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Crop Monitoring Analysis and Controlling System

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Abstract: ***The world around us is getting automated with the advent of technology. As automated systems are energy efficient and minimize the need for tedious manual labor, they are favored over manual system. In India Agriculture being the primary economic sector than other countries, it is essential to automate it in order to increase efficiency. Lots of labors are required for typical farming in manual system but in Automation system the amount of manual labor can proficiently moderate, and make farming faster as well as easier .So it is leading to more agricultural growth. The purpose of our system is to design and develop an agricultural low cost remote monitoring and controlling system using Wireless Sensor Network .Use of cables for monitoring would make the desired system expensive as well as vulnerable. A sensor network is composed of tiny autonomous devices which are called as sensor nodes. Main objective is to monitoring and controlling of the environments as per the requirements of perticular crop. A WSN consists of Wireless sensor nodes which are in small size and more cost efficient. It observes and senses data periodically and sends it to the base station. System is based on Zigbee Wireless Communication which is low power device. The microcontroller is the HEART of System which controls all the sensors, activates it and runs them in synchronization.***

Keywords: Sensors, WSN, Zigbee , BeagleBone, Access point.

I. INTRODUCTION

Using machines, information technologies and control systems to optimizeproductivity and delivery of services is nothing but the automation. The Indian farms are slowly beginning to feel the inducement for the control, automation industry and instrumentation. Now day's Indian automation is advancing at a fast step, yet it is one area that can never be achieved and admired, it is something that needs constant identification and innovation of trends in technology, and the innovations that impel the implementation of automation in other countries. India, as one of the world's fastest growing economies based on agriculture, has not taken to technology at a rather quick pace.

A wireless sensor network consists of sensor nodes which are deployed densely and for various physical parameters to be measured or monitored. Each of these nodes gathers the data and route this information back to a coordinator. As the positions of individual nodes are not predetermined, then that network must possess self-organizing capabilities. Thus Cooperation among these nodes is the dominant feature of this type of networks, where groups of nodes cooperate to disseminate the information which is already gathered in their vicinity to the user. In Farm the controller node will be connected to internet by which it can dump all the readings into webserver periodically. Now, the farmer's android mobile application and web application will be connected to web-server, from where farmer can continuously monitor the levels of Temperature and humidity. Sensor nodes are extremely small in size and wireless so it's very easy to relocate any time.

II. EXISTING SYSTEM AND PROPOSED SYSTEM

Existing System:

The existing system consists of manual implementation of all the things that are necessary for this system. Suppose if a person wants to know about the agriculture land profile of a particular field, then he need to go to his land which is far away. So, it is proven to be a hectic task to do like that. This reveals, wireless sensor network applications are successful for agricultural environment. Conventional methods require much man power and forces men to monitor the environmental data transmitted by cable. Hence it is very difficult to obtain the real-time information on environmental monitoring, because of high investment of cost, laying lines hardly and man-made destruction and so on.

Proposed System:

The proposed system is to design and develop an agricultural monitoring, analysis and controlling system using wireless sensor network to improve the quality of farming and productivity without observing crop for all the time manually. Humidity, soil moisture and Temperature are the very crucial factors for the productivity, improvement, and quality of plants in agriculture. Using this system environmental parameters can be periodically measures inside the farm, thus the farmers or the agriculture experts can observe the environmental measurements from the remote location simultaneously. With the continuous monitoring of many parameters, the environmental conditions can analyze to improve crop productiveness, for superior productivity and to achieve remarkable energy savings.

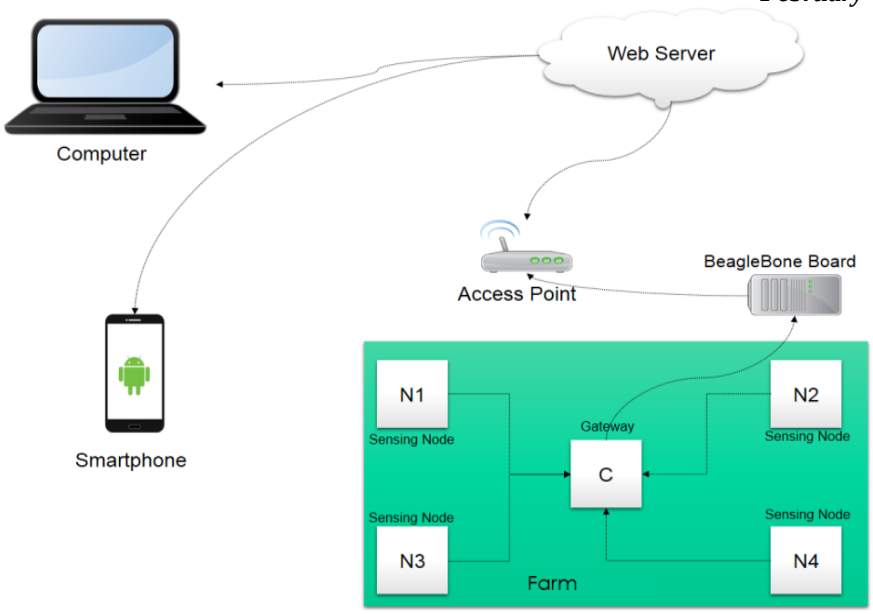

Fig1. System Architecture

As shown in Figure 1, Details about the Proposed System Architecture are various devices/blocks are present in architecture; following is the brief description of it:

1. Sensing Node:

Sensing node is the xbee (Zigbee) radio device on which various sensors are mounted. Sensing node is connected to controller/gateway. It will sense the various readings at specific interval and forward it to gateway. [5]

2. Gateway:

Gateway is an xbee (Zigbee) wireless device which will accept the values from various sensing nodes. Gateway is connected to Beagle Bone Board which is capable of processing of all the values. All the readings are forwarded to Beagle Bone for processing by gateway.

3. Beagle Bone Board:

Beagle Bone is processor embedded board which is capable of processing the input also to connect external networks. Beagle Bone is connected to Access Point for Internet connectivity. [5]

4. Access Point:

Access Point is the hotspot for the Internet connectivity for various devices. It will provide wireless internet connectivity to Beagle Bone.

5. Web-Server:

Web-Server is used to store the readings forwarded by Beagle Bone Board from farm. It is suited for observing the parameters and predicts the situation accordingly. If uncertain conditions occurs then it is skillful of generating alert's messages such as push notification for android mobile application and Sending SMS to farmer's mobile etc.

Also, the web application for real-time analysis, monitoring and controlling will be deployed on web-server. This application will be directly accessible from anywhere by using security credentials.

6. Computer/Desktop/Mobile:

This is the standard monitoring devices from where we can remotely monitor the farm. In future advancement we can connect display directly in the farm to get real time statistics.

III. HARDWARE USED

3.1 BeagleBoneBlack:

The most important part of the system is Wireless Sensor Network (WSN). For implementing the Wireless Sensor Network we require various devices and sensors. Below is the brief description of parts of WSN. [9] It is the open-source development board with RAM of 512 MB, the processor clock to 1 GHz, and it adds HDMI and 2 GB of eMMC ash memory. The Beagle Bone Black also ships with Linux kernel 3.8, upgraded from the original Beagle Bone's Linux kernel 3.2, allowing the Beagle Bone Black to take advantage of Direct Rendering Manager (DRM). It is a high-expansion, focused Beagle Board by using a low cost Sitara XAM3359AZCZ100 Cortex A8 ARM processor from Texas Instruments.

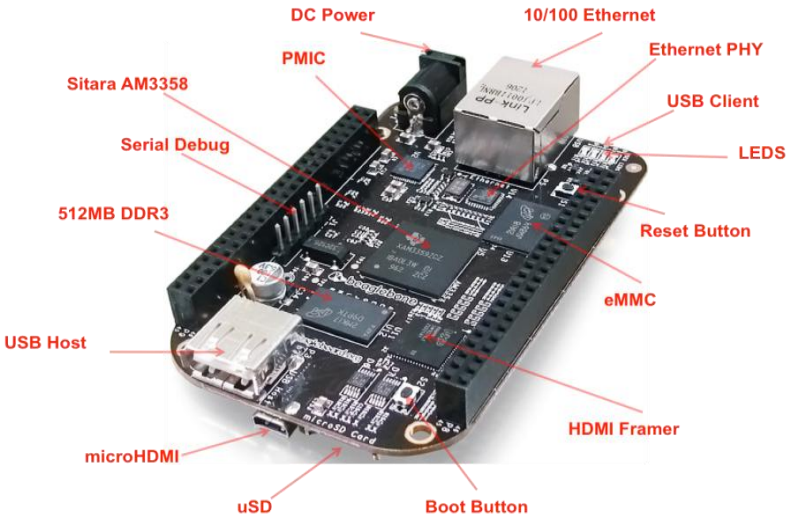

Fig2. BeagleBoneBlack

3.2 ZigBee:

To maintain wireless end-to-end connectivity to the devices Digi XBee modules are embedded solution. For fast point-to-multipoint or peer-to-peer networking these modules uses the IEEE 802.15.4 networking protocol. Basically XBee is Digi's own Zigbee based protocol which is designed for high-throughput applications requiring predictable communication timing and lowlatency. They are fairly easy to use in wireless modules. Using ZigBee we can design personal area networks which are built from low-power and small digital radios. It is typically used in long battery life and low data rate applications that require and secure networking. Defined rate of ZigBee is 250kbit/s and it is best suited for intermittent data transmissions from input devices or sensors. Applications are like traffic management systems, electrical meters, and other industrial equipment and consumer which require short-range low-rate wireless data transfer. ZigBee specification is intended to be cheaper and simple than other WPAN suchas Wi-Fi or Bluetooth.

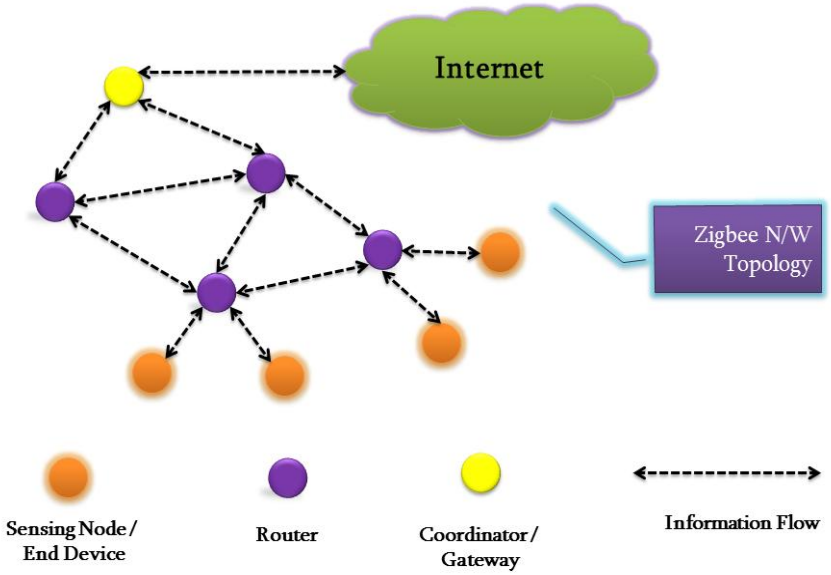

Fig3. Working of Zigbee Devices

IV. ADVANTAGES

- It is unnecessary to lay wire, the network is only deployed once, and the man-made impact on the control environment is small.
- The nodes are deployed very densely, so data acquisition has high accuracy.
- Sensors nodes with storage capacity, certain calculations are enabling collaboration among nodes is ideal for environment.
- It can accommodate new devices at any time.
- All Manual work gets automated so less man power is required.
- In real time sensing and communication can be done
- It can control an economical way of climate, for producing the best crop condition, decreasing cost and provide the real-time information while increase the production efficiency.

V. APPLICATIONS

- Low cost solution for implementation and affordable to farmers.
- Wireless communication technology so easy to use and move to any remote location.
- Automatic time provisioning alerts on instant climate parameter variations.
- Analysis of various environmental/climate parameters like CO2, temperature and humidity.
- Remote operations on Green House Devices

VI. CONCLUSION

In farming Temperature, Humidity and CO2 are the most essential parameters. The growth of crops is mainly depending on these three parameters. Currently farmers don't have any system which will show real time levels of these parameters. Even farmer don't know when humidity is increased or CO2 level increased in his farm, because of it crop cultivation gets affected. The proposed system is going to monitor these changes periodically and take an action automatically or pretend the required action to the farmer. System will have a provision to visualize the graphical representation of all the streaming data from the green house. Later on farmer can operate the devices from remote location by using its smart phone

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