AGRICULTURAL PRODUCTION STASIS AND FARMING ASSISTANCE SYSTEM

Ramesh Kumar S, Pradeepha D, Mythili L, Navaz Khan N, Dr.Vasanthi S
Department of Electronics and Communication Engineering
K.S.Rangasamy College of Technology Tiruchengode, Namakkal- 637 215

***Abstract* - Developing codes of good farming practice, diversifying markets and agricultural production systems require implementation of more elaborate management strategies, in the field of agriculture. Beyond that, the demand for information about the production processes is growing. An important prerequisite for farmers to comply with all these different demands is to easily have sufficient and timely information available for decision making. The rapid development of technologies for information and communication, new sensors as well as the vast potentials for providing geo- referenced data (remote-sensing, on-line sensors, public databases etc.) also allows farmers to access new and high quality data and use them as specific information in decision making. With automated data acquisition and handling in an on-farm management information system the farmers can be seen to comply with a rapidly growing demand of standards in the management of the production processes. The proposed system aims in building a bridge between farmers and regional corporates through an online application, in which both can interact and meet their demands. It also provides a hardware module, which is particularly developed for the benefit of farmers. By using this, farmers can adopt better farming methods in accordance with the weather conditions and topography and improve their production.**

Keywords — Remote-sensing, on-line sensors, Public databases, Online Access portal, Farmer-Corporate Bridge.

I. INTRODUCTION

The Internet of Things (IoT) is an emerging topic of technical, social, and economic significance. At the same time, however, Technical challenges remain and new policy, legal and development challenges are emerging. The term Internet of Things generally refers to network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. Internet of Things which develop the agricultural facilities by producing the impact of human consumption and the farmland environment. Extensive use of automation, intelligent remote-controlled production equipment can obtain accurate crop and crop information. Through these, people who stay at home can monitor a variety of field information.

The IoT technology is divided into three levels: the perception layer, transport layer and application layer. Perception layer is mainly responsible for data-aware acquisition; the transport layer is mainly responsible for the perception of data transmission; application layer is mainly responsible for sensing data analysis, statistics, and early warning, automatic control and scientific decision-making.

Farmers can use their smart phones for running statistical predictions of their crops and livestock as well as obtain stasis on their feeding. The goal of improving production output while minimizing cost and preserving resources. The farmers means empowerment through control over their resources and decision-making processes. It is noted that being an effective and efficient delivery system of essential information and technology services facilitates the clients' critical role in decision-making towards improved agricultural production, processing, trading, and marketing. Food and Agriculture Organization points out, information is very important for rural development because improving the income of farming community will depend crucially upon raising agricultural productivity. Achieving sustainable agricultural development is less based on material inputs (e.g., seeds and fertilizer) than on the people involved in their use. For achieving this there is a need to focus on human resources for increased knowledge and information sharing about agricultural production, as well as on appropriate communication methodologies, channels and tools. Farming assistance systems that would provide necessary information to farmers, to cultivate healthy crops.

II. LITERATURE REVIEW

Chunmeng Wang et al. [1] proposed IoT based agricultural convergence technology to create a high value such as improvement of production efficiency, quality increase of agricultural products in the whole process of agricultural production. The core and foundation of the Internet of things is the Internet, but the client not only confined to the personal computer, but also extends to any items which need real-time management. For the people cannot make scientific management in the agricultural production process currently, consumers find it difficult to express their views on agricultural production and farmers own lack of ways to improve the agricultural planting level and so on.

A design scheme of agricultural information service platform based on Internet of things that provides a scheme which offers services to farmers from the planting management subsystem, agricultural planting technology subsystem and query feedback subsystem, is ultimately necessary. Agricultural information service platform is put forward to realize the agricultural production, transportation and after sale service for intelligent control and information processing.

B.Schaffer et al. [2] designed a system with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page. The automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.

Vishnu Vardhan et al. [3] proposed the wireless sensor network carved path in many applications where there are many manual methods to cultivate a healthy crop. But it requires a lot of manpower involved which is a burden now days. In order to make it smart, simple and give correct input to the crop, here we are designing a wireless sensor network for smart agriculture. This design helps to give real input according to the environment. This design uses arduino as the core component. Here we are designing a sensor network; each node has a group of sensors connected to the arduino and Zigbee (Xbee). The values which are measured by the sensors are transmitted to a centralized device which is Zigbee (Co-coordinator). After the values received by the Zigbee, according to those values precise decision will be taken by the experts.

Raheela Shahzadi et al. [4] proposed a system that enhances the productivity and reduce losses by using the state of the art technology and equipment. As most of the farmers are unaware of the technology and latest practices, many expert systems have been developed in the world to facilitate the farmers. However, these expert systems rely on the stored knowledge base. The system proposes an expert system based on the Internet of Things (IoT) that will use the input data collected in real time. It helps in taking proactive and preventive actions to minimize the losses due to diseases and insects/pests.

Sanjukumar et al. [5] designed a project which aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly it includes smart irrigation with smart control and intelligent decision making based on accurate real time field data. Smart warehouse management which includes temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and raspberry pi.

Meonghun Lee et al. [6] designed the IoT-based monitoring system to analyze crop environment, and the method to improve the efficiency of decision making by analyzing harvest statistics. Therefore, this paper developed the decision support system to forecast agricultural production using IoT sensors. This system was also a unified system that supports the processes sowing seeds through selling agricultural products to consumers.

The IoT-based agricultural production system through correlation analysis between the crop statistical information and agricultural environment information has enhanced the ability of farmers, researchers, and government officials to analyze current conditions and predict future harvest. Additionally, agricultural products quality can be improved because farmers observe whole cycle from seeding to selling using this IoT-based decision support system.

Chetan Dwarkani M et al. [7] proposed the technological advancements in the arena of agriculture will ascertain to increase the competence of certain farming activities. Therefore, a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology is proposed. The proposed system focuses on the measurement of physical parameters such as soil moisture content, nutrient content, and pH of the soil that plays a vital role in farming activities. Based on the essential physical and chemical parameters of the soil measured, the required quantity of green manure, compost, and water is splashed on the crops using a smart irrigator, which is mounted on a movable overhead crane system.

The main idea of the system is to automate the activities of farming by using the principles of mechanics, communication, and electronics. The proposed system uses two modules, namely a smart farm sensing system and movable smart Irrigator that on mechanical bridge slider arrangement.

S. R. Nandurkar et al. [8] proposed a new method of decreasing water tables, drying up of rivers and tanks, unpredictable environment present an urgent need of proper utilization of water. We have the technology to bridge the gap between water usage and water wastage. Technology used in some developed countries is too expensive and complicated for a common farmer to understand. Our project is to give cheap, reliable, cost efficient and easy to use technology which would help in conservation of resources such as water and also in automatizing farms. We proposed use of temperature and moisture sensor at suitable locations for monitoring of crops.

The sensing system is based on a feedback control mechanism with a centralized control unit which regulates the flow of water on to the field in the real time based on the instantaneous temperature and moisture values. The sensor data would be collected in a central processing unit which would take further action. Thus by providing right amount of water we would increase the efficiency of the farm. The farmer can also look at the sensory data and decide course of action himself.

Rajalakshmi.P et al. [9] designed a system to monitor crop-field using sensors such as soil moisture, temperature, humidity, light sensor and automate the irrigation system. Smart Agriculture helps to reduce wastage, effective usage of fertilizer and thereby increase the crop yield. The data from sensors are sent to web server database using wireless transmission. In server database the data are encoded in JSON format. The irrigation is automated if the moisture and temperature of the field falls below the brink. In greenhouses light intensity control can also be automated in addition to irrigation. The notifications are sent to farmers' mobile periodically. The farmers' can able to monitor the field conditions from anywhere. This system will be more useful in areas where water is in scarce. This system is 92% more efficient than the conventional approach.

Prachi Patil et al. [10] proposed a system where soil moisture sensor at each place has to be monitored. Once the moisture reaches a particular level, the system takes appropriate steps to regulate or even stop the water flow. It also monitors the water in the water source so that if the water level be-comes very low, it switches off the motor to prevent damage to the motor due to dry run. The system also consists of a GSM modem through which the farmer can easily be notified about the critical conditions occurring during irrigation process. This system will be useful for monitoring the soil moisture condition of the farm as well as controlling the soil moisture by monitoring the level of water in the water source and accordingly switching the motor ON/OFF for irrigation purposes.

All the systems proposed have some practical limitations. The agricultural information service platforms those are designed so far, would not provide necessary information that a farmer needs to know to reach the market for his/her crops. This is because, in all these systems, there are no direct interactions between the farmers and the traders. The proposed system would create a platform for farmers and traders and allow them to take valid decisions regarding their trade. And thereby, the proposed system would stabilize the demand and supply chain in the agricultural markets.

III. HARDWARE MODULE

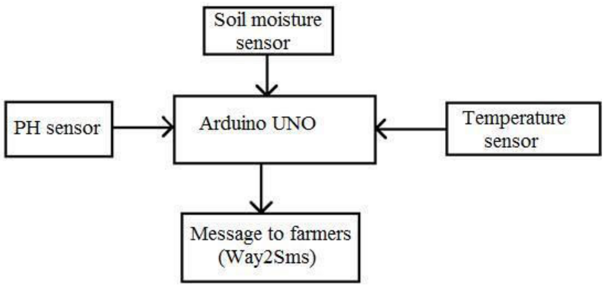

Figure 1 Hardware Module for Assisting the Farmers

Hardware Description

In the hardware module, Arduino Uno is used as a System on Chip (SoC) and it receives the information from temperature sensor, PH sensor and moisture sensor. The moisture sensor measures the moisture level of the agricultural field. If the moisture level goes below a certain threshold, then the reading of the temperature sensor is taken into consideration. If the weather is found suitable to irrigate, then the farmer is instructed to irrigate immediately. Otherwise, the farmer is instructed to irrigate whenever the weather is found suitable. The PH sensor continuously monitors the PH level of the soil, and if in case the PH exceeds or goes below a certain limit, the farmer is instructed to provide manure to the soil. All these instructions are sent as messages to farmers through way2sms. This module could be fixed in the agricultural fields of farmers and could help them in improving their production.

Microcontroller – Arduino UNO

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 analogy inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. The AVR is a modified Harvard architecture. It is 8-bit RISC single chip microcontroller. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time. The AVR is a modified Harvard architecture machine where program and data are stored in separate physical memory systems that appear in different address spaces, but having the ability to read data items from program memory using special instructions. It has 1kB EEPROM, 2kBSRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz

IV. SOFTWARE MODULE

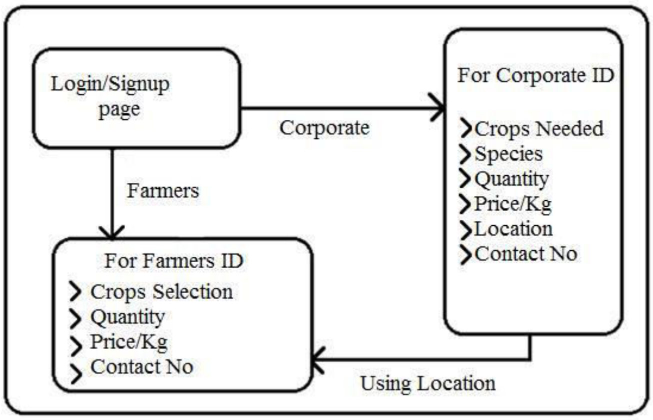

Figure 2 Flow Diagram of android application

Software Description

The software module is an android app that bridges the gap between farmers and merchants and help them in taking better decisions as well as in fulfilling their needs. There are two separate logins. One for the regional merchants and the other for the farmers. The merchants could provide their demands of amount & variety crops that they are in need of. While the farmers could get to know the market demands and grow crops accordingly to meet the market needs. All the transactions regarding the trade could be done in the application. By using such an application, both the farmers and merchants could be benefitted.

Once signed up, a regional merchant could login in the app and could be able to provide details such as the crop needed, its quantity, its variety and its estimated costs. And once a farmer signs up and logs in, based on his/her location, the demand of different types of crops nearby would be made visible. And the farmer could plant crops accordingly and sell it to regional merchants. In addition, the farmers could also post their crop production details in the app. This will be displayed to the merchants and they could buy the crop from the farmer if interested.

Therefore, the android application acts as an integrated platform to perform trading of crops.

V. PROPOSED SYSTEM

A.MOISTURE SENSOR

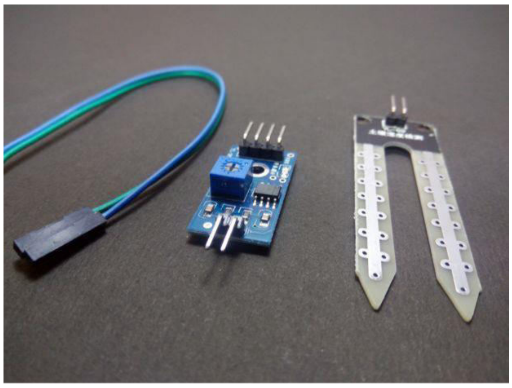

Figure 3 Moisture Sensor

The soil moisture sensor or the hygrometer is usually used to detect the humidity of the soil. The sensor has a built-in potentiometer for sensitivity adjustment of the digital output (D0), a power LED and a digital output LED. The voltage that the sensor outputs changes accordingly to the water content in the soil.

When the soil is

- **Wet:** the output voltage decreases
- **Dry:** the output voltage increases

The output can be a digital signal (D0) low or high, depending on the water content. If the soil humidity exceeds a certain predefined threshold value, the modules outputs low, otherwise it outputs HIGH. The threshold value for the digital signal can be adjusted using the potentiometer. Soil moisture sensors measure the volumetric water content in the soil. The direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample. Soil moisture sensors measure the volumetric water content by using other property of the soil, such as electrical resistance, dielectric constant. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature or electric conductivity. The maximum volumetric water content in the soil is 45%, at this level soil is said to be saturated, soil can hold no more water. So, it is perfect to build an automatic watering system or to monitor the soil moisture of the plants.

PIN CONFIGURATION

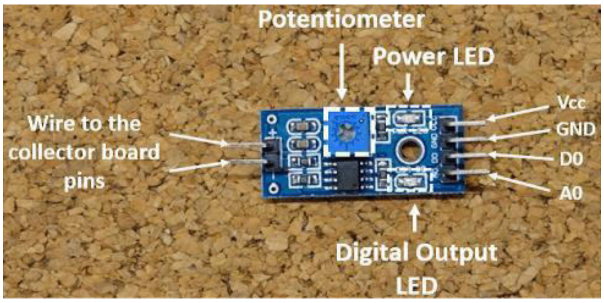

Figure 4 Moisture Sensor Calibration Board

Table 1 Pin Configuration of Calibration Board

S.no	Pin	Wiring to Arduino Uno
1	A0	Analog Pins
2	D0	Digital Pins
3	GND	GND
4	VCC	5V

B. TEMPERATURE AND HUMIDITY SENSOR (DHT11)

DHT11 sensor is very basic and slow sensor, but is great for hobbyists who want to do some basic data logging. The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a very basic chip inside that does some analog to digital conversion and spits out a digital signal with the temperature and humidity. The digital signal is fairly easy to read using any micro-controller.

The DHT11 humidity and temperature sensor measures relative humidity (RH) and temperature. Relative humidity is the ratio of water vapour in air vs. the saturation point of water vapour in air. The saturation point of water vapour in air changes with temperature. Cold air can hold less water vapour before it is saturated, and hot air can hold more water vapour before it is saturated.

The formula for relative humidity is as follows:

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

Basically, relative humidity is the amount of water in the air compared to the amount of water that air can hold before condensation occurs. It's expressed as a percentage. For example, at 100% RH condensation (or rain) occurs, and at 0% RH, the air is completely dry. The DHT11 calculates relative humidity by measuring the electrical resistance between two electrodes. The humidity sensing component of the DHT11 is a moisture holding substrate with the electrodes applied to the surface. When water vapour is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes while lower relative humidity increases the resistance between the electrodes. Inside the DHT11 you can see electrodes applied to a substrate on the front of the chip. The DHT11 converts the resistance measurement to relative humidity on an IC mounted to the back of the unit and transmits the humidity and temperature readings directly to the Arduino. This IC also stores the calibration coefficients and controls the data signal transmission between the DHT11 and the Arduino or any other micro-controller you use. The temperature readings from the DHT11 come from a surface mounted NTC temperature sensor (thermistor) built into the unit.

V1. RESULTS

Figure 5, Figure 6 & Figure 7 are the snapshots of the pages available in the android application.

The figure 5 represents the snapshot of the registration page, in which the user can provide his/her credentials to register with the app.

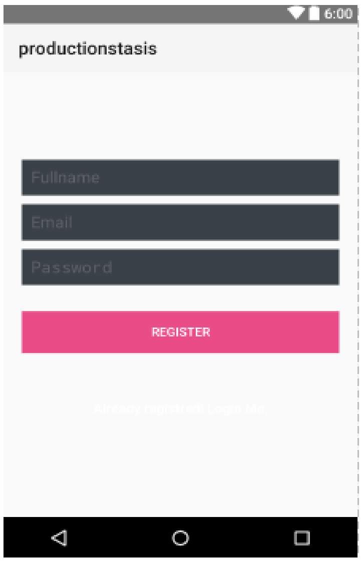

Figure 5 Registration page of the android application

The Figure 6 represents the login page in which the user is required to provide his/her credentials to login in the app, after registration.

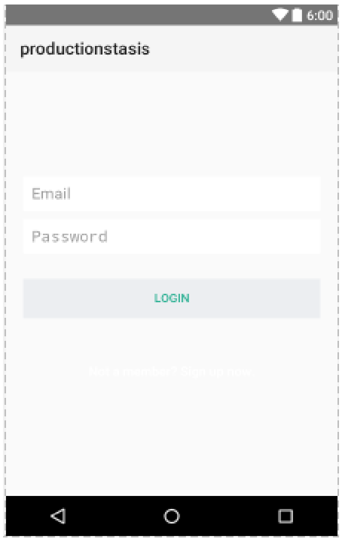

Figure 6 Login page of the android application

Figure 7 is the home page of the app, to which the user will be directed on successful login

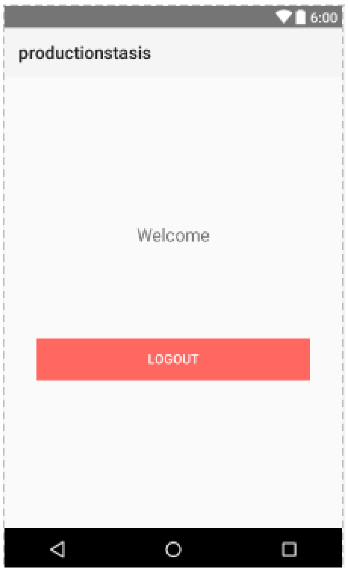

Figure 7 Home page of the android application

V11. CONCLUSION

The proposed design scheme of agricultural information service platform based on Internet of things, makes the Internet of things technology used in the agricultural production. From the acquisition of the data by the bottom sensor and detector device, to transfer the data to the computer system via the Internet. After intelligent processing like cloud computing the system will get valuable information, and the information is sent to the application layer, for people to use in agricultural production, agricultural transportation.

IoT technology could be used to improve agricultural productivity by achieving the best level of cultivation conditions in the greenhouse production. The service platform scheme can make agriculture increase from the current inefficient state to a more digital management level. The competitiveness of agriculture can be greatly enhanced with this information service platform, farmers can manage their lands more scientifically and make scientific decisions in time when some difficult situations appear. Thus, farmers will be able to benefit from scientific management and agriculture can make contributions to the world. But application in actual production is still facing many problems to be solved such as data security, distribution and installation of sensors, system maintenance, power problems in remote environments etc. The characteristics of agriculture and national conditions, and strive to achieve breakthroughs and innovation of the key technology and common technology, should be combined. By empowering farmer with information about price and successful practices, the system could improve the production efficiency and economic status of farmers. By replacing physical transaction with digital mode of transaction, the system would also play at least a small role in contributing towards Digital India.

V11. REFERENCES

1. Chunmeng Wang and Dapeng Zhang (2013), "Research of Agricultural Information Service Platform based on IoT", Proceedings of IEEE 12th International Conference on Distributed Computing and Applications to Business, Engineering and Science, pp: 8-19.
2. K.W.Migliaccio, B.Schaffer and J.H.Crane (2010), "Automated Irrigation System Using a Wireless Sensor Network and GPRS module", Proceedings of IEEE 14th International Conference on Soil Moisture and Water Management in Agriculture, pp: 23-30.
3. D. Ramesh and Vishnu Vardhan (2013), "Wireless Sensor Network for Smart Agriculture", Proceedings of IEEE 11th International Conference on Data Mining Techniques and Applications to Agricultural Yield, pp: 32-41.
4. Raheela Shahzadi, Muhammed Tausif, Javid Ferzund and Muhammed Assif Suryani (2016), "Internet of Things based Expert System for Smart Agriculture ", International Journal of Advanced Computer Science and Application, Vol. 7, No 09, pp: 342-350.
5. Sanjuumar and R.V.Krishnaiah (2013), "IoT Based Smart Agriculture", International Journal of VLSI and Embedded Systems, Vol. 4, pp: 24-35.
6. Meonghun Lee, Jeonghwan Hwang, and Hyun Yoe, (2013), "Agricultural Production System based on IoT", proceedings of IEEE 16th International

Conference on Computational Science and Engineering, pp: 26-34.

7. Chetan Dwarkani M, Ganesh Ram R, Jagannathan S and R. Priyatharshini (2015), "Smart Farming System Using Sensors for Agricultural Task Automation", proceedings of IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development, pp: 34-42.
8. S. R. Nandurkar, V. R. Thool and R. C. Thool, (2014), "Design and Development of Precision Agriculture System Using Wireless Sensor Network", proceedings of First International Conference on Automation Control and Systems, pp: 56-65.
9. Rajalakshmi.P, Mrs.S.Devi and S. Mahalakshmi (2016), "IOT Based Crop-Field Monitoring and Irrigation Automation", International Journal on Intelligent Systems and Control Vol. 4, No-05, pp: 2278-0181.
10. Prachi Patil, Akshay Narkhede, Ajita Chalke, Harshali Kalaska and Manita Rajput (2014), "Real Time Automation of Agricultural Environment", proceedings of International Conference for Convergence of Technology, pp: 43-51.
11. Rashid Hussain, JL Sahgal, Anshulgangwar and Md. Riyaj (2013), "Control of Irrigation Automatically By Using Wireless Sensor Network", International Journal of Soft Computing and Engineering, Vol-3, No-01 pp: 2231-2307.