APPLICATION OF IOT FOR WIRELESS SMART IRRIGATION AND ITS OVERVIEW

Sameer Swain[1], Bhabani Sankar Pati[2], Mrutyunjay Senapati[3]

[1]Dept of EEE, Gandhi Engineering College, Bhubaneswar Odisha
[2]Dept of EEE, GIET, Ghangapatna, Bhubaneswar Odisha
[3]Assistant Professor, Department of Electrical & Electronics Engineering, GIET, Ghangapatna, Bhubaneswar, Odisha,

---***---

ABSTRACT : IoT is a recent technology that represents the future of computing and communications. A recent study found that, on average, *33 percent of the global population suffers from water scarcity* in some form or the other. By 2030, this figure is likely to rise to 50 percent, clearly underlining the alarming rate at which the problem of water deficiency is expanding. Interestingly, *approximately 70 percent of the total volume of water withdrawals in the world are used for irrigation*, and that's precisely where most of the water waste happens. Around *60 percent of the water meant to be used for irrigation is lost,* either due to evapotranspiration, land runoff, or simply inefficient, primitive usage methods. This, in turn, brings to light the importance of *smart irrigation* – powered by the Internet of things (IoT) – that can go a long way in managing the rising levels of water stress worldwide. In what follows, we will put the spotlight on some interesting facts about smart irrigation. The Smart Irrigation System is an IoT based device which is capable of automating the irrigation process by analyzing the moisture of soil and the climate condition (like raining).Also the data of sensors will be displayed in graphical form on BOLT cloud page Advances in image sensors and Wireless Sensor Networks (WSN) help to identify and delineate landscape to manageable field-level food production zones more quickly and effectively than before and at much higher resolutions. Image processing software supports these sensors providing more excellent analytical capabilities and improved knowledge than was previously possible. RFID technology is relatively mature, and food traceability is now more common in the developed world. Agri-business organizations are increasingly becoming active in social media. Cloud computing is "a new style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet".

INTRODUCTION

The resurfacing of the global recession has caused ripples across both the developed and the developing economies. The agriculture sector will have to be much more efficient and resilient to ensure global food security. Indian farmers are at a significant disadvantage in terms of the size of farms, technology, trade, government policies, etc. Information and Communication Technology (ICT) can mitigate some of the problems of farmers. After the World Wide Web (of the 1990s) and the mobile Internet (of the 2000s), we are now heading to the third and potentially most "disruptive" phase of the Internet revolution—the "Internet of Things" (IoT) which is also known as "Ubiquitous Computing. IoT applications encompass diverse areas including agriculture, healthcare, retail, transport, environment, supply chain management, infrastructure monitoring etc. Applications in agriculture include soil and plant monitoring, and greenhouse environment monitoring and control systems, monitoring of food supply chain, monitoring of animals, etc. Precision farming equipment with wireless links to data collected from remote satellites and ground sensors can take into account crop conditions and adjust the way each part of a field is farmed—for instance, by spreading extra fertilizer on areas that need more nutrients (Chui et al., 2010). The networking of things or physical objects must be cost-effective and useful to the end-users for acceptance and wide-scale adoption of IoT. Global ICT Standardization Forum for India has listed the potential benefits of IoT as (i) Improved performance, visibility and scalability, (ii) Better and more cost-effective service, (iii) Transparency of physical flows and detailed status information, (iv) Enhanced efficiency, accuracy, mobility and automation.

1. CONCEPT OF IOT

The Internet of things (**IoT**) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet. But the actual term "Internet of Things" was coined by **Kevin Ashton** in 1999 during his work at Procter Gamble. **Ashton**, who was working in supply chain optimization, wanted to attract senior management's attention to a new exciting technology called RFID. An **IoT** system consists of sensors/devices which "talk" to the cloud through some connectivity. Once the data gets to the cloud, software processes it and then might decide to act, such as sending an alert or automatically adjusting the sensors/devices without the need for the user. **IoT** devices can be **used** to monitor and control the mechanical, electrical and electronic systems **used** in various types of buildings (e.g., public and private, industrial, institutions, or residential) in home automation and building automation systems. In short, the Internet of Things refers to the rapidly growing network of connected objects that can collect and exchange data using embedded sensors. Thermostats, cars, lights, refrigerators, and more appliances can all be connected to the **IoT**. The Internet of Things (IoT) is a worldwide network of intercommunicating devices. It integrates the ubiquitous communications, pervasive computing, and ambient intelligence. IoT is a vision where "things", especially everyday objects, such as all home appliances, furniture, clothes, vehicles, roads and smart materials, etc. are readable, recognizable locatable, addressable and controllable via the Internet.

2. IoT Architecture & Technologies

The second module "IoT Architecture & Technologies" focuses on the functionality and characteristics of the IoT architecture layers as well as the characteristics of IoT technologies, which include WSN (Wireless Sensor Networks), IoT cloud computing, IoT R&D (Research & Development), and IoT hardware technologies. Further details are provided in the descriptions of the characteristics of IoT sensors types, actuator types, and RFID types as well as the functionality and characteristics of IoT device platforms, which include the Arduino, Raspberry Pi, and Beagle Board products. Next, a comparison of the representative IoT developer platform products are presented, which include the Raspberry Pi, Raspberry Pi 3 Model B, Beagle Board, Beagle bone Black, and the Arduino systems Uno R3 (for entry and general purpose), Yun (for IoT), and Lilypad (for wearable).

3. ARDUINO BASED SMART IRRIGATION SYSTEM USING IOT: -

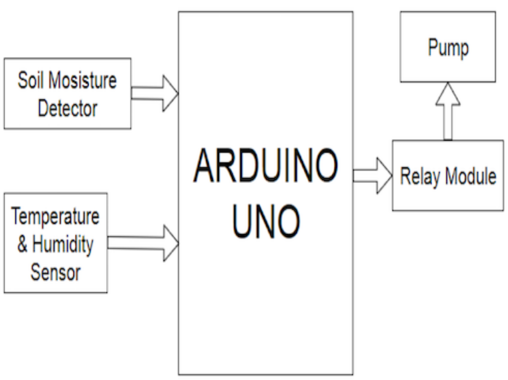
The hardware and software requirements of this project include
3.1 Arduino UNO
3.2 Soil moisture sensor
3.3 BOLT Wi-Fi module
3.4 Arduino CC(IDE)
3.5 Android studio
3.6 MySQL, etc.

3.1 Arduino UNO: -The Arduino UNO is one of the most used microcontrollers in the industry. It is effortless to handle, convenient, and use. The coding of this microcontroller is effortless [4][5]. The program of this microcontroller is considered as unstable due to the flash memory technology. The applications of this microcontroller involve a wide range of applications like security, home appliances, remote sensors, and industrial automation. This microcontroller can be joined on the Internet and perform as a server too.

3.2 Soil moisture sensor: -Soil moisture sensor is one kind of sensor used to detect the soil moisture content. This sensor has two outputs like the analog output as well as the digital output. The digital o/p is permanent, and the analog o/p threshold can be changed. The working principle of soil moisture sensor is open & short circuit concept [6][7]. Here the LED gives an indication when the output is high or low. When the condition of the soil is dried up, the flow of current will not flow through it. So, it works as an open circuit. Therefore, the o/p will be maximized. When the soil condition is soaked, the flow of current pass from one terminal to the other. So, it works like a closed circuit. Therefore, the o/p will be zero [8]. Here the sensor is coated with platinum, and anti-rust to make higher efficiency as well as long life. The sensing range is also high, which will pay for the farmer at a minimum cost.

3.3 BOLT Wi-Fi module: -Bolt is an IOT platform that helps enterprise and makers to connect their devices to the Internet. Bolt comes with a WIFI/GSM Chip to connect your sensors to the Internet.

4. WORKING WITH SMART IRRIGATION SYSTEM USING IOT: -In the agriculture field, sensors are used like soil moisture. The information received from the sensors is sent to the Database folder through the Android device. In the control section, the system is activated using the Application; this is finished using the ON/OFF buttons in the Application. Also, this system is automatically activated when the soil moisture is low; the pump is switched ON based on the moisture content [9]. TheApplication has a feature like taking some time from the user and water the agriculture field when the time comes. In this system, there is a switch used to turn off the water supply if the system fails [10]. Other parameters, such as the moisture sensor demonstrate the threshold price and the level of water in the soil.



5. THE WORKING OF IOT

The Internet of Things is a technological revolution that represents the future of computing and communications, and its development depends on dynamic technical innovation in several essential fields—from wireless sensors to nanotechnology. First, to connect everyday objects and devices to large databases and networks, and indeed to the network of networks (the Internet), a simple, unobtrusive and cost-effective system of item identification is crucial. Only then can data about things be collected and processed. Radiofrequency identification (RPID) offers this functionality. Second, data collection will benefit from the ability to detect changes in the physical status of things, using sensor technologies. Embedded intelligence in the things themselves can further enhance the power of the network by devolving information processing capabilities to the edges of the network. Finally, advances in miniaturization and nanotechnology mean that smaller and smaller things will have the ability to interact and connect. A combination of all of these developments will create an Internet of Things that connects the world's objects in both a sensory and an intelligent manner. 3.1 Structure of IoT for Agriculture (Datang Mobile, China) Datang Mobile proposes the Wisdom Agriculture system solution of Internet of Things for Agriculture. The system has three layers, namely, sensor layer, transport layer, the application layer. Their functions are as follows: 1. Sensor/Information Collection Layer: The main task of this layer is to achieve the automatic and real-time transformation of the physical figures of real-world agricultural production into digital information or data that can be processed in a virtual world through various means. The information categorizes that Internet of Things for Agriculture collects is:

- Agricultural sensor information: temperature, humidity, pressure, gas concentrations and vital signs, etc.
- Agricultural products attribute information: name, model, feature and price, etc.
- Agricultural working status information: operating parameters of apparatus, equipment, etc.
- Agricultural location information: location of products, etc.

The main task of Information collection layer is to mark the various kinds of information, and collect the marked information and the physical information in the real world by sensing techniques, and then transform them to digital information for processing. Information collection layer involves these techniques: two-dimension code labels and readers, RFID tags and readers, cameras, GPS sensors, terminals, cable networks, sensor networks and wireless networks.

2. Transport/Network Layer: The main task of this layer is to collect and summarize the agricultural information acquired through Sensor Layer for processing. Transport Layer is the nerve centre and cerebra of Internet of Things for Agriculture, transmitting and processing data. The

network layer includes the integration of the Internet network and telecommunication, network management centre, information centre and intelligent processing centres. 3. Application Layer: The main task of this layer is to analyze and process the information collected to cultivate digital awareness of the real world. It is a combination of IoT and Agricultural Market intelligence.

6. Benefits of IoT

In Agriculture, the following are the benefits of IoT applications:

1. Improvement in the use efficiency of inputs (Soil, Water, Fertilizers, Pesticides, etc.)
2. Reduced cost of production
3. Increased profitability
4. Sustainability
5. Food safety
6. Protection of the environment.

7. CONCLUSIONS

With the Internet of Things, single farmers may be able to deliver the crops directly to the consumers not only in a small region like in direct marketing or shops but in the broader area. This will change the whole supply chain, which is mainly in the hand of large companies, now, but can change to a more direct, shorter chain between producers and consumers. Cloud Computing would enable the corporate sector to provide all the necessary services at an affordable cost to farmers in rural areas.

REFERENCES

[1] Patil V.C, AI-, GaadiK.A, Biradar D.P, Ranagswamy M,2012, Internet of Things (IOT)and cloud computing foran agriculture-An overview, Preceding's ofAIPA 2012, INDIA.

[2]Chui, M., Loffler, M. and Roberts, R., 2010, The Internet of Things. McKinsey Quarterly, March 2010. Global ICT Standardization Forum for India. www.gisfi.org.

[3]Hori, M., Kawashima, E. and Yamazaki, T., 2010, Application of cloud computing to agriculture and prospects in other fields. Fujitsu Science and Technology Journal, 46(4): 446–454.

[4] Kamath, S. and Chetan, A.A., 2011, Affordable, interactive crowdsourcing platform for sustainable agriculture: Enabling public-private partnerships. Cloud Computing Journal, April 2011.

[5] Sundmaeker, H., Guillemin, P., Friess, P. and Woelfflé, S., 2010, Cluster of European Projects on the Internet of Things: Vision and Challenges for realizing the Internet of Things. European Commission—Information Society and Media DG, Brussels.

[6] White, B. and Maganti, P., 2010, Cloud computing at MBR-Indian rural business opportunities. www.mbrmart.com/mbrdocument/CloudComputing_study_paper.doc.

[7] Vani P.D., Rao K.R. Measurement and monitoring of soil moisture using cloud IoT and android system. Indian J. Sci. Technol. 2016; 9:1–8.

[8] Shahzadi R., Tausif M., Ferzund J., Suryani M.A. Internet of things based expert system for smart agriculture. Int. J. Adv. Comput. Sci. Appl. 2016; 7:341–350.

[9] Joshi, A., Ali L. A Detailed Survey on Auto Irrigation System; Proceedings of the IEEE Conference on Engineering Devices and Smart Systems; Tamilnadu, India. 3–4 March 2017.

[10] Yiming Zhou, Xianglong Yang, Liren Wang, Yibin Ying, A wireless design of low-cost irrigation system using ZigBee technology, International Conference on Networks Security, Wireless Communications and Trusted Computing, IEEE 2009.

[11] Zhang Xihai, Zhang changli Fang junlong. Smart Sensor Nodes for Wireless Soil Temperature Monitoring Systems in Precision Agriculture 2009.

Author-

SAMEER SWAIN Completed his Bachelors of Technology Degree in Electrical and Electronics Engineering from GANDHI ENGINEERING COLLEGE under BIJU PATNAIK UNIVERSITY OF TECHNOLOGY (BPUT),ROURKELA, ODISHA on 13th AUGUST 2020.

BHABANI SANKAR PATI Completed his Bachelors of Technology Degree in Electrical and Electronics Engineering from GANDHI INSTITUTE OF EXCELLENT TECHNOCRATS under BIJU PATNAIK UNIVERSITY OF TECHNOLOGY (BPUT), ROURKELA, ODISHA on 13TH AUGUST 2020

Mrutyunjay Senapati completed his B. Tech degree in EEE from The Techno School, Bhubaneswar in the year 2010 and completed his MTech degree in Power system & control Engineering from CUTM, Bhubaneswar in the year 2014. Before it, he worked as an Asst. Professor in the Dept. of EEE in at KEC, Bhubaneswar from 2010 to 2011.Now he is working as a Sr. Asst. Professor in the Dept. of Electrical Engineering at GIET, Ghangapatna, Bhubaneswar since 2011 onwards.