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Agriculture Automation using Internet of Things

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Abstract — *Agriculture is important in the overall economic development of a nation. Internet of Things (IoT) plays a crucial role in smart agriculture. In this project an automated agriculture system is developed to optimize the water and fertilizer usage of crops. And this project also includes detection of animals and prevention of trees. The purpose of the experiment is to find better ways of controlling an irrigation system with automatic system and manual control by smart phone. The system is proposed using embedded systems, MPLAB and PROTEUS software. The detailed monitoring and control strategy of a smart irrigation and smart controlling system are demonstrated in this paper.*

Keywords- *Embedded systems, Smart Irrigation system, Smart Controlling system, Wireless sensor networks, sensors*

INTRODUCTION

Agriculture is the backbone of Indian economy. In India, around 70% of the population earns its livelihood from agriculture. The major problem faced in many agricultural areas is that lack of mechanization in agricultural activities. Manual collection of data for desired factors can be sporadic, not continuous and produce variations from incorrect measurement taking [1].Wireless distinct sensor nodes can reduce time and effort required for monitoring the environment. We can reduce a lot of manual work in the field of agriculture using automation.

Internet of Things (IoT) is widely used in connecting devices and collecting data information. IoT is a shared network of objects and things which can interact each other provided with the internet connection. By using Iot we can expect the increase in production with low cost by monitoring the efficiency of the soil, fertilizer efficiency, monitoring storage capacity of water tanks and also theft detection in agriculture areas [2-4].

The most important things of smart farming are environmental measurements and water management. The combination of traditional methods with latest technology as Internet of Things and wireless Sensor Networks can lead to agricultural modernization. The wireless Sensor Network which collects the data from different types of sensors and sends it to the main server using wireless protocol [6]. Our smart farming system reduces the manual work and automates the agricultural activities.
This paper is organized as follows: section I. existing methods, section II proposed methods, section III materials and methods, followed by result in section IV and conclusion in section V.

I. EXISTING AGRICULTURAL AUTOMATION SYSTEM

This part illustrates the present method of monitoring and controlling agricultural fields.

1.1 IoT based monitoring system in smart agriculture

Smart farming is an emerging concepts, because IoT sensors capable of providing information about the agriculture fields. This systems make use of evolving technology i.e. IoT and smart agriculture using automation. Monitoring environmental factors is the major factor to improve the yield of the efficient crops. The features of this paper includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip [5].
The traditional method of agricultural monitoring includes the following steps that are illustrated in the flowchart below:

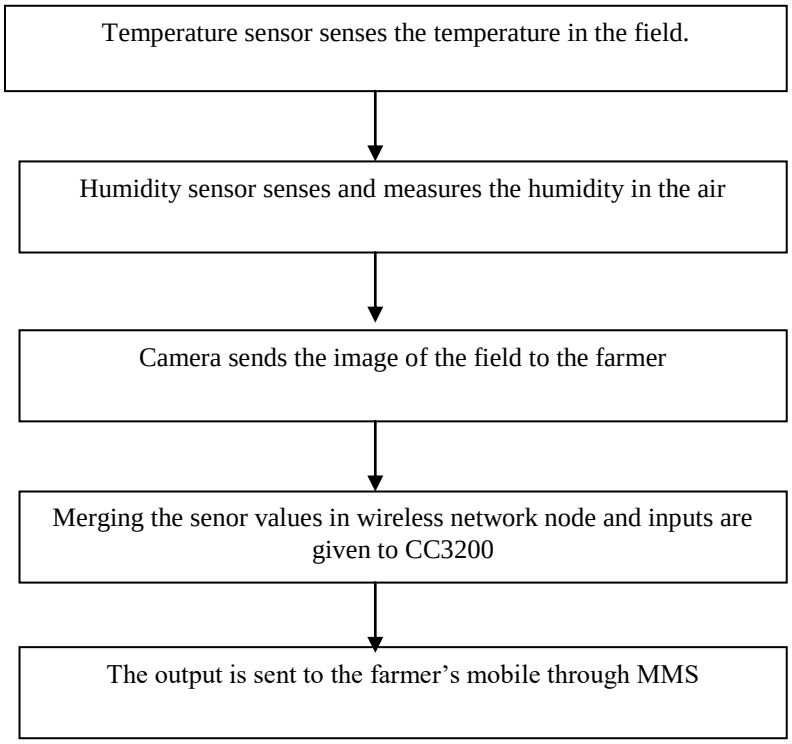

Fig 1 Iot based monitoring system in smart agriculture

In this system cameras are used to monitor the field but we cannot sense the exact Moisture content in the soil. Therefore water level is not optimized.

1.2 Smart Farming System using sensors for agricultural task automation.

The main idea of this system is to automate the activities of farming by using the principle of mechanics; communication and electronics. There are two modules, namely a smart farm sensing system and movable smart irrigator that moves on mechanical bridge slider arrangement. This system consists of moisture sensor, optocouplers, spectroscopy sensor which measures light intensity and measured chlorophyll content which evaluates the nutrient content in the crops.

A crane consists of the two main sensors and the Smart irrigator is mounted on the overhead crane through which crop growth can be analyzed. Sensors triggers the optocoupler connected to green manure, seeds, compost and water container [7].

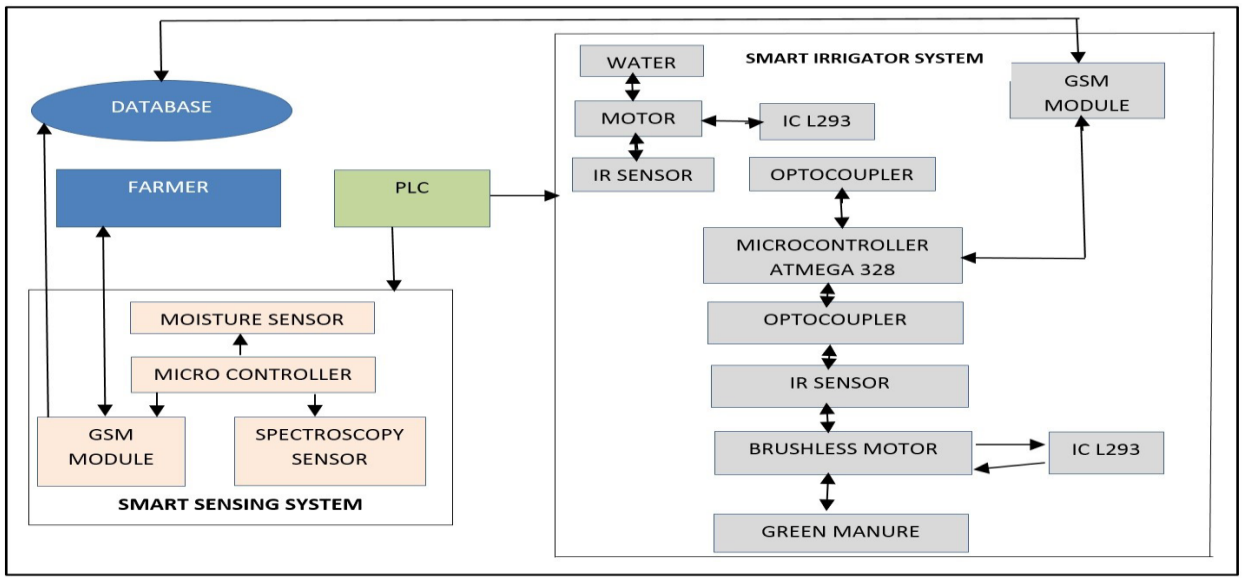

Fig 2 Smart farming system using sensors

1.3 Sensor data collection and irrigation control on vegetable crop using smart phone and wireless sensor networks for smart farm

The research goal of this system is to provide long term sustainable solutions for automation of agriculture. The system had developed a portable measurement technology including soil moisture sensor, air humidity sensor and air temperature sensor. Irrigation system using wireless sensor network has installed these sensors with the purpose for collecting the environment data and controlling the irrigation system via smart phone.

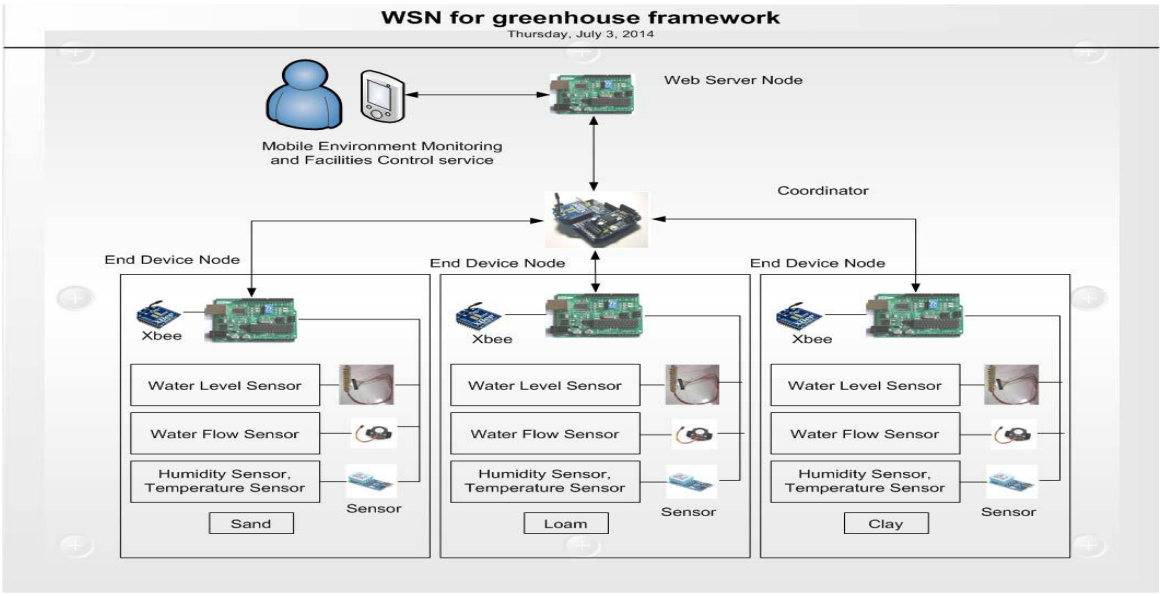

Fig 3 Sensor data collection and irrigation control

The microcontroller unit (MCU) collected data from each sensor. When the environment had changed, the MCU will convert a raw data to correctly transmission pattern. After the environment information was complete and ready to send.MCU will prepare Xbee module and serial communication to send information.

1.4 Remote agriculture automation using wireless link and IoT gateway infrastructure

The system architecture for remote agriculture process automation, involving sensors and actuators connected to IoT gateway running OPC UA server. This approach features the advantage of convenient possibilities to change control rules from cloud service (installing or configuring process controller) without updating firmware of remote sensor/actuators. This research focus is on wireless local network suitability to server needs of remote automation task [8].

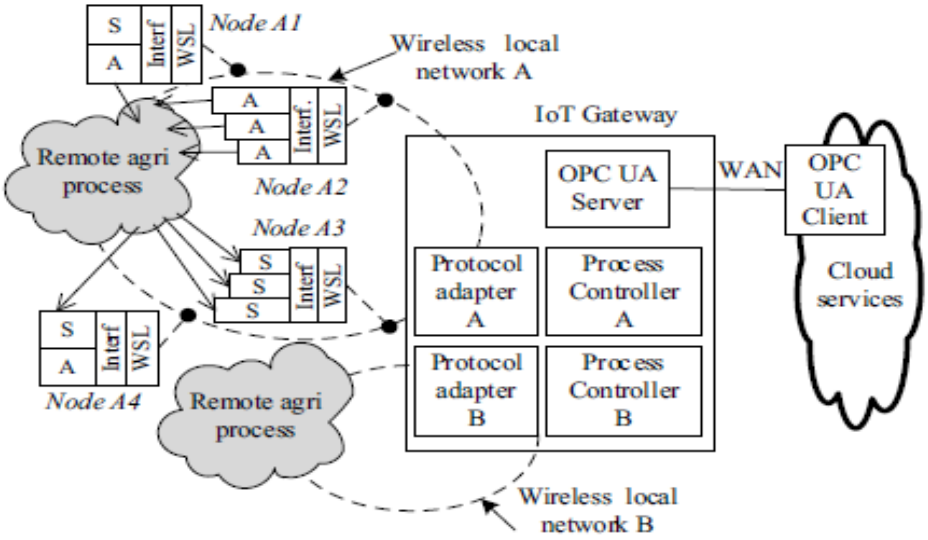

Fig 4 Remote agriculture automation

The system presented is on implementation of data delivery system between remote sensor and actuators that fulfills requirements of remote configurability, separation of sensing/actuation devices from application control devices utilizing OPC UA server based IoT gateway infrastructure [9-10].

II. PROPOSED METHOD WORKING METHODOLOGY

In the proposed system monitoring and controlling are done through sensors such as soil moisture sensor, PIR sensor, pH sensor, water flow sensor. To prevent tress, a microphone is used to record the sound of axe or other tools used for cutting of trees. Here the data is transmitted through IoT. In this system the data is being processed by PIC16F877A microcontroller. The Internet of Things is regarded as the third way of information technology after Internet and mobile communication network, which is characterized more through sense and measure. Fig.5 shows the block diagram of the proposed system model.

The working of this proposed technique is illustrated as follows:

- ✓ The soil moisture sensor senses and measures the moisture level in the soil.
- ✓ The PIR sensor detects the animals and a high frequency sound signal is provided.
- ✓ The ph sensor and water flow sensor is used to optimize the fertilizer usage.
- ✓ These data are processed and the optimum water level will be supplied to the field by automatically switching on the power supply to the water pump.
- ✓ These data will be transmitted to the user's mobile phone through Iot using a separate IP address for the given microcontroller which is programmed to send the data given by the sensor to the user through a web page showing the live condition of the field.

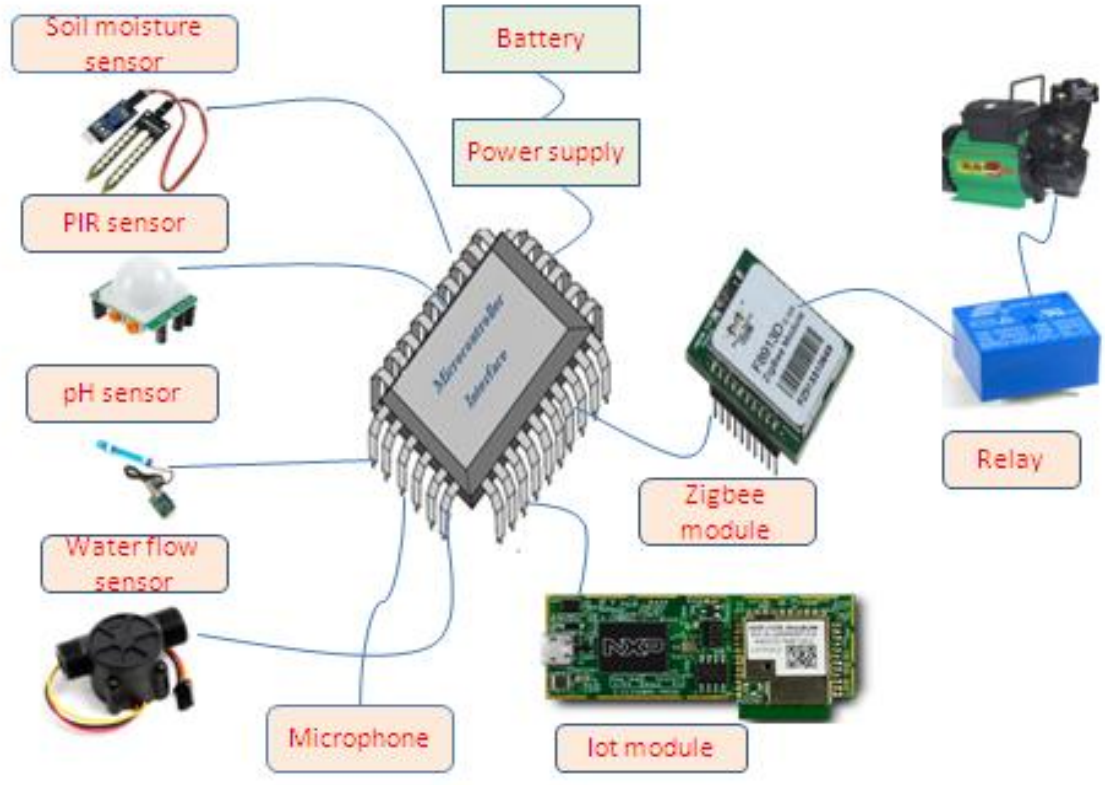

Fig 5 Block Diagram of the Proposed Method

III. MATERIALS & METHODS

3.1 PIC Microcontroller

PIC is a family of microcontrollers made by Microchip technology. The acronym PIC stands for "Peripheral Interface Controller" or "Programmable Interface Controller". A typical microcontroller includes a processor, memory and peripherals. It is a type of microcontroller component that is used in the development of electronics, computers, robotics

and similar devices.

PIC16F877A consists of five ports such as Port A, Port B, Port C, Port D, Port Eand the inputs are connected to the required ports. It has an inbuilt analog to digital converter.

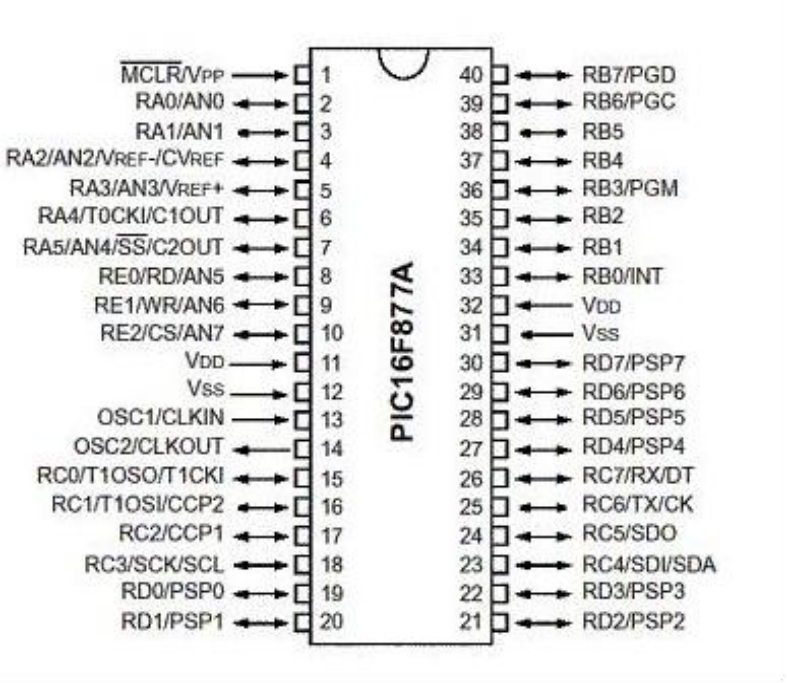

Fig 6 PIC Microcontroller

3.2 Soil moisture sensor

Soil moisture plays an important role in the development of weather patterns and agricultural applications. A soil moisture sensor measures the quantity of water contained in a material, such as soil on a volumetric basis.

In this proposed research soil moisture sensor is used to know the exact soil moisture conditions on their fields. This helps farmers to generally use less water to grow a crop; they are able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

Fig 7 soil moisture sensor

3.3 PIR sensor

In this proposed system Passive Infrared (PIR) sensors are used for the purpose of human and animal detection in the field. This is a type most commonly encountered in motion sensing.

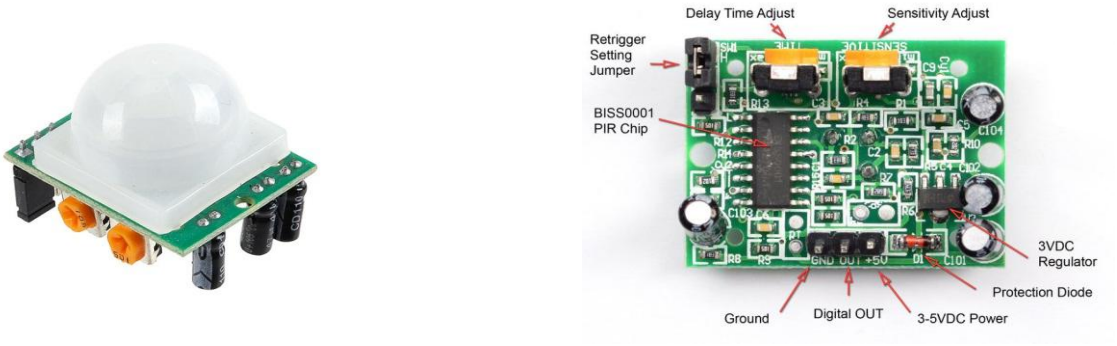

Fig 8 Passive infrared sensor

They are commonly used in automatic door opening system, security alarm systems .PIR sensors are used as motion detectors in many applications such as Hospitals, grocery stores and libraries.

3.4 pH sensor

A pH sensor measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH meter is used in many applications ranging from laboratory experimentation to quality control.

Fig 9 pH sensor

In this proposed system pH sensors are used for soil, crop, and water testing in agriculture to achieve high quality produce from farming operation. The output can be digital or analog, and the device can be battery-powered or rely on line power. With pH sensor we can measure the growing conditions and improve both the health and yield from our crops.

3.5 Water flow sensor

A water flow sensor consists of a plastic valve body, a water rotor,and a hall-effect sensor. When water flows through the rotor, rotor rolls. The speed of the flow sensor changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse signal.

Fig 10 Water flow sensor

In the proposed system the water flow sensor is used to measure the amount of fertilizer mixed with water. Through this the farmers can get the exact scenario of fertilizers mixed with water and the usage of fertilizers can be optimized. There are different types of applications such as gas meter, chemicals, process auto-control, medical, food and beverages.

IV. HARDWARE RESULT

Hardware results showing monitoring and controlling of moisture level and animal detection is shown in fig.11.The soil moisture sensor senses and measures the moisture level in the soil. The PIR sensor detects the animals and a high frequency sound signal is provided. The ph sensor and water flow sensor is used to optimize the fertilizer usage. These data are processed and the optimum water level will be supplied to the field by automatically switching on the power supply to the water pump. These data will be transmitted to the user's mobile phone through Iot using a separate IP address for the given microcontroller which is programmed to send the data given by the sensor to the user through a web page showing the live condition of the field.

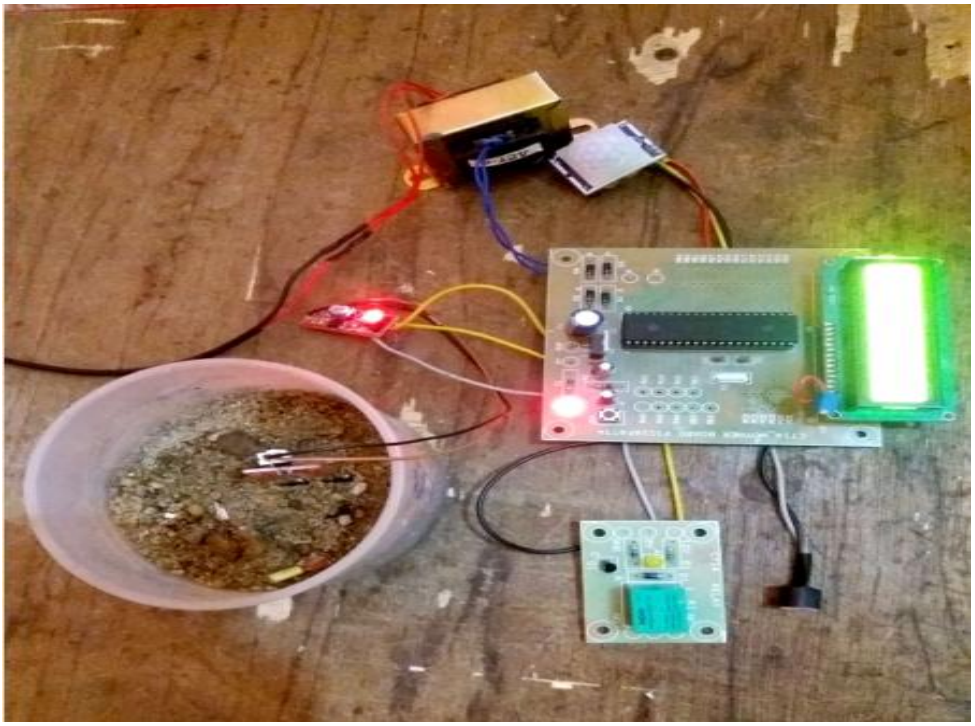

Fig 11 Hardware output

V. CONCLUSIONS & FUTURE ENHANCEMENTS

After examining the survey papers on intelligent farming such as IoT based monitoring system in smart agriculture, Smart Farming System using sensors for agricultural task automation, Sensor data collection and irrigation control on vegetable crop using smart phone and wireless sensor networks for smart farm and Remote agriculture automation using wireless link and IoT gateway infrastructure, a novel agricultural automation system using Internet of Things (IoT) is proposed. This system provides real time information about the farmland and alerts the farmer in case of animal threats. The proposed system also prevent the trees from illegal cut down. The future enhancements are given below:

- ✓ Irrigation system can be monitored.
- ✓ Damage caused by predators is reduced.
- ✓ Increased productivity.
- ✓ Water conservation.

REFERENCES

[1] Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar, "IoT based Smart Agriculture" International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 6, ISSN (Online) 2278-1021 ISSN (Print) 2319 5940, June 2016.

[2] Tanmay Baranwal, Nitika , Pushpendra Kumar Pateriya "Development of IoT based Smart Security and Monitoring Devices for Agriculture" 6th International Conference - Cloud System and Big Data Engineering, 978-1-4673-8203-8/16, 2016 IEEE.

[3] Shihao Tang, Qijiang Zhu, Xiaodong Zhou, Shaomin Liu, Menxin Wu, "A Conception of Digital Agriculture" (Research Center for Remote Sensing and GIS, Dept. Geography, Beijing Normal University & Beijing Key Laboratory for Remote Sensing of Environment and Digital Cities, Beijing, 100875).

[4] Kaewmard, Nattapol ; Saiyod, Saiyan "Sensor data collection and irrigation control on vegetable crop using smart phone and wireless sensor networks for smart farm", IEEE Conference on Wireless sensors (ICWiSE), DOI: 10.1109/ICWISE.2014.7042670 , Page(s): 106 – 112,2014

[5] Angel, G. ;Brindha, A. "Real-time monitoring of GPS-tracking multifunctional vehicle path control and data acquisition based on ZigBee multi-hop mesh network"

[6] Migdall, S.; Klug, P.; Denis, A; Bach, H., "The additional value of hyperspectral data for smart farming," Geoscience and Remote Sensing Symposium (IGARSS), 2012 IEEE International , vol., no.,pp.7329,7332, 22-27 July 2012

[7] Eric D. Hunt., et al.2008. "The development and evaluation of a soil moisture index." Int. J. Climatol. Published online in Wiley InterScience. www.interscience.wiley.com.

[8] Zhenyu Liao; Sheng Dai; Chong Shen, "Precision agriculture monitoring system based on wireless sensor networks," Wireless Communications and Applications (ICWCA 2012), IET International Conference on ,vol., no., pp.1,5, 8-10 Oct. 2012.

[9] O.Vermesan, P.Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, -2013 (Internet access: http://www.internet-of-things-research.eu, Accessed:2015-02-26).

[10] Ning Wang, Naiqian Zhang, Maohua Wang, Wireless sensors in agriculture and food industry—Recent development and future perspective, Computers and Electronics in Agriculture 50 (2006) p. 1–14.

