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Implementation of Multi Zone Smart Gardening System

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Abstract: The main objective is to develop a wireless Gardening system using zigbee technology and Internet of Things (IOT) gateway. This wireless gardening system keeps track the moisture levels of the soil in the field. Depending on the reading the valves at particular places will be opened wherever moisture levels are less. The proposed system consists of two types of nodes, one is sensor node and the other is actuator node are placed in zone wise. The collected data is displayed on the webpage by using the IOT gateway. These collected data will be transfer in between the nodes and IOT gateway through the zigbee. In this system, zigbee can form the mesh network for transfer in between the nodes and IOT gateway. The system has ability to work remotely.

Keywords: Sensor node, Actuator node, Internet of Things (IoT) gateway, Zigbee.

I. INTRODUCTION

Now a day, water has become one of the most precious resources on the earth and one of the most important factors in agriculture is water availability. Water availability is also a critical variable for virtually every other economic activity, including industry, the energy sector, and public use. In recent years, water availability has become an issue. To schedule irrigation properly, a grower must know the environmental demand for surface water. Knowledge of exact amount of water required by different crop in a given set of climate logical condition of a region is great help in planning of irrigation scheme, irrigation scheduling, effective design and management of irrigation system. This is achieved by use of irrigation controllers.

Many types of gardening controllers have been developed for automatically controlling application of water to landscapes. Known irrigation controllers range from simple programmers is based upon fixed schedules. With respect to the simpler types of irrigation controllers, farmers, Municipalities and commercial owners of green areas typically set a watering schedule that involves specific run-times and days, and the controller executes the same schedule regardless of the season or weather conditions. From time to time a technician may manually adjust the watering schedule, but such adjustments are usually only made a few times during the year rather than actual watering needs. One change is often made in the late spring when a portion of the plants become brown due to a lack of water. Another change is often made in the late fall when the home owner assumes that the vegetation does not require as much watering. These changes to the watering schedule are typically insufficient to achieve efficient watering.

The purpose of this work is to develop autonomous gardening systems that use every moisture levels daily gardening depths to plant needs. Criteria for this, track the moisture levels from land. As per moisture levels watering will be done automatically. Thus, this work intends to develop a cost-effective gardening controller that is adaptive to moisture conditions. It must also be reliable and easily deployable in order to work under harsh outdoor conditions without the need for supervision or regular monitoring.

II. EXISTING MODEL

In today's world many water monitoring systems are designed by considering different soil parameters and different technologies. Existing system model [1] is presented evaluate the performance of the traditional irrigation scheme, using a common irrigation programmer, and the smart irrigation scheme, using a distributed wireless sensor network [2]. It can say that the smart home-irrigation system manages to maintain soil humidity at the same level. It dissipates less water and it provides an irrigation scheme that is adaptable to the watering needs of each plant. The most important feature is the fact that by constantly monitoring the humidity levels, it basically adapts to current environmental conditions. Whether there are high temperature or sunlight variations or not, the system will adjust the irrigation process so as to maintain the same level of soil humidity.

The existing system includes sensor motes, soil humidity sensors, mote driven electro valves that control the water flow towards the plants and a java application running on a PC that collects data from the sensor network and stores them in a MySQL database. The data can be transfer in between the devices through wireless sensor network [3] and soil humidity of each pots monitored by a mote equipped with soil humidity sensor. The watering of each

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pot is controlled by a corresponding mote driven electro valve independently.
Throughout the operation of the system, the levels of the soil humidity each pot are forwarded to the sink by the corresponding motes. When it receives a soil humidity measurement, it forwards it to the PC where a java application receives data and stores in MySQL database.

III.PROPOSED MODEL

In the proposed model, system can be operated by considering the moisture levels of the soil and using the zigbee technology [4]. The proposed model consists of the sensor node, actuator node and Internet of Things (IOT) [5] Gateway. This system can be implemented in the zonal wise in an area. The sensor node consists of the soil moisture sensor [6], Atmega328 microcontroller and zigbee [7] module. The soil moisture sensor can be deployed in the soil at the plant root zone. It can sense the moisture readings of the soil and readings can be transferred to the actuator node and IOT Gateway through zigbee meshed network.

The actuator node consists of the zigbee, Atmega328 microcontroller and solenoidal valve [8]. The solenoidal valve can be placed in the zonal wise. The solenoidal valve will be opened if the moisture levels are below the level. When the soil moisture readings are return to the normal values the solenoidal valve will be closed.
The Internet of Things (IOT) Gateway consists of the Zigbee module and Spark core. In this zigbee can be act as router and it can collect the data from the sensor and actuator nodes. The sensor readings can be displayed on the webpage through the spark core. This spark core [9] is a tiny wifi development board consists of wifi module and Arm processor.

A. System Architecture:
The implemented system consists of a sensor node, actuator node and IOT gateway. The sensor at the sensor node can be operated by the microcontroller and sense the reading from soil and it transfer to the actuator node through zigbee. These readings can be processed by the micro controller and solenoidal valve at the actuator node can be operated as per the sensor readings. The sensor readings can be updated on the webpage by using the spark core at the IOT gateway board. These data can be transferred in between the nodes and IOT gateway through zigbee. In this system zigbee can form the meshed network in between the nodes and IOT gateway.

Based on the framework shown in figure 1, system identified a suitable implementation model that consists of custom build boards of sensor node, actuator node and IOT gateway and other devices and modules. These all are connected through the zigbee. In this zigbee establish a mesh network in between the nodes and gateway for transferring the data. The data can be transfer in mesh network is bidirectional.

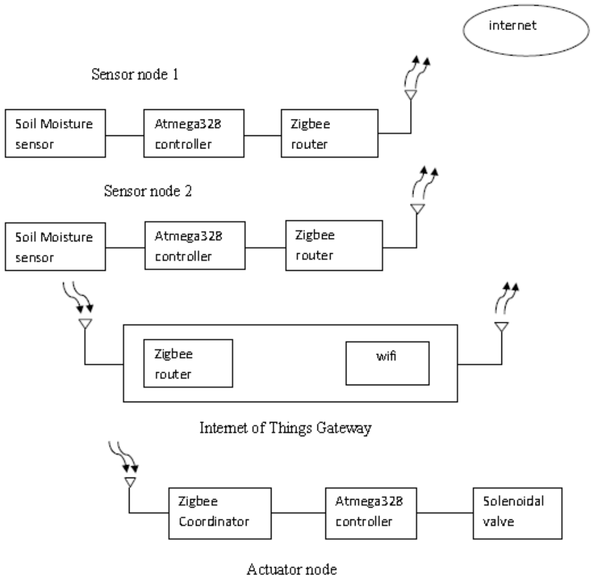

Fig. 1. Block diagram of the proposed system.

In this system multiple sensors are deployed in an area. These sensor readings are processed through the micro controller of the respective sensor node. The actuator node of the system is getting the reading from the sensor node through the zigbee. In this system only one actuator node is using in a field. So if sensors reading are less than the level at half of the sensors the solenoidal valve will be opened automatically. If they can reach the normal moisture readings the valve will be closed automatically.
These sensor readings will be displayed on the webpage through IOT gateway. In this board, Zigbee can receive the data from the actuator node and displayed on the web page through spark core. This spark core contains the inbuilt wifi module. Serial communication can be established in between the spark core and zigbee in IOT gateway board.

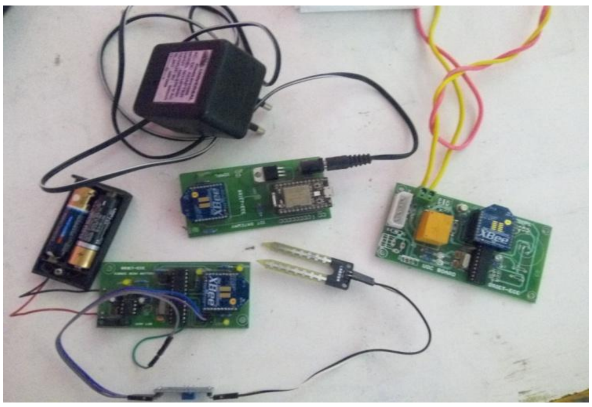

Fig. 2. Hardware implementation of the proposed system

Figure 2 shows the hardware implementation of the whole system, which include the sensor node, actuator node and IOT gateway. Sensor readings are gathering and valve can be operated as per the readings automatically and the sensor readings will be display on the webpage processing through IOT gateway.

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IV. RESULTS

In this system, multiple sensors are deployed into the soil in the field. For these sensors gave a numbering in an order. Each sensor node sent a moisture reading to actuator node along with the respective sensor number. These readings can be observed in the serial monitor like as shown in figure 3. Actuator node sends sensor number to the sensor node for moisture reading of soil. At that time respective sensor node can respond and it can send sensor reading along with the respective sensor number.

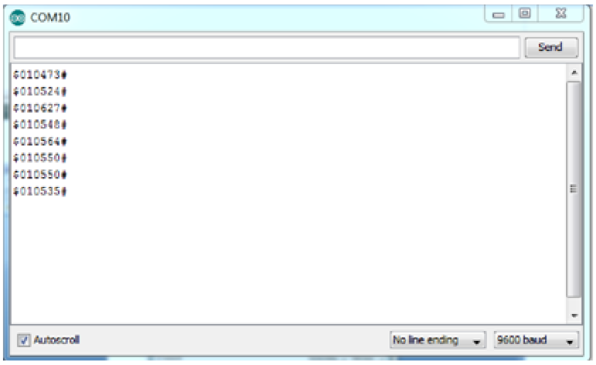

Fig. 3. Sensor node response on the serial monitor

On other end, actuator node can get the all the sensor readings with respective sensor numbers. With these entire readings actuator node can establish an order to display the data on to webpage. That format as like starting with number of sensors in a field and condition of the soil at each sensor node and status of the solenoidal valve can be sent to the IOT gateway.

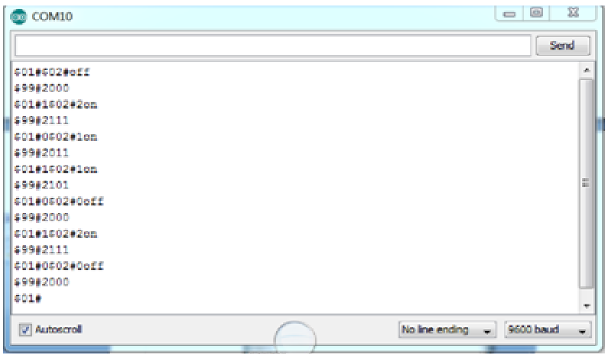

Fig. 4. Actuator node response on the serial monitor

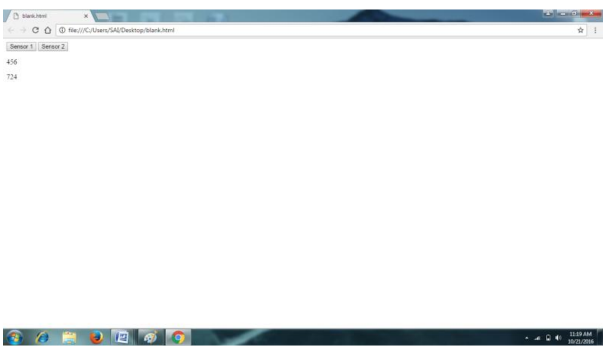

Fig. 5. Soil moisture sensor readings on webpage

The actuator node data will be observed on the serial monitor like as shown in figure 4.

By using the spark core displaying the soil moisture sensor readings on webpage. The spark core is a tiny wifi development kit and it can have wifi. As per the programming the spark core the readings of the soil moisture sensor can be displayed on the webpage like as shown in figure 5.

V. CONCLUSION

The proposed system implemented is feasible and cost effective for the optimization of water resources in agriculture. This system allows cultivation in places with water scarcity thereby improving sustainability. This system developed proves that the usage of water can be diminished till good amount of fresh biomass production and adjustable to a variety of specific crop needs and it requires minimum maintenance. The hardware of the system allows it to use it large scale for greenhouses or open fields. This can be adapted to different cultivation situations like changing environmental seasons, different moisture levels of soils etc.

Furthermore, the Internet link also provides supervision through mobile telecommunication devices, such as a smart phone. Besides the monetary savings in water usage, the importance of preserving this natural resource justifies the implementation of this system. In future work plan to use solar panels along with rechargeable batteries in order to make this system self sustainable in terms of energy consumption and develop an application for monitoring the field and getting the information in an mobile app.

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