting, some of these methods are explained below:

Raspberry Pi Weather Station [6] which use to monitor the weather by using IoT (Internet of Things). This system uses raspberry pi which is connected with sensors to monitor the current changes of weather integrate them with the online readings.

The indoor weather station [5] is the product which can monitor home atmospheric conditions. This product also acts as a clock and a calendar and it can display all of those data on the screen. The indoor weather station measures and compare the weather conditions of the indoor and the outdoor of your house and it compares them both together.
The main aim of this product is to measure the weather condition of indoor and compare these readings with the readings of outdoor weather conditions.

Majority of the existing methods utilize the method of Internet of Thing (IoT) to give their readings.

Proposed method

In the proposed technique which would give more accurate measurements of weather forecasting information, it was advised that the system should not use the Internet of things for processing the data rather than it should use its own equipped devices to process and give out the readings of the weather forecasting. Then the systems readings should be compared to the internet readings and the readings of local news stations.

System and block diagram

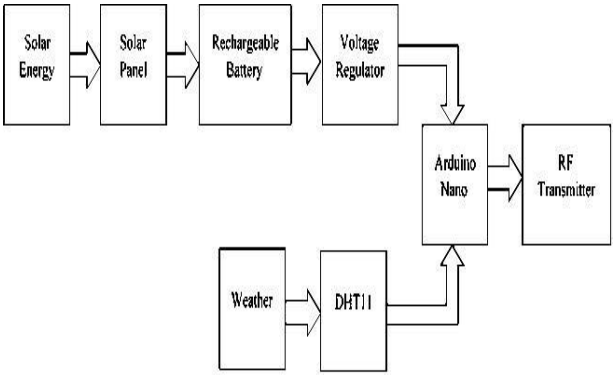

Fig 1: Block diagram of Transmitter Unit

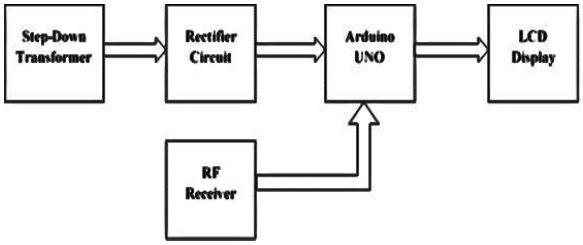

Fig 2: Block diagram of Receiver Unit

This system is design with two main circuit the transmitter and the receiver side. The transmitter act as the data collector and reader while the receiver side works as the display of the data collected by the transmitter.

The transmitter is powered by solar power, in which the solar energy is collected by the solar panel which this electrical energy is used to charge a battery of 12V. A suitable panel capable to charge the battery by making sure that the current and the voltage ratings of the solar panel is higher than that of the rechargeable battery. This battery output is connected to the voltage regulator to turn the voltage to 6V which is used to power the Arduino Nano. On the other hand, the weather readings are measured by an accurate sensor which is DHT11 which collects the data and then send them to Arduino Nano for processing of the data. After the data is processed it is transmitted by using RF transmitter module so that they can be displayed.

The receiver side is equipped with 12V step-down transformer which takes the input from the outlet and convert it to 12V AC, the output of the transformer is then connected to the rectifier circuit which converts the AC to DC. Then, the rectifier is also connected to LM7809 which steps the voltage further down to 9V that is suitable voltage for the working of the Arduino. The Arduino is interfaced with RF receiver module which receives the data from the RF transmitter wirelessly and feed it to the Arduino for processing of the received data.

Finally, the processed data by the Arduino is then Displayed on 16 x 2 LCD screen which shows the readings of the current temperature and humidity.

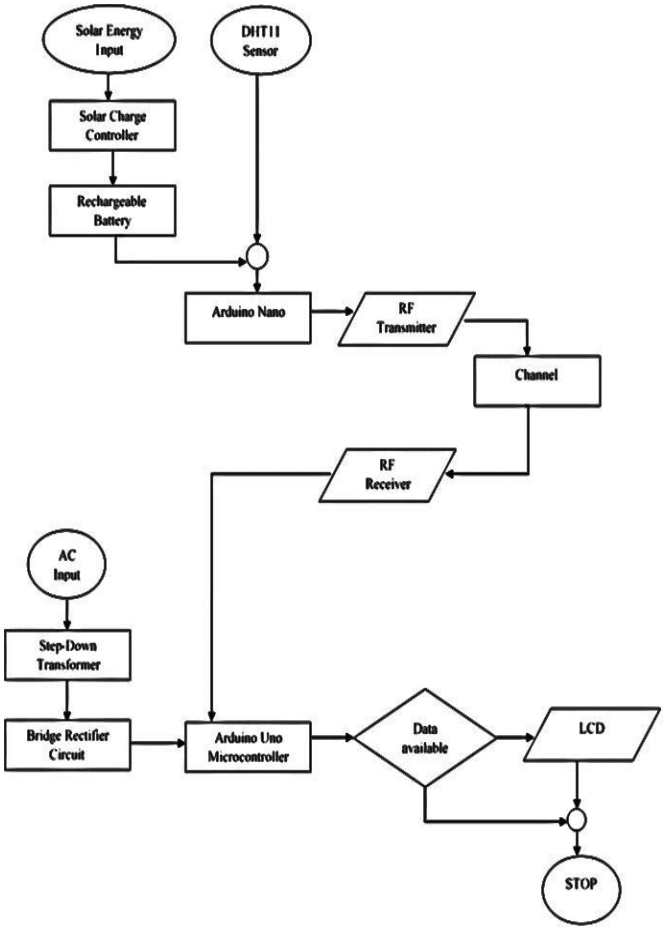

Fig 3: Renewable Power Source Weather Station Flow Chart

Functional Test:

This paper thought that the project design deals with temperature and humidity, then it should compare the test results obtained with the weather reading in the local news and the internet. The readings are tabulated in the table 1 and displayed graphically in figure 6.

The Arduino UNO connected to the computer as power source and also to upload the codes to the Arduino server and interfaced with RF receiver and the LCD. The Arduino Nano connected to computer as well for power and for uploading of the codes while being connected to DHT11 and RF transmitter.

The images below show the connections of the Arduino UNO with the LCD and the circuit testing on the breadboard.

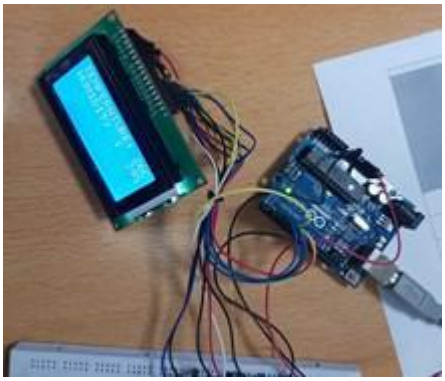

Figure 4: Arduino &LCD connections

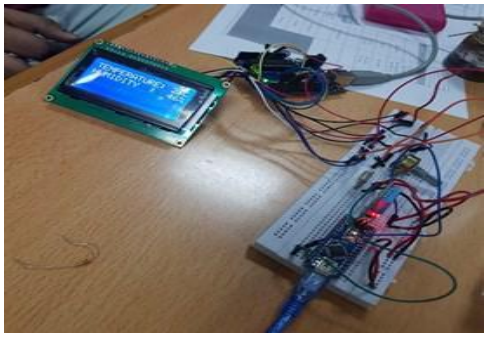

Figure 5: Testing the circuit

Results & Discussion

	Temperature	Humidity
Internet Readings	28°C	43%
Circuit Readings	26°C	39%
	Temperature	Humidity
Internet Readings	18°C	46%
Circuit Readings	24°C	54%
	Temperature	Humidity
Internet Readings	26°C	62%
Circuit Readings	25°C	63%

Table 1: Comparison between internet readings and Circuit readings

Results:

After testing the circuit repeatedly, it was observed that the readings which the system was giving are accurate readings of the local area temperature and humidity, but the readings were different compare to those which are obtained online.

Also, the range of the RF transmitter and receiver depends much on the type of antenna used. For a normal wire antenna, the range of distance between the two circuits must be small and the two systems need to be closer to each other. This implies that improving the antennas it will also improve the range of the two systems.

In addition, for the circuit to work effectively we found out that the transmitter side needs to be powered on first and start working then power on the receiver side for good display of results, while if receiver side is power on first the LCD will just display the readings as 0.

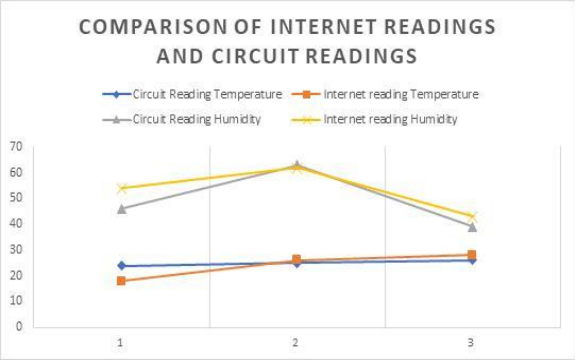

Fig 6: Graph showing deviations of internet readings and the circuit readings

Discussion:

From the Table 1 and Graph in the Figure 6 shown above, they show the differences of the readings provided by the system and the weather forecasting information obtain from the internet and news.

This deviation is because of the internet and the news stations sources of the weather information are obtain from the nearby station, but not the exact location or they obtain weather information by taking the average of the data and provide readings.

Conclusion

In conclusion, the changes in the weather conditions such as temperature and humidity may be reflected negatively or positively with environmental activities and agricultural projects.

This research was done and it obtained an electronic system that can monitor temperature and humidity accurately and instantaneously at a local area, rather than the readings that are provided from the news station and Internet.

In addition of the advantage of being environmentally friendly by means of solar energy, the system is also portable, well designed, and can be moved from one place to another. The implementation of two types of Arduino, programming work, and several experiments were carried out to the system so that it functions accurately and achieve the overall project objectives.

Furthermore, this project is an open gate for further studies and experiments concerning weather parameters, as it will help to provide the base ground for the researchers to learn more and discover on this particular topic.

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