



WEATHER MONITORING SYSTEM

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Abstract:

Weather is the state of the atmosphere at a particular place and time in terms of heat, cloudiness, dryness, sunshine, wind, and rain. Monitoring weather conditions is difficult without an automated process. This paper presents an automated system that monitors the weather condition. The system detects the temperature and humidity of an environment using an open source electronic platform, Arduino written in C/C++ language. A DH11 sensor was used due to its ability to measure the humidity and temperature of an environment, to collect the data. LiquidCrystal_I2C library was used alongside an I2C module to display the data obtained from the sensor on a 16X02 LCD. The system was able to display the temperature and humidity of any environment. Through this system, information about temperature and humidity can be collected easily. Major objective of this paper is to be able to detect the temperature and humidity of an environment without error.

Keywords: Temperature, vapor, photosynthesis.

INTRODUCTION:

Temperature and Humidity are vital and important factors in the environment. Temperature according to Google is a measure of the degree or depth of warmth found in a substance or environment, expressed majorly in degree Celsius. It is also regarded as a measure of the average kinetic energy of the particles of a substance. While humidity according to the National Geographic Society is simply the amount of water vapor in the air. In the air, the amount of water vapor present, the higher the amount of water vapor in the air, the higher the humidity and vice-versa. Relative humidity is the amount of water vapor in air relative to the maximum amount of water vapor the air can hold at a given temperature. Temperature is a major factor affecting the rate of plant development. The rate at which plant grows when planted by a farmer is highly dependent on temperature. Temperature affects how fast a plant or crop will grow hence making it a primary factor. Farmers have to ensure that the current temperature is suitable for them to grow a certain plant. This is done usually in a manual process by merely feeling the surrounding atmosphere. This is not efficient and leads to inaccurate results at times. Farmers suffer huge losses when the temperature is too

high or low hence affecting the crops they grow. This is why it is necessary to have an automated system that will allow farmers to know the exact temperature of their environment before they plant a certain crop. Temperature also affects poultry farmers where birds reared in a poultry are affected when the temperature is either too high or too low. The farmers need to regulate the temperature within the poultry to ensure the birds live in a comfortable and suitable environment.

For photosynthesis to take place, it needs humidity. For certain plants like Anthurium, humidity around it is much more necessary than for other crops. Humidity helps keep the stomata in plants open. If too much water is lost by the plant, the stomata closes which will result in the stop of photosynthesis. This is why it is necessary for the farmer to make sure there is adequate amount of humidity in the air to ensure that photosynthesis take place.

Temperature and Humidity can also be used in other areas where the information is necessary. This is why this paper presents an automatic system that allows users and farmers to keep track of the temperature and humidity of their environments and the environments of where plants are grown. With this system, the loss of crops and livestock due to inadequate information on the weather of the environment will be reduced as the users will now have accurate information of the temperature and humidity of the surrounding.

Related Word:

The Weather application available on every smartphone is an application that can be used to know every information about the weather in your current city or state. It also allows you to check the weather in other states and regions. It contains a prediction feature where the weather prediction of the next week, month, etc. is displayed, this allows you to know what sort of weather will be present within the range of available dates presented by the application. However, this application does not have the ability to sense your present environment and provide you with the temperature and humidity in that particular space. Rather, the application works with data sent from a certain database and displays it in the application. With the weather application, you cannot know the temperature or humidity in a certain room rather, it just tells you the temperature and humidity of the region or city where you stay.

Ambient Weather WS-2000 Smart Weather Station with Wi-Fi Remote Monitoring and Alerts & Thermo Hygrometer comes with a complete bundle of rather correct sensors with the choice to feature more sensors if wanted over time. The machine is simple to set up, very correct and rather customizable. It consists of sensors for humidity, temperature, rainfall, and UV and sun radiation. An integrated sun panel is protected to the sensor array to maintain it walking after the day time and backup batteries also can be established which will maintain it walking. However, the Ambient Weather WS-2000 Smart Weather Station with Wi-Fi Remote Monitoring and Alerts & Thermo Hygrometer is absolutely expensive within a range of \$300-\$400 and that is absolutely high. Weather-Flow Tempest Weather System uses an ultrasonic sensor and measures rain with a haptic sensor. Options to install temperature

sensors are not available. The sensors available however are fast and accurate. Also, the system does not provide a physical display, instead, one has to install their applications or access the information through their website. The data can also be accessed remotely, meaning you can access the data wherever you are as long as you have access to the application or website. However, the Weather-Flow Tempest Weather System is also expensive and costs around \$250-\$294.

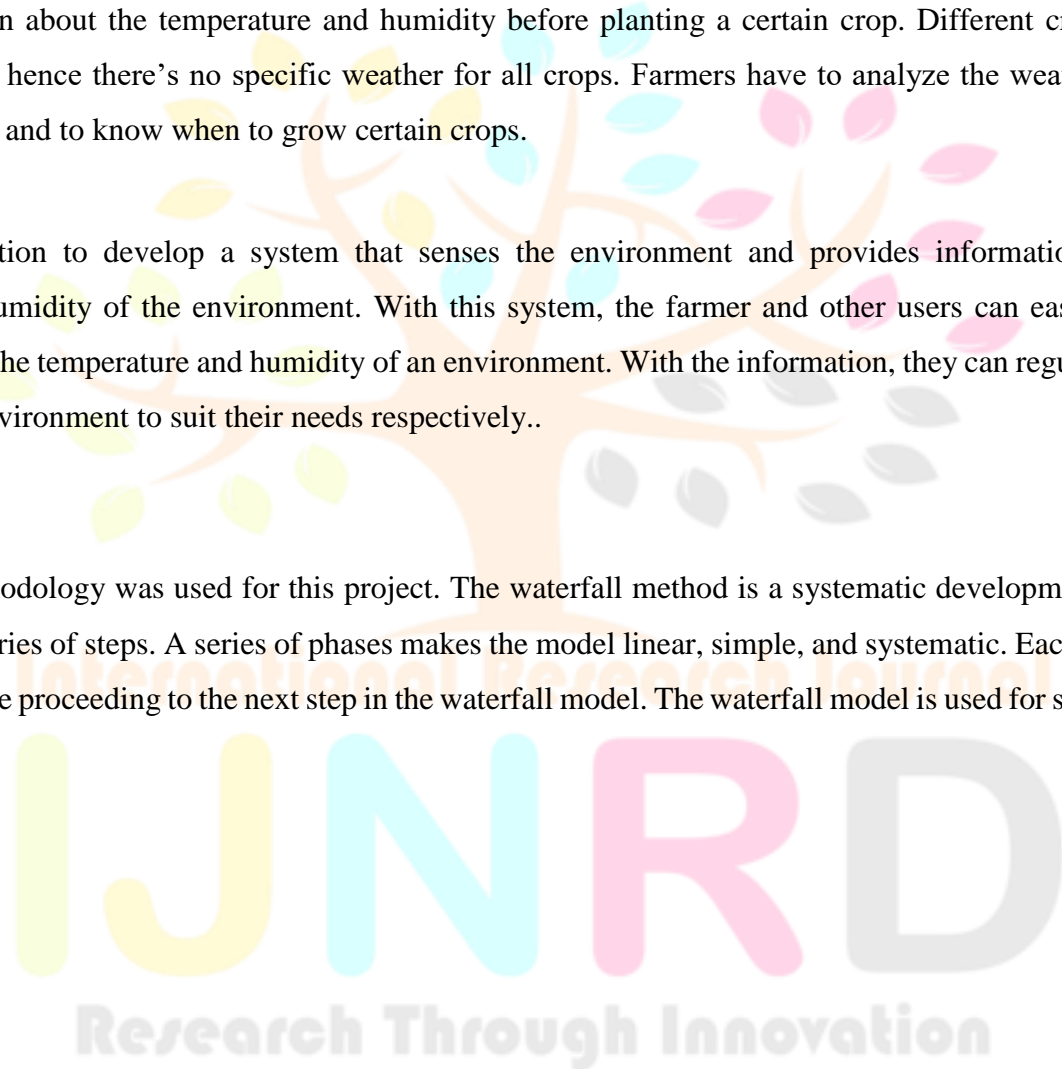
System Analysis and Design:

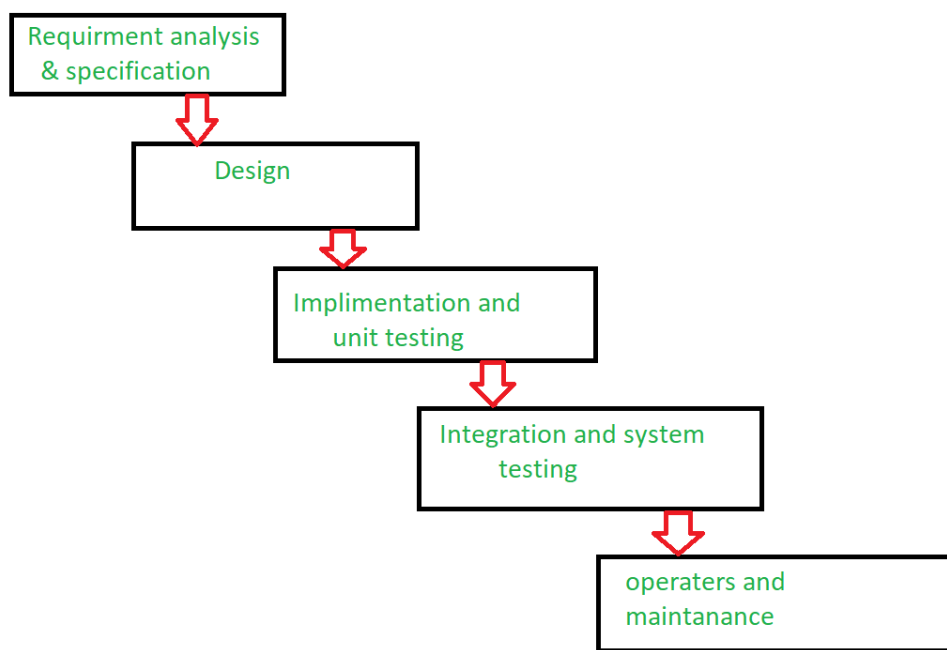
Temperature and Humidity are key factors in the environment. The amount of temperature or humidity in the environment affects a lot of things including the rate of growth of plants. This is why farmers try as much as possible to have information about the temperature and humidity before planting a certain crop. Different crops grow in different weathers, hence there's no specific weather for all crops. Farmers have to analyze the weather to know what action to take and to know when to grow certain crops.

Hence my motivation to develop a system that senses the environment and provides information about the temperature and humidity of the environment. With this system, the farmer and other users can easily have the information about the temperature and humidity of an environment. With the information, they can regulate the crop and or livestock environment to suit their needs respectively..

Methodology:

The waterfall methodology was used for this project. The waterfall method is a systematic development approach represented by a series of steps. A series of phases makes the model linear, simple, and systematic. Each phase must be completed before proceeding to the next step in the waterfall model. The waterfall model is used for small projects mostly.





Waterfall Model

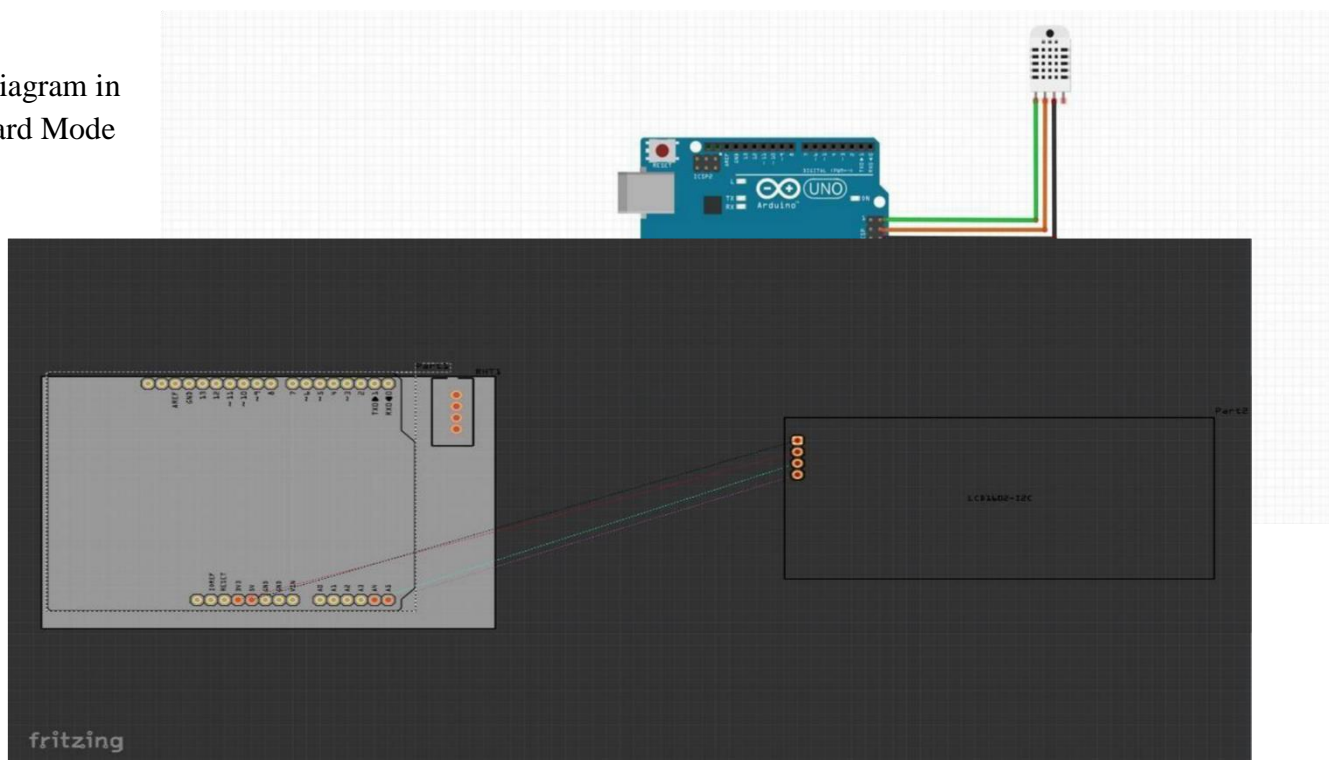
Design:

Designing is the most important and most efficient function while developing a system. Without a proper design, it is very difficult to achieve the system to be developed. The design serves as a guide to the developer and ensures no stones are left unturned. A sketch can be made to get a proper design of the system.

A sketch was made using Fritzing application. As we are using Arduino, we need an application to sketch the circuit diagram to confirm the connections are accurate before implementing using the components physically. Fritzing provides this feature that allows us to sketch a circuit diagram. It contains several to all components needed to design a circuit diagram. It allows us to choose what components we want to use and all we have to do is drag and drop the component into the sketch space. It provides 3 sketch spaces, Breadboard, Schematic and PCB.

Components dragged to any sketch space will be represented in other sketch spaces in their formats. The application also allows us to see detailed explanation of each component and allows us to add more components that are not there by downloading their respective library file. The application has a section for Code where we can write our code and test the code within the Fritzing application using the components in the sketch spaces.

Circuit Diagram in Breadboard Mode



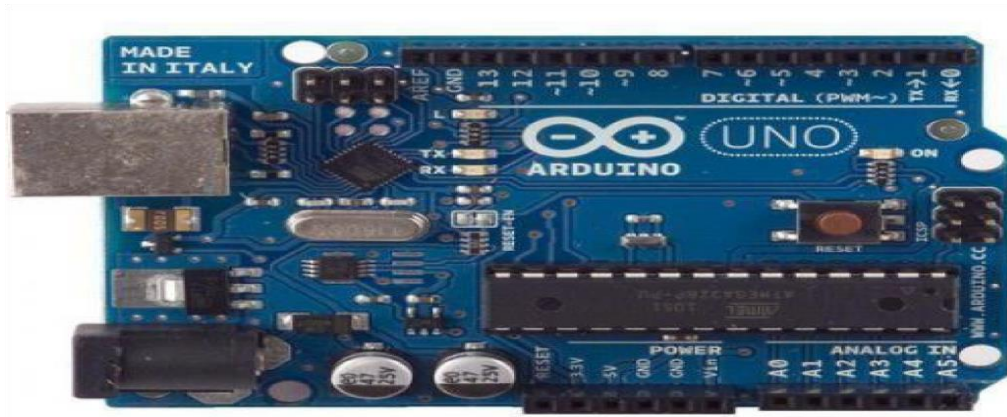
Circuit Diagram in PCB Mode

Implementations:

1. Hardware Components Required

Arduino UNO: The Arduino UNO is a microcontroller board with 14 digital input/output pins, a USB connector, a power jack, and everything else needed to support a microcontroller. It is a very robust board and it is the most used board in the Arduino family.

It is compatible with the Arduino IDE and other software like Arduino CLI and a Web Editor. The board is based on the ATmega328P. The Arduino UNO is the board that other components will be connected to. It is the brain of the system. We simply connect it to a computer via a USB cable or connect it with another power source such as batteries or an AC-to-DC adapter. Arduino UNO is user friendly and can be used to play around with hence we are using it.



Arduino UNO

2. Software Components Required

Arduino IDE: The Arduino IDE is a software program that contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to communicate and upload programs. The Arduino IDE connects to the Arduino UNO where it uploads and executes the code written on the text editor of the IDE. This allows the Arduino UNO communicate easily with the code written. The code written on the text editor is what controls the Arduino UNO and makes it display whatever output it is meant to display.



Arduino IDE

C Programming: C programming language is a general programming language developed to write the UNIX operating system. It is one of the most popular programming languages worldwide and it is very fast compared to other programming languages. C programming can be used to program Arduino UNO efficiently. However, Arduino has its own programming language and it is easy to understand, but in this case, C programming was used to program the Arduino UNO board.



C Programming

Fritzing: Fritzing is a software application that allows us to sketch and draw circuit diagram. The application provides a platform where circuit connections can be tested virtually before making the connections in real time. It contains several to all components needed to design a circuit diagram. It allows us to choose what components we want to use and all we have to do is drag and drop the component into the sketch space. It provides 3 sketch spaces, Breadboard, Schematic and PCB. Components dragged to any sketch space will be represented in other sketch spaces in their formats.

fritzing

Fritzing Application

Result and Discussion

The results show us that the system was able to measure the temperature and humidity of the environment. It reads the weather of the environment and provides the data that is to be shown on the LCD. When heat was applied, we saw that the sensor reacted immediately affecting the temperature and humidity amount. This shows that the system works and would be able to detect the temperature and humidity of any environment.

With this system, a farmer for example can take this into his farm of poultry and read the exact temperature and humidity and know how to adjust the source of heat or cold in the environment to ensure that the environment is suitable for the plants and animals. The system is handy and can be used in small areas.

Local farmers who are just having a small farm and not an industrious one will find this handy and very easy to use as all they have to do is connect it to a power source and it will read the temperature and humidity for them

Future Work

A more robust system can be developed where the sensor can detect the temperature and humidity of environments far from it. The feature of weather forecast can also be included in the system, where it not only displays the present temperature, it is also able to detect the temperature and humidity of the future. The system can also be upgraded into a large-scale system where it can be used by industries and other large-scale companies.

Conclusion

The Weather Monitoring System was developed using C programming and Arduino components to detect the temperature and humidity of any given environment. It successfully detected the temperature and humidity of the environment with the temperature accuracy of ± 2 degrees and humidity accuracy of $\pm 5\%$. The sensor used was the DHT11 sensor and results obtained were displayed on a 16X02 LCD. Fritzing application was used to draw the sketch of the circuit diagram while Arduino UNO and Arduino IDE were used to connect and program the components.

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