# A Real Time Automation of Green House Farming with Wireless Sensor Network Using Beagle board And Arduino

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***Abstract***
*Traditional agricultural practices increase the production cost and the uncontrolled environmental conditions in farm field results production in low quality and quantity. In most cases we are not able to utilize the available resources maximum. This results in the wastage of resources. The resources include water, light, fertilizers, human resources etc. The artificial methods to increase the production like increased usage of chemical fertilizers increase health problems. The proposed work increases the agricultural production with low production cost and maximum utilization of the resources. The user friendly system helps the farmer to monitor and control the field with less effort. The controlled agricultural environment decreases the use of chemical fertilizers and herbicides; thereby it will provide healthy products. The farmer is able to cultivate the crops throughout the year without considering the climate thereby it increases the production.*

**Keywords—** *Beagle board Xm; Wireless Sensor Network (WSN) Communication;Data Acquisition; Image processing; Graphical User Interface (GUI).*

## I. INTRODUCTION

Programmers Agriculture has played a key role in the development of human civilization. Due to the increased demand of food, people are trying to put extra efforts and special techniques to multiply the food production. Use of different technologies towards agriculture is one of such efforts. Apart from use of scientific technologies in agriculture, information technology is now being heavily exercised in this area. Technologies like satellite navigation, sensor network, grid computing, ubiquitous computing and the context-aware computing are supporting the said domain for improved monitoring and decision making capabilities. Use of sensors and their networks is supporting agriculture practices in a very positive direction.

For sensor based agriculture, varieties of terminologies are now in use like Precision Agriculture (PA), Smart Agriculture, Variable Rate Technology (VRT), Precision Farming, Global Positioning System (GPS) Agriculture, Farming by Inch, Information-Intensive Agriculture, Site Specific Crop Management etc. but the underlying concept in all of them is same. Advancements of technologies reduced the size of sensors to such extent that enabled them to be utilized in variety of the domains of human life. Due to the significance of sensor technology, several issues related to sensors and their networks are in research. Energy constraint, limited computing power, small memory and data security are some of the substantial issues of sensor networks for which researchers proposed several solutions

Monitoring different parameters of interest in a crop has been proven as a useful tool to improve agricultural production. Crop monitoring in precision agriculture may be achieved by a multiplicity of technologies; however the use of Wireless Sensor Networks (WSNs) results in low-cost and low-power consumption deployments, therefore becoming a dominant option. It is also well-known that crops are also negatively affected by intruders (human or animals) and by insufficient control of the production process. Video-surveillance is a solution to detect and identify intruders as well as to better take care of the production process

Security in crops is an important issue as an additional means to further reduce the potential product losses in the current agriculture. In particular, in precision agriculture, security is becoming more relevant as revealed by the increasing costs of the equipment and sensors that are being installed. Video-surveillance in agricultural plots helps the farmers to protect their crops and farm equipment from intruders Security tasks include intrusion detection and identification. In addition, video surveillance systems may also be used for other functionalities than protection, developing other applications, such as the monitoring of the agricultural process, verification of personnel access or best practices control, and employees' safety at work. In precision agriculture, Wireless Sensor Networks (WSNs) have been deployed as a cost-effective communications technology that allows the acquisition and transmission of different data from the crop to final users, in locations without a previous telecommunication infrastructure or implementing a costly one (e.g. wired communications). A WSN consists of non-intrusive communication devices of small size, to which one or more precision sensors for data collection are adapted. Sensors usually measure parameters such as soil-moisture, salinity or pH, among others. Once the information arrives at their operators, it is further processed and studied in order to make an appropriate decision (e.g. extra watering if the soil conditions indicate so). Various studies dealing with this research topic can be found in the specialized literature

In recent years, the IEEE 802.15.4 standard (IEEE 802.15.4 Standard, 2006), whose services form the so called ZigBee system, has been accepted as the standard for the commercial wireless sensor networks technology. In many occasions, this standard is also denoted as Low-Rate Wireless Personal Area Networks (LR-WPAN). In the agriculture context, wireless technologies such as Wi-Fi and Bluetooth penalize energy consumption, becoming a major drawback when transmitting images or video sequences, as required by an identification system However, the low-cost, low-power consumption and similar communication range distances offered by IEEE 802.15.4 technology in comparison to those aforementioned, makes it a suitable candidate to be applied to precision agriculture. In the system proposed, crops are separated long distances from each other and from the final master control emplacement.

Video-surveillance of these scattered crop areas may imply high energy consumption and delays due to the tasks of capturing, processing and sending pictures. In addition, the low bitrate (250 kbps) allowed and the small size of the IEEE 802.15.4 messages generates a large amount of data frames to transmit an image. In these circumstances, video messages, along with the monitoring data transmission coming from many sensors placed in separated crops is a challenge that may provoke frame collisions and, consequently, losses. In the case of video traffic, these collisions are translated into the degradation or loss of images, becoming a more critical issue when several cameras are considered. Besides that, the retransmission of monitoring messages may also cause higher delays and more energy consumption.

## II. PROPOSED METHODOLOGY

The system consists of different modules and they are integrated to form the complete system. The modules include the power supply unit with the solar panel, master controlling unit, sensor slave unit , the graphical user interface Unit and the internet interfacing and accessing unit. The sensor nodes are distributed in the farm fields and the distribution is based on the resolution of the sensor nodes. The sensor slave nodes acquire the data with the help of sensors attached to it and sent the data to the master control. The master controlling unit always monitors and analysis the data sent by the slave nodes. When the parameter values exceed the threshold value, the control unit takes the necessary steps to make the parameter in control. The master node upload the data acquired by the slave nodes to the internet, thereby the user can access the data from anywhere with the help of the internet. The user is also able to control the system with the help of the internet.

The graphical user interface provided in the internet make it easy to access by the user and it provides a user friendly atmosphere

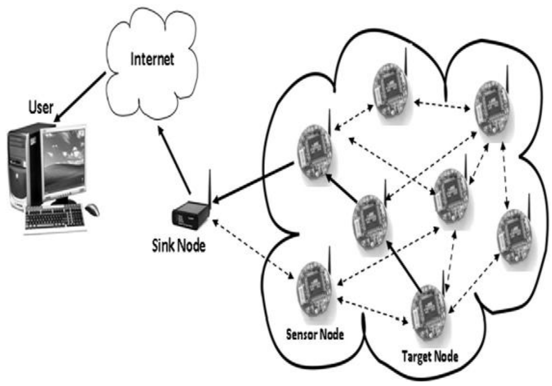


**Fig 1. Typical distribution of the systems**

The figure 3 shows the flow chart of the proposed system. Arduino will act as the slave node and it is attached with the sensors like temperature sensor, humidity sensor, light sensor and the PIR sensor .Slave node collects the data from the sensors and sent that to the master node The beagle board acts as the Master node and the master node analysis the data sent by the slave nodes.

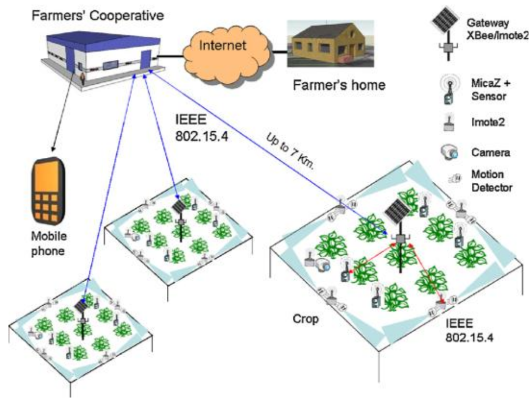


**Fig 2. System implementation in farm field**

When the parameter values exceed the threshold value, the control unit takes the necessary steps to make the parameter in control. The master node upload the data acquired by the slave nodes to the internet, thereby the user can access the data from anywhere with the help of the internet. The user is also able to control the system with the help of the internet. The slave node communicates with the master node through the wireless medium. ZigBee and the RF communication protocols are used for the wireless communication. It provides low cost wireless communication. Thereby the total cost of the system gets reduced considerably.

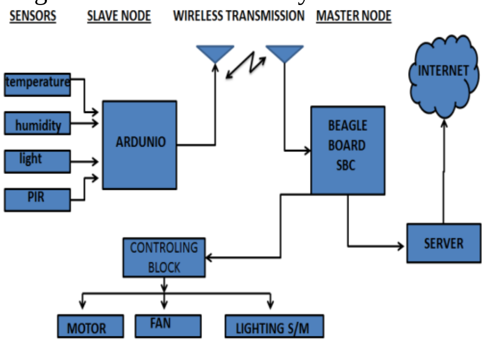


**Fig 3. System Architecture**

## III. HARDWARE IMPLEMENTATION

The system hardware includes several controlling and data acquisition units. Each of these units is controlled by the master node. The master node is capable of acquiring the data from the slave nodes and respond correspondingly with the data acquired.

### *A. Solar Panel Power Supply Unit*

The solar panel power supply unit provides the necessary power supply needed for the slave nodes. As the slave nodes are placed in different regions of the farm fields, it is difficult to provide the power supply through wires and the use of the solar panel reduces the electricity cost and it will provide uninterrupted power supply. As the solar panel is supplied with the light sensors, the panel can be rotated to the direction of maximum light intensity therefore the total efficiency of the solar panel increases

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### *B. Wireless Sensor Slave Node*

The proposed work is based on the concept of "control from seed to fruit". Only the healthy seeds are allowed to grow. For the system each and every plant is important. The system ensures the availability of resources in the right amount to each and every plant. The system consist of number of wireless sensor nodes (slave node) controlled by the master control node. Wireless sensor nodes monitors the parameters like temperature, humidity, soil water content, light availability etc. and inform the master node The master node analysis the received data from the slave nodes and take the necessary steps to control the system parameters with in the limit. Each slave node is attached to a solar panel and it provides the necessary power needed for the working of the slave node and thereby it is suitable for any farmland. This solar power can also be utilized for other power demands in the farmland. Each slave node consists of temperature sensor, light sensor, humidity sensor, water level sensor, PIR sensor, fire sensor etc. Theses sensors are attached to the system based on the priority scheduling algorithms. And system is able to sense the priority of the sensors,

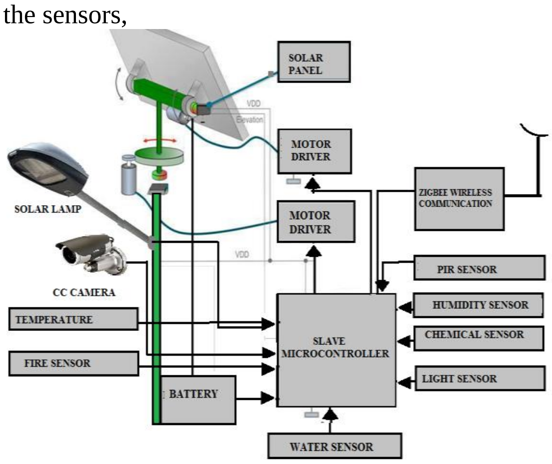


**Fig 4. Solar panel arrangement with the slave node control**

for example if there is a trespasser in the farmland detected by PIR sensor then the system give most priority to the surveillance camera provided for the security purposes and emergency alerting system.

The system consists of intelligent lighting system for plant growth, which ensures availability of sufficient light to each plant. It avoids the clustering of plants. The camera provided for surveillance is also utilized for detecting the herbs, deceased plants, and for detecting the fruits and flowers in the field using the image processing technologies.

### *C. Beagle Board Master Node*

The master node collects the data from the slave nodes and analysis it and take the necessary steps to make the parameters with in the control. Here Beagle board Xm acts as the master node. The master node upload the data to the internet and the graphic user interface provide in the internet help the farmer to monitor his farm land and can control the system.

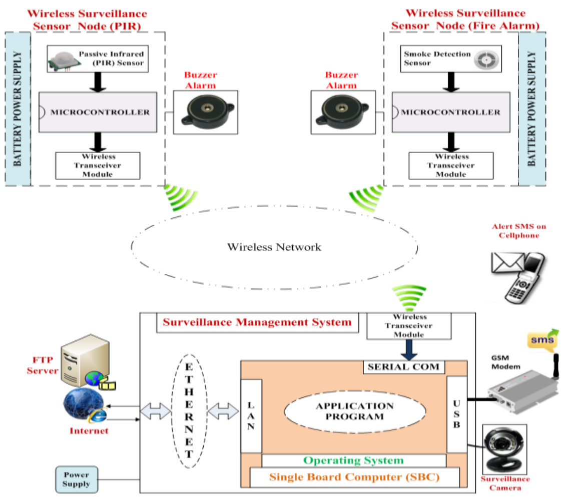


**Fig 5. Single master-multi slave node arrangement**

## IV. CONCLUSION

In this project, we have described a prototype that able to provide real time monitoring and controlling of the greenhouse farming. The system is based on the concept of "control from seed to fruit ".Only the healthy seeds are allowed to grow. For the system each and every plant is important. The system ensures the availability of resources in the right amount to each and every plant. The system increases the agricultural production with low production cost and maximum utilization of the resources. The user friendly system helps the farmer to monitor and control the field with less effort. The controlled agricultural environment decreases the use of chemical fertilizers and herbicides; thereby it will provide healthy products. The farmer is able to cultivate the crops throughout the year without considering the climate thereby it increases the production My future work will implement the use of image processing in the surveillance. The image processing tools can be utilized to identify the defected parts in the crops and thereby it helps to identify the healthy plants from the group. Using the advanced algorithms in image processing the security of the system can be improved by recreating the original image from the blurred image of the camera in real time.

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