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Smart Agriculture Monitoring using Energy Harvesting Internet of Things (EH-IoT)

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ABSTRACT

The internet of Things (IoT) are now a days being used for the smart agriculture monitoring and control applications. Small wireless sensor networks (WSN) are used as IoT nodes in agriculture monitoring which is very much similar to those used in Industries, Process control, Building Automation and Security Systems. In this paper, we propose IoT sensor nodes which are powered by solar energy are used for monitoring and control of agriculture fields. The monitoring and control in agriculture fields include operations like crops managements, crops harvesting, water supply control, animal control, pesticide distribution, humidity and temperature measurement applications.

Keywords: Agriculture monitoring, Solar Energy Harvesting, Internet of Things, Wireless Sensor Networks

1. INTRODUCTION

Now a days, the Indian agriculture sector is growing at a very fast rate with the development in Internet of Things (IoT) and solar energy harvesting technologies. The internet of things (IoT) is a network of sensors, actuators, communication equipment, internet, digital devices, various software and hardware with connectivity between them with excellent user control facility from all over the world. The wireless sensor networks (WSNs) are smart autonomous sensing devices which can cooperatively pass their data to a remote location.

The Smart agriculture include the incorporation of advanced technologies into existing agricultural practices in order to increase the production efficiency and the quality of cultivated crops. As an additional profit, smart farming also improves the quality of life of rural farmers by reducing hefty labor and tiresome tasks [1]. As shown in Figure 1, the moisture sensor senses the humidity in the crops or soil and sends data to the remote gateway location wirelessly.

The depending on the threshold data value the necessary actuators can be activated like motor pump speed control, On-Off of the water pump, Crops harvesting, Crops seeding, pesticide distribution over the crops etc. [2].

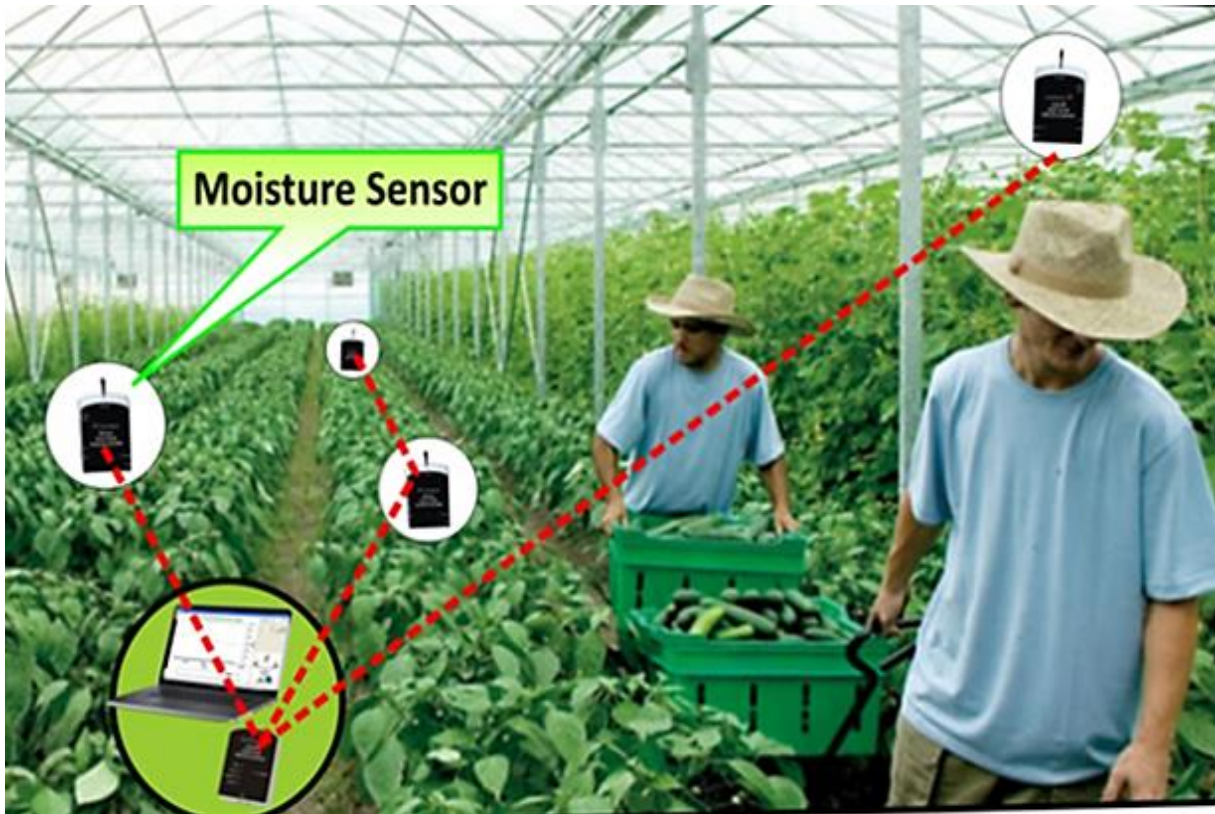


Figure 1. Role of Internet of Things (IoT) in Agriculture Monitoring & Control application

2. BLOCK DIAGRAM

The basic Block diagram of Smart Agriculture Monitoring using Energy Harvesting Internet of Things (EH-IoT) is shown in Figure 2.

Here, the DHT11 sensor module measures the humidity and temperature of the soil. This sensed data is sent to the Wi-Fi module (ESP8266). The measured data is sent to the Internet of Things (IoT) Cloud like Thingspeak.com [3].

From the IoT Cloud the measured data is sent to GSM mobile and or Wi-fi router. The user can observe the measured data using monitoring and control application running on their mobile phone or Personal Computer (PC) [4].

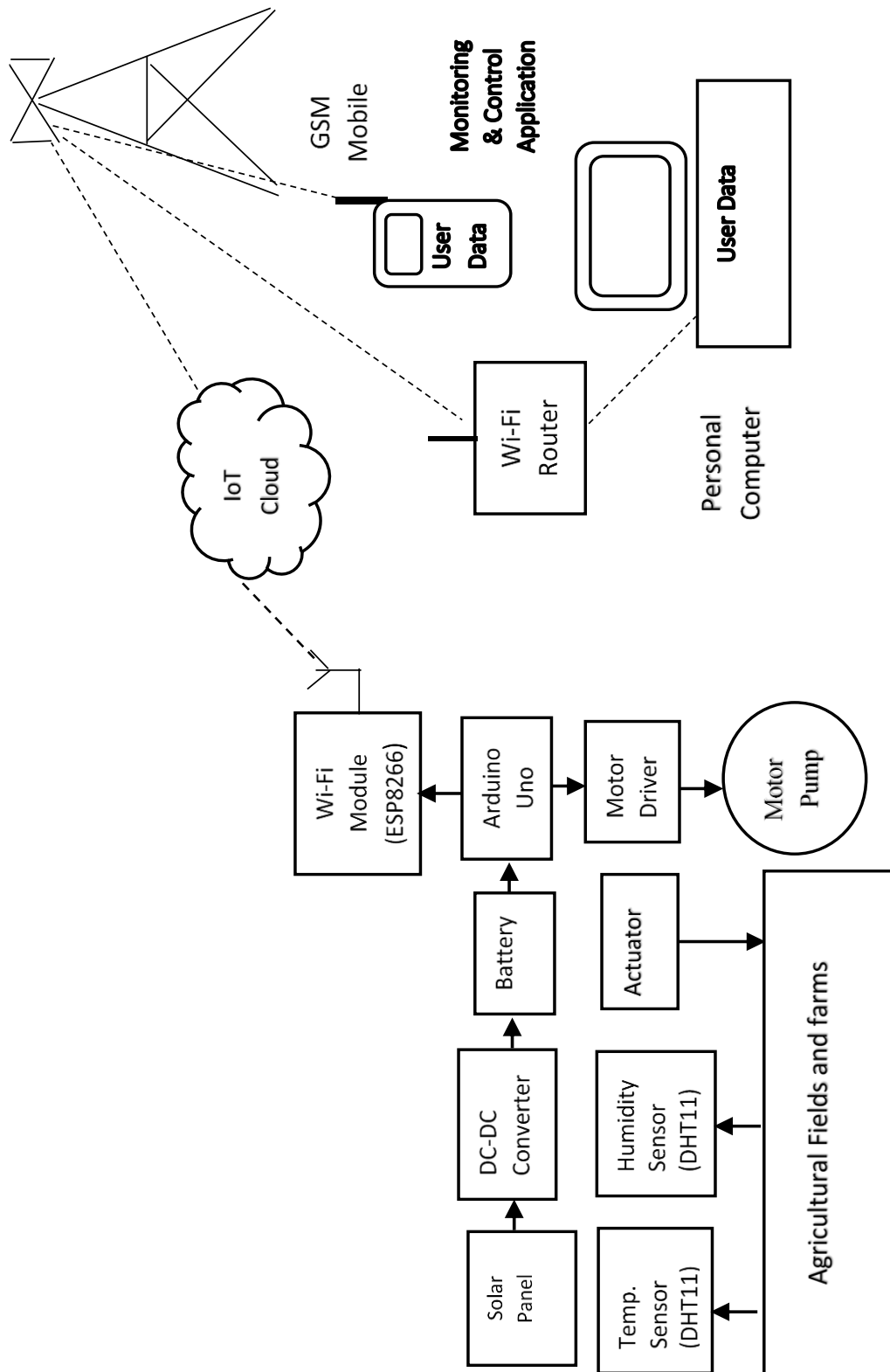


Figure 2. Basic Block diagram of Smart Agriculture Monitoring using Energy Harvesting Internet of Things (EH-IoT)

3. PROCESS FLOWCHART / METHODOLOGY

A flow chart is shown in Figure 3 which shows the complete process for Agriculture fields monitoring and control operation. Here, first step is to measure the various environmental parameters of the agricultural fields using sensors. This measured data is sent over the IoT cloud using arduino board and Wi-Fi module (ESP8266) [5]. Simultaneously, the energy required to operate the IoT sensor node is harvested from the solar panels and can be directly used to power the sensor node. The harvested energy can also be stored in a battery to operate the IoT node during night time when solar energy is not available [6]. The use sitting at remote place can observe the data (temperature, humidity, video signal etc.) from anywhere across the world using mobile phone or personal computer. The user can generate necessary control actions to regulate the agricultural farming processes like watering of the plants, pesticide distribution, crops harvesting, waste management, animal control etc. [7].

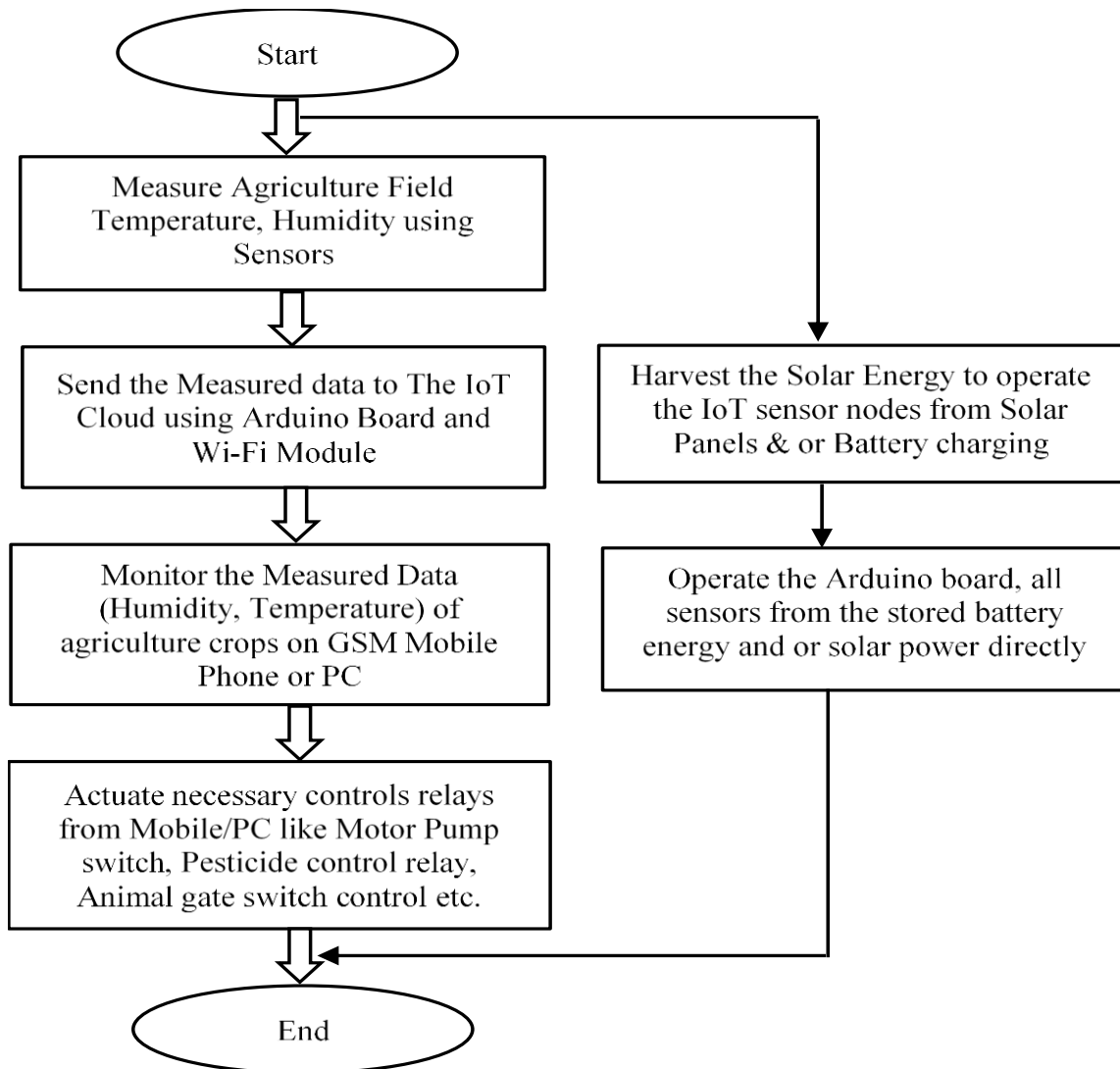


Figure 3. Process flowchart for Agriculture fields monitoring and control operation

4. CONCLUSION

From the above block diagram, operation and flow chart it is concluded that the Energy harvesting IoT can be used for monitoring and control of agriculture fields. This sensed data is sent to the Wi-Fi module (ESP8266). The measured data is sent to the Internet of Things (IoT) Cloud like Thingspeak.com [3]. From the IoT Cloud the measured data is sent to GSM mobile and or Wi-Fi router. The user can observe the measured data using monitoring and control application running on their mobile phone or Personal Computer (PC) [4].

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