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Android Arduino Interface with Smart Farming System

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ABSTRACT

The purpose is used to plan and grow an agricultural system based on arduino method. The arduino chip was used in combination with sensors to measure ecological factors namely the temperature, humidity and soil moisture. The data's are sent to the farmer through message from the cloud based on necessities used by weed detection algorithm. This will be estimated to supportive for farmers in the order of the state.

KEYWORDS: Agriculture, Wireless sensor network, Arduino, Wi-Fi. Think Speak, IoT.

1. Introduction

Agriculture is the important construction of critical food crop. Agriculture is represent as manufacture, dispensation, encouragement and division rural products. Agriculture play a important role in the entire life of a given nation. Agriculture is the spine of financial system of a given country. In this wireless sensor networks, it is a self configuring network of small sensor nodes communicating among themselves using broadcasting signal, and deploy in capacity to logic, observe and realize the purpose world. WSN provides a bridge between the actual objective and essential humanity.

WSN allow the capability to view the earlier unobservable at the fine decision above huge spatiotemporal balance. It have a thick collection of possible application to manufacturing, knowledge, carrying, municipal roads and Security. The challenge of WSN are energy competence, understanding, stoutness, organized propose, isolation and protection. The sensor node is always called a mote, is a node in a sensor arrangement that is proficient of performing some dispensation, assembly sensory in order and communicate with other connecting nodes in the network fig 1: They are hardware procedure to determine the temperature, pressure, humidity and soil conditions.

2. Wireless Sensor Technology

The Internet of Things is a system of inter-related compute devices, mechanical and digital machines, matter, mammal or persons that are provided with only one of its kind identifiers and the capacity to transfer data over a network without requiring human to human or human to processor communication. Useful applications of IoT knowledge can be found in many industries today including accuracy cultivation, construction organization, healthcare, power and moving. Darken computing is a general term for the release of hosted forces over the internet. Cloud computing enables companies to devour a compute property, such a effective machine, storage or an application as a utility just like electricity rather than having to build and maintain computing transportation in house.

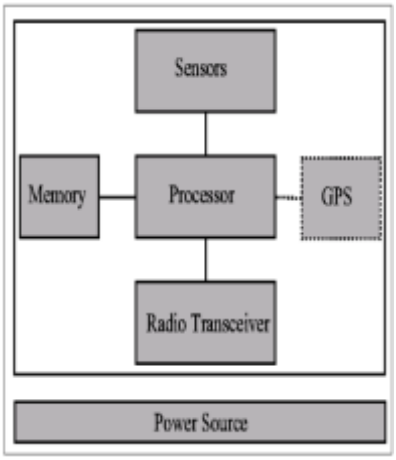

Figure 1: Essential mechanism of WSN node

3. Performance Characteristics of Existing Technology

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Zigbee is a wireless networking standard at remote control and sensor applications suitable operation in radio atmosphere and remote location fig 2. The zigbee knowledge carry three machine: zigbee director, zigbee router, and zigbee end device[1]. Each type defines various levels of functionality related with cost impacts. The application maintain cover (APS) provides a organize edge to communicate with the application maintaining up-to-date binding tables. Wireless sensor are spread independent sensors to monitor physical or environmental conditions such as temperature, sound, pressure etc.., and pass their data through network to main location. The most modern networks are bi-directional enabling control of sensor activity. The development of wireless sensor network was motivated by military applications such as battlefield surveillance such as industrial process monitoring and control machine, health monitoring and so on.

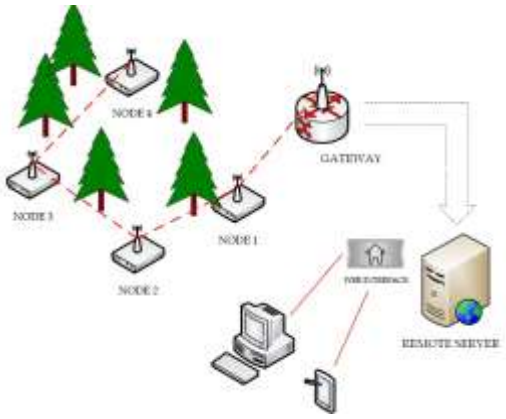

Figure 2: WSN Schema

In this paper, low cost soil moisture sensors, temperature and humidity sensors, Light dependent resistor and barometric pressure are used. They continuously monitor the field and send it to web server using NRF24L01 transmitter and receiver and Ethernet connection at receiver ends. The sensor data are stored in database. The web application is designed in such a way to analyse the data received and to check with threshold values of moisture, humidity and temperature. The decision making is done at server to automate irrigation [2]. If soil moisture is less than threshold value, the motor is switched ON and if soil moisture exceeds the threshold value the motor is switched OFF.

The WSN is built of nodes from a few to several hundreds or even thousands where each node is, connected to one sensors. Each sensor network node has several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with sensor and energy source. Size and cost results on sensor nodes corresponding on resources such as energy memory, computational speed and communication bandwidth fig 3. The topology of WSN can vary from a simple star network to an advanced multi- hop wireless mesh network. The propagation techniques between the hops of network can be routing or flooding.

3.1 Soil Moisture Sensor

This sensor is interfaced with microcontroller and programmed. Once it is programmed it is placed inside a box and kept in field fig 3.1. The soil moisture sensor has two probes which is inserted into the soil. The probes are used to pass current through the soil. The moisture soil has less resistance and hence passes more current through the

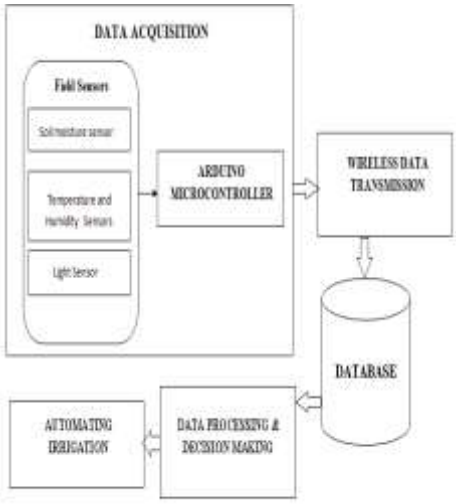

Figure 3: System Design

soil whereas the dry soil has high resistance and pass less current through the soil.

Figure 3.1. Soil Moisture Sensor

3.2 Temperature and Humidity Sensor

The total amount of water vapour in air is defined as a measure of humidity fig 3.2. Relative humidity is calculated because when there is a change in temperature, relative humidity also changed. The temperature and humidity changes occur before and after irrigation. the temperature and humidity sensor can also be used in green houses.

Figure 3.2. Temperature and Humidity Sensor

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3.3. Light Dependent Resistor

Light sensor is used to detect light intensity of environment. Light is major source for crops which is responsible for photosynthesis fig 3.3. Light dependent resistor is used in resistivity decreases with increases in high intensity and vice-versa. The voltage divider circuit is designed to measure resistance due to light intensity variations.The voltage level increases with increase in light intensity. The analog reading is taken from board. It is used in green house where artificial lighting is done using any of the incandescent lamps, fluorescent lamps instead of sunlight.

Figure 3.3. Light Dependent Resistor

3.4. Barometric Pressure

Barometric pressure is the total outside air pressure measured with reference to perfect vacuum fig 3.4. The pressure varies depending on geographical location, altitude and local weather conditions for weather reporting purposes of the barometric pressure is normally adjusted to sea level value so that all location can be compared with independent of altitude at each location. Pressure sensors which are calibrated and have output signal scaled to barometric pressure range 800 to 1200 mbar absolute for use in industrial and research applications.

Figure 3.4. Barometric Pressure

In this journal, understanding location manager in android and implementing on optimal image Geotagging application, the researchers designed a Geotagging application in android order to compare GPS data provided by camera which comes with GPS monitor and location manager service of android.

Location data can be received using three methods:

1.2.1 Satellite Positioning: location data are determined using satellites. GPS is the example of satellite positioning.

1.2.2 Cellular Positioning: location data are determined using cellular network. A cellular network consist of cells each carries the base station.

1.2.3 Wi-Fi Positioning: location data are determined using Wi-Fi access nodes. The mobile device is connected to location of device.

4 Related Work

4.1 Agriculture Field Monitoring

Instead of observing the productivity and quality of farming all the time, this paper proposes the design to monitor the same attributes using wireless sensor network. For the growth, quality and productivity of crops in agriculture temperature, humidity and carbon dioxide levels are the most important climatic parameters. Moreover, when a critical change in one of the measurements occurs, then the farmer will be acknowledged via SMS and e-mail by an agriculture expert [4].

4.2 Environment Monitoring System

There are various problems in the traditional agriculture like weak real-time data acquisition, limitations in monitoring area, excessive manpower etc., The system collects various climatic parameters like temperature, humidity etc. From greenhouse and from there it transmits the data to nearest server via GPRS. The system includes a web application which is using Google Maps to show the greenhouse status and provide regular voice and SMS alarm service. Since, it requires lots of power so it is powered by solar and storage batteries. This results that low power system has better scalability and can provide better service [5].

4.3 Development of Precision Agriculture System

In this scheme temperature and humidity sensors are deployed at suitable location to examine the yield. Sensing system uses response control device with manage component which wheel stream of water depending on temperature and moisture value. Control unit collects data from sensor analyze it and take feat [6].

4.4 Extending Automation to the Farm

Mechanization can be used to reduce quantity of physical effort and make cultivation accurate also leading to more farming growth number of operation of farm can be automatic like irrigation system, heat forced system for farm animals and farm creation [7].

4.5 Drip Irrigation System And Monitoring of Soil Wirelessly

In precedent various lifetime the farming technology has abrupt expansion. The consumption of suitable method for irrigation by leak is very capable and sensible. The advance review monitoring system and also propose an regular monitoring system model which is using Wireless Sensor Network (WSN) which is useful for the farmers to develop the growth of crops. In this method the test of soil for chemical constituent, salinity, manure & irrigate stuffing and all these information is collect wireless nodes and further processed for the development instream irrigation plan.

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5 Proposed Model Architecture

The proposed model consists of a Microcontroller (Arduino Mega 2560) as a main processing unit for the entire system and all the sensors and devices can be connected with the microcontroller. The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates into the cloud through Wi-Fi module connected to it. Here we are using Arduino mega 2560 because it is compatible with 3.3v ESP8266 Wi-Fi module and it also contain more than one on chip UART's so we can connect more number of Serial devices.

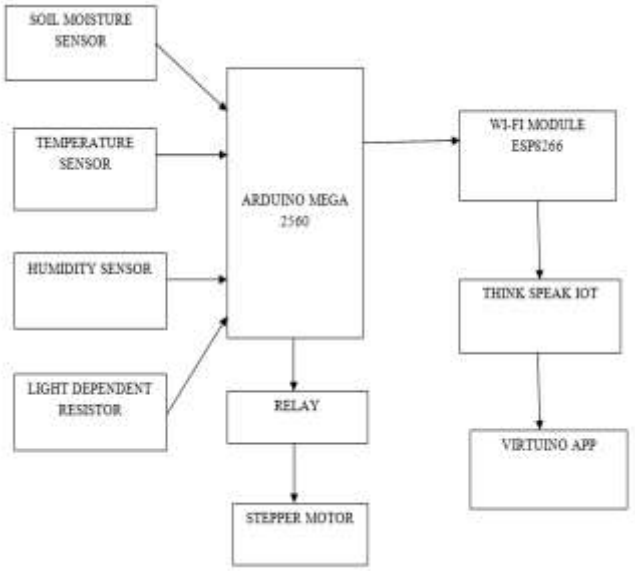

Figure 5. Block Diagram of Implementation Model

5.1 Thing Speak:

Thing Speak is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The Thing Speak IoT platform provides apps that let you analyze and visualize your data in MATLAB, and then act on the data. Sensor data can be sent to Thing Speak from Arduino, Raspberry Pi, Beagle Bone Black, and other hardware. Thing Speak has integrated support from the numerical computing software MATLAB from MathWorks Allowing Thing Speak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from MathWorks.

5.2 Relay:

A relay is an electrically operated switch. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relay control power circuits with no moving parts, instead using a semiconductor device to perform switching.

5.3 WI-FI Module:

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

5.4 Stepper Motor

Stepper motor is basically a brushless DC motor whose rotor rotates through a fixed angular step in response to input current pulse. That means, the full rotation of the rotor is divided into equal number of steps, and rotor rotates through one step for each current pulse. Stepper motors are becoming very popular due to the fact that they can be controlled directly by computers, microprocessors or microcontrollers. Stepper motors are used for precise positioning of an object or precise speed control without closed loop feedback.

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6. Computational Analysis of Sensor Parameter

Here we include some basic analytic methods to calculate the Sensors parameters, like Temperature, Humidity, Light intensity in the surrounding environment

TEMPERATURE AND HUMIDITY CALCULATION:

LM35 Temperature sensor gives output voltage 10 mv for 1°C.this sensor output is connected to any analog pin of Arduino Due. Due converts analog voltage into digital using on chip ADC.

ADC reading=analogRead(A1);

Voltage= ADC reading*5/(1023);

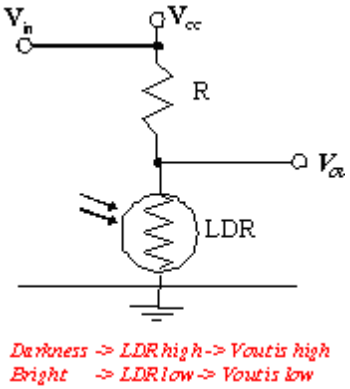
Temperature=Voltage*100;

The DHT22 sensor is easy to connect to the Arduino. Before we can use the DHT22 on the Arduino, we need to install the DHT22 library, which contains all of the functions we will need to get the humidity and temperature readings from the sensor.

Relative Humidity = (density of water vapor / density of water vapor at saturation) x 100%.

The Wi-Fi connection has to be established to transfer sensors data to end user and also send it to the cloud storage for future usage. An embedded system designed for environmental monitoring and its components are shown in figure 5.The embedded device is placed in particular area for testing purpose. The DHT22 sensor and LDR will record the Temperature, Humidity and Light intensity in that region, if the threshold limit is crossed the corresponding controlling action will be taken. All the sensor devices are connected to internet through Wi-Fi module.

LIGHT INTENSITY CALCULATION:



Output across LDR is given to any analog pin of Arduino Due. When light is falling on LDR its resistance decreases .then voltage across its decreases, ADC reading decreases. When no light is falling on LDR its resistance increases .then voltage across its increases, ADC reading also increases.

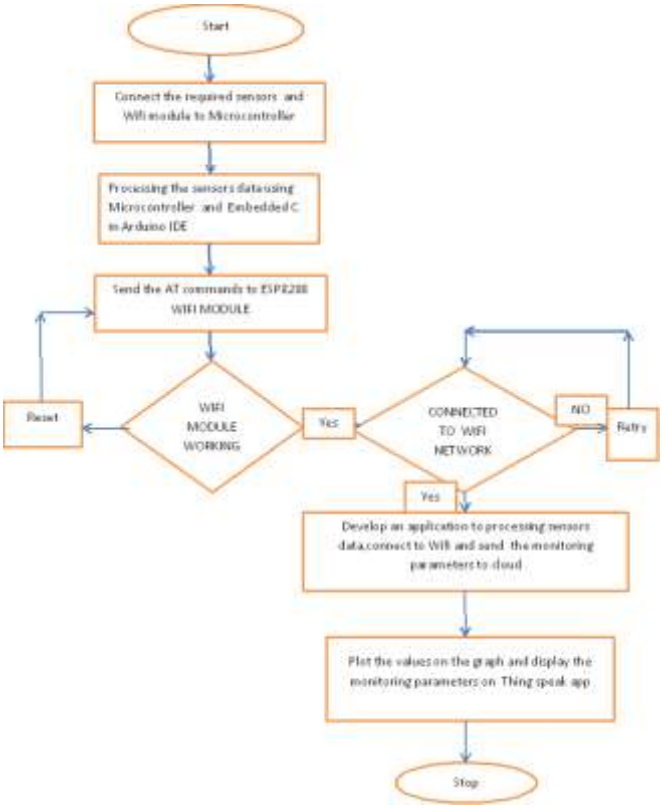
ADC reading=analogRead(A2);

Voltage= ADC reading*5/(1023);

ADC Reading = 400 to 650 when brightness.

ADC Reading =700 to 1023 when darkness.

FLOW CHART



7. Implementation

In this implementation model we used Arduino mega board, Sensors and ESP8266 Wi-Fi module as an embedded device for sensing and storing the data in to cloud. Arduino mega board consist of 12 analog input pins (A0-A11), 54digital output pins (D0-D53), inbuilt ADC. Wi-Fi module connects the embedded device to internet.

After successful completion of sensing, the data will be processed and stored in database for future reference. After completing the analysis on data the threshold values will be set for controlling purpose.

8. conclusion

By keeping the embedded devices in the environment for monitoring enables self protection to the environment. To implement this need to deploy the sensor devices in the

environment for collecting the data and analysis. 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.

The sensors to cloud system with Internet of Things (IoT) concept experimentally tested for monitoring four parameters. It also sent the sensor parameters to the cloud (Thing speak). This data will be helpful for future analysis and it can be easily shared to other end users.

9. Future Work

The WSN applications combine an stimulating new area of explore that will really develop value in farming manufacture, accuracy irrigation and will have impressive decline in cost needed. This paper provides lot of technique to develop the expansion of farming activities. Using the future style, finding the sensor topology of inferior implementation cost.

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