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IOT Based Weather Monitoring for Agriculture

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Abstract—In agriculture zone, it is necessary to continuously monitor weather conditions so as to plan future activities accordingly. However, using the currently available wired and analog devices may not be easy as well as suggestible as they are very difficult to handle during critical weather conditions. To overcome this problem, we are developing a sensor network, so as to monitor weather changes. Monitoring the weather parameters in agriculture zone is an important aspect of the farming production process. A wireless sensor network is developed as a weather monitoring system for informing farmers about weather changes and provides them with respective guidelines to plan their field. The weather parameters that are being monitored are temperature and humidity. The main aim of the system is to make use of wireless sensor network for sending information over long distances consuming low power. Low power proves to be an advantage,as because of this, the system can be easily installed and managed at locations where hardwiring is impossible or there is no access to electricity. The system put forth in this paper is a well-advanced solution for monitoring the weather conditions at a particular place and make the information available anywhere to the farmers within a click. We are using the technology called Internet of Things (IoT) to connect devices and sensors involved using Internet.

Keywords-*component, microcontroller , sensors ,agriculture*

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I. INTRODUCTION

The Automated Weather Station System was initially used to measure and continuously monitor the changes in various weather parameters without human efforts or interference to prevent the hazardous and irreparable situations caused due to improper planning and guidance for cropland in various agricultural zones.

Previously, the measured parameters were stored in a specially designed database and were sent to far-off locations over a wired communication medium. If the data was stored in a database, every time the farmer needed information, stored data had to physically download to a computer late on when it was needed for further mechanisms. Hence, the communication medium was the utmost necessary element in an automated weather system. A weather station provides equipment that run on certain mechanisms to check, monitor and observe the weather conditions. The obtained weather parameters are used to make weather forecast reports and to study the weather and climate. In this system the weather parameters that will be studied are temperature and humidity. The measurements are taken through the weather sensors placed in the agriculture zone.

The system is aimed at designing a wireless weather monitoring system with embedded sensors which enables to analyze and keep a check on the weather parameters in an agriculture zone. It will provide proper framed reports based on the analyzed parameters with to the point conclusions to the farmers. It will contain all necessary information that will help the farmers to make proper decisions regarding crop selection, agriculture mechanisms etc. This will help to reduce the impact of hazards that may be caused due to weather on a farmer's life.

II. LITERATURE SURVEY

The survey was firstly done on standard technologies to establish a standard sensor network. Study was continued on choosing the suitable standard sensors. It should be suitable in all aspects like economic and technological. After this, the next choice to be made was about the communication method to be used depending upon the range of communication it will provide [1]. It was decided to make use of ESP8266 WIFI module. When internet is provided, the data can be sent to the required locations through the hotspot established by the Wi-Fi module. The next concern was to select a microcontroller that would match the other system requirements [2]. There is a hidden goal of the system which is to achieve a low power consumable solution. Along with the sensors consuming low power, the microcontroller should also possess the same feature. As a result, ARDUINO UNO, which is low power microcontroller and works with only 2.0V to 5.5V [3] was chosen. Study went on choosing the suitable wireless technology [4]. It should be suitable in all aspects like economic as well as technological.

The proposed architecture is depicted in figure 1. Here, the module 1 provides information about the parameters of the region which is to be monitored for measuring of parameters. Module 2 deals with the sensor device having suitable required functions and this sensor device is operated and controlled based on its sensitivity as well as the range of sensing. In between module 2 and module 3 necessary sensing and controlling actions will be taken depending upon the conditions, like deciding the threshold value , duration of

sensing, messages (alarm or buzzer or LED) etc. Based on the data analysis performed in between module 2 and module 3 and also from previous experiences the parameter threshold values during extreme situations or normal working conditions are determined. Module 3 describes about the data retrieval from sensor devices and also includes the decision making for report generation.

III. Implementation Details

A. Hardware Specification

Various hardware components are used for the design of this system. Arduino UNO, WIFI Module, and various types of sensors are used for measuring the parameters.

Arduino is an open source tool for making programs that can do a way more functioning as compared to desktop computer. The physical world can be sensed and controlled using sensors which are programmed using Arduino programming. This open-source physical computing platform is based on a simple micro-controller board, and a development environment for implementing software on the board.

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of

which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The functionsin arduinohelp the programmer to stay organizedand this often hnelps to conceptualize the program.

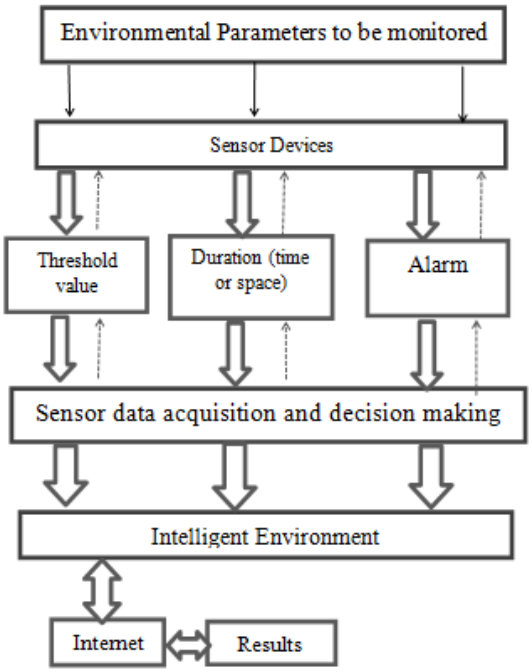

Figure 1: Implementation diagram

This microcontroller serves all the purposes that are a part of this system; only thing to do is to connect it to a computer with a USB cable or power it with an external battery source. Arduino can be used to design interactive objects, function efficiently according to switches or sensors connected to it, and controlling other output devices connected to it.Arduino projects can function as a single module by itself or they can combined with the software running on your computer and together run as a complete module. The boards can be connected and assembled on your own as well as pre-connected boards can be bought that are readily available.The open-sourceArduino IDE software is available for free download on the internet Sensor is connected to Arduino UNO board as shown in figure 5, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated.

The communication method used is the ESP8266 Wi-Fi module as shown in figure 3. ESP8266 is a previously programmed SOC and it is possible for any microcontroller to connect with it through the UART interface. Its working voltage is 3.3v. Feature possessed by it, is that, it is having a TCP/IP protocol stack integrated on chip so as to allow any microcontroller to connect to it with ease.

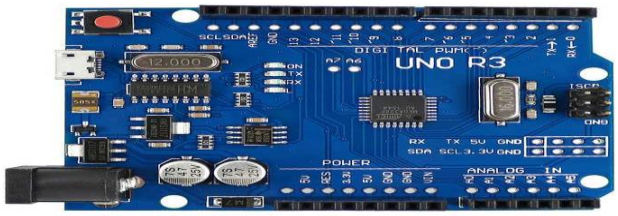

Figure 2: Arduino UNO

The module can be programmed with AT commands and the microcontroller is programmed in such a way that it can send the AT commands in a necessary sequence to configure the WiFimodule in client mode. TheWifi module can be used in two modes namely: client and server modes.

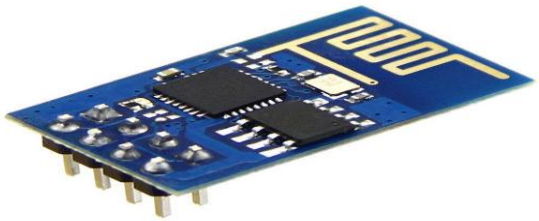

Figure 3: ESP8266 WiFi Module

The system consists of DHT11 sensor which is shown in figure 4, which is a temperature and humidity sensor. This sensor will measure the primary environmental factors temperature and humidity. All the measurements made by this

sensor will be in the form of analog signals. The analog signals will be converted to digital data by the microcontroller.

Figure 4: DHT11 Sensor

The hardware connections are represented by the following image:

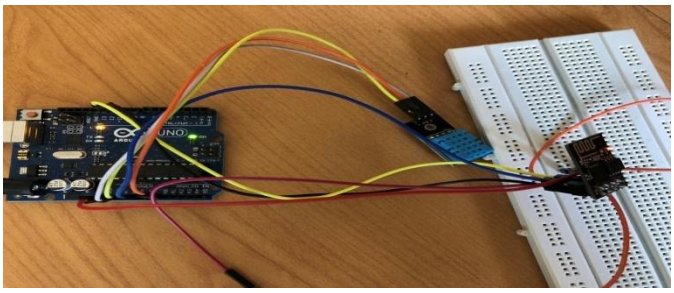

Figure 5: Hardware Connections

B. Software Specifications

The microcontroller can be programmed as per our need and hence requires a program to operate and execute the process associated with the proposed system. Arduino programming has been used to construct the program for the proposed design. In the proposed system, the software implementation plays a vital role while retrieving the sensor data and updating it to the server.

For the implementation of website, various programming languages are used. HTML is used for building the website, CSS for the styling of the website and PHP for the database.

Javascript is also used for the website implementation. HTML5 and CSS3, the latest version of HTML and CSS are also used.

The various weather parameters are measured using the sensor. These parameters are recorded and compared with the database. Based on these comparisons, reports are generated. These reports consist of adequate measures and solutions for the growth of the crops. Following are certain screenshots of the website created.

After the farmer places this instrument in his selected area, within one click the result will be displayed on the website. The result displayed will include: temperature, humidity and location and ID of the place and most importantly, the suggestion of which crop has to be grown. Along with this, precautionary measures for growing that particular crop will also be provided.

Figure 6: Screenshot of website

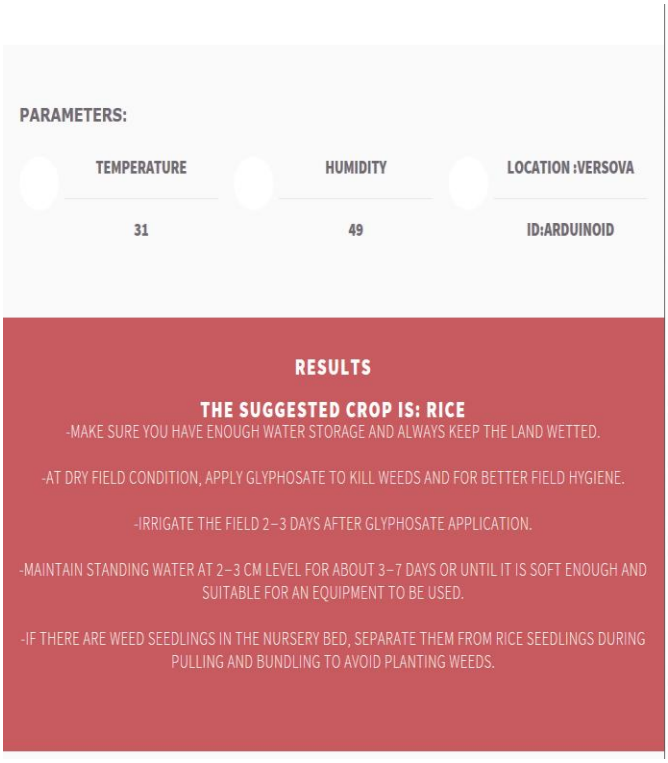

Figure 7: Screenshot of results displayed on website

IV. CONCLUSION

The embedded devices are kept in the environment to monitor the required parameters and hence enabling self protection and

smart environment. To implement this it is needed to deploy the sensor devices in the environment for collecting the data and further analysis of the data. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The smart way to monitor environment and an efficient, low cost embedded system is presented with different models in this paper.

In the proposed architecture functions of different modules were discussed. The weather monitoring system using the Internet of Things (IoT) concept experimentally tests for monitoring two parameters. This system is aimed at making the farmers well aware as well as the agriculture well planned. Another aspect is also that the hazards faced by farmers due to improper planning are reduced leading to a fall in suicide rate of farmers.This data will be helpful for future analysis and it can be easily shared to other end users.

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