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IOT BASED SMART AGRICULTURE RESEARCH OPPORTUNITIES AND CHALLENGES

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Abstract: The growth potential for the embedded industry is enormous. And the path forward is becoming clearer every day. Ites time that we start building IOT systems, and provide value to our customers. The IoT is expected to connect 28 billion things. to the internet by 2020, ranging from wearable devices such as smart watches to automobiles, appliances, and industrial equipment. Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nations capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. 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. In this paper author gives various opportunities and challenges in the field of IoT based smart agriculture.

Index Terms: IoT, Agricultural Field Monitoring, automation, Wi-Fi, RFID, IPv6,Wireless Sensor Network

I. INTRODUCTION

The term of Internet of Things (IoT) was first invented in 1998 which is a network of networks where typically, a large number of objects or sensors are connected through communications and information infrastructure to provide value-added services. It assured in creating a world where all the objects around us are connected to the internet and therefore the communication to each other with minimal human intervention. The ultimate aim is to create a better world for human beings, where the objects around us understand our desire and hence act accordingly without any explicit instructions.[4] All these things have certainly changed the entire look of the word =connectivity. Internet of Things is highly on the rise and it can be observed from the areas that are completely under its effect. From smart cities, environment, health, energy, vehicle, transport, public safety to our daily essentials, Internet of Things has completely revitalized these areas [6]. Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of countrys economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by au-tomatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield. Most of the papers signifies the use of wireless sensor network which collects the data from different types of sensors and then send it to main server using wireless protocol. The collected data provides the information about different environmental factors which in turns helps to monitor the system [7]. Internet of things (IoT), is a cloud of interconnected physical devices, which can communicate with each other over the Internet. Physical devices such as microcontrollers, microprocessors, actuators, and sensors will not directly communicate with the Internet; they do so by using an IoT gateway. This entire infrastructure is known as IoT infrastructure. For example we can take a Home Lighting System, where all the switches are been connected to the main controller which is connected to the internet. The smart farm, embedded with IoT systems, could be called a connected farm, which can support a wide range of de-vices from diverse agricultural device manufacturers. Also, connected farms could provide more intelligent agriculture services based on shared expert knowledge [8].

II. RELATED WORK

Farm management deals with the organization and operation of a farm with the objective of making a livelihood whilst dealing with global trade, traceability and consumer requirements, agricultural policies, environmental requirements, and the multi-functionality of agricultural enterprise as a whole. A Farm Management Information System (FMIS) is a system for collecting, processing, storing and disseminating of data in the form of information needed to carry out the operations functions of the farm (Salami and Ahmadi, 2010). These functions include strategic, tactical and operational planning, implementation, and documentation, assessment and optimization of the performed work on the fields or on the farms. To improve the execution of these functions, various management systems, database network structures and software architecture have been proposed to serve these purposes (Beck, 2001; Nikkil et al., 2010; Srensen et al., 2010 [7]. The paper consist of four sections; node1, node2, node3 and PC or mobile app to control system. In the present system, every node is integration with different sensors and devices and they are interconnected to one central server via wireless communication modules. The server sends and receives information from user end using internet connec-tivity. There are two modes of operation of the system; auto mode and manual mode. In auto mode system takes its own decisions and controls the installed devices whereas in manual mode user can control the operations of system using android app or PC commands [3].

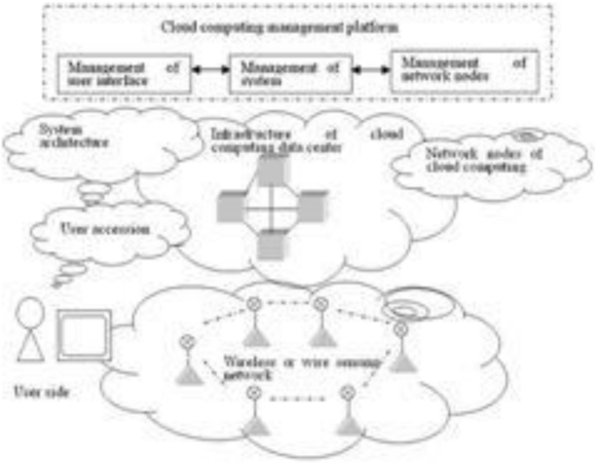

Figure 1. The principle of cloud computing for IOT

The IOT definition changes as the time of cloud computing comes. Now it is defined as the IOT =cloud computing + intelligent sensing network+ubiquitous net-work. Cloud computing management is the brain of cloud computing and the relevant data. It involves the management of accession of cloud computing customization application by users of the IOT, computing and processing what is involved in customization service; organizing and coordinat-ing the service nodes in the data center. Ubiquitous network includes the 3G, LTE, GSM, WLAN, WPAN, Wi Max, RFID, Zigbee, NFC, bluetooth and other wireless commu-nication protocol technology. It also includes optical cable and other wire communication protocol and new technology. The principle of cloud computing for IOT is shown in fig 1 [4]. In the studies related to wireless sensor network, re-searchers measured soil related parameters such as tem-perature and humidity. Sensors were placed below the soil which communicates with relay nodes by the use of effective communication protocol providing very low duty cycle and hence increasing the life time of soil monitoring system. The system was developed using microcontroller, univer-sal asynchronous receiver transmitter (UART) interface and sensors while the transmission was done by hourly sampling and buffering the data, transmit it and then checking the status messages. The drawbacks of the system were its cost and deployment of sensor under the soil which causes attenuation of radio frequency (RF) signals. [5]

III. SMART AGRICULTURE

The world agriculture is undergoing industrialization, it is important to develops agricultural interdenominational same time. The Agricultural intercolumniation has become the trend of development for the world agriculture. As far as Ideas agricultural development is concerned with, the agricultural intercolumniation is a major force promoting the agricultural development and transformation and a cor-ner stone for maintaining sound and sustaining economic development. In a past few years , we have been focus-ing on agricultural information service and infrastructure development. After many years of hard efforts, remarkable results had seen in agricultural infrastructure development. These infrastructure provided to foundation for agricultural information service. However, the problems still exist in Indias agricultural information. For an example, we put more emphasis on hardware than software and could not provide high quality information to meet the production needs of farmers. Moreover, information is not sufficiently used by farmers and the effect of information on agriculture, farmers and rural area is not that notable. To change this situation and promote fast development of agricultural inter-columniation, it is now necessary to use the cloud computing and visualization technology to constructs agricultural infor-mation cloud[10],which combines the IOT technology and RFID technology, so we have to realize smart agriculture.

The agroecological environment control subsystem in-cludes: (1) Water quality monitoring, automatic improve-ment of water quality (2) Accurate fertilization saves fertil-izer (3) Monitor soil constituent, soil humidity, light, wind, air, etc.

The agricultural resource control subsystem includes:
(1) Intelligent greenhouse that allows automatic adjustment of temperature (2) Water irrigation that can automatically control flow and save water (3) Scientific disease and pest monitoring

The production process control subsystem includes: (1) Identification of individual animals allows healthy cultiva-tion (2) Monitoring of animal and plant growth (3) Product sorting guarantees quality

3.1. Challenges in IoT based Agriculture

This section discusses some of the major challenges that need to be addressed in order to build the IoT. The solutions for these issues need to be come from technological, social, legal, financial, and business backgrounds in order to receive wide acceptance by the IoT community [9]. Standards and inter operability : Standards are important in creating markets for new technologies. If devices from different manufacturers do not use the same standards, interoperability will be more difficult, requiring extra gateways to translate from one standard to another. In addition, a company that controls different parts of a vertical market (e.g. the acquisition of data, its integration with other data streams, and the use of those data streams to come up with innovative solutions or to provide services) may dominate a market, stifling compe-tition and creating barriers for smaller players and entrepreneurs. Differing data standards can also tend to lock consumers into one family of products: if consumers cannot easily transfer their data when they replace one device with another from a different manufacturer, they will in effect lose any benefit from the data they have been accumulating over time [3]. Security : As the IoT connects more devices to-gether, it provides more decentralized entry points for malware. Less expensive devices that are in physically compromised locales are more subject to tampering. More layers of software, integration middleware, APIs, machine-to-machine communica-tion, etc. create more complexity and new security risks. Expect to see many different techniques and vendors addressing these issues with policy-driven approaches to security and provisioning [3]. Evolving architectures, protocol wars and com-peting standards : With so many players involved with the IoT, there are bound to be ongoing turf wars as legacy companies seek to protect their proprietary systems advantages and open systems proponents try to set new standards. There may be multiple standards that evolve based on different requirements determined by device class, power requirements, capabilities and uses. This presents opportunities for platform vendors and open source advocates to contribute and influence future standards. [7]

IV. CONCLUSION AND FUTURE DIRECTIONS

The IOT is related to cloud computing in a way that IOT obtains powerful computing tools through cloud computing and it finds the best practicing channel based on IOT. Agricultural information cloud is constructed based on cloud computing and smart agriculture is constructed with com-bination of IOT and RFID. Its main characteristics include apart from the support of the typical farming procedures, the seamless support and integration of different stake hold-ers and services, interworking with the networked infras-tructures and the introduction of autonomic and cognitive elements in the overall management process.The potential of the IoT appears to be great, despite the range of issues that need to be Addressed. This paper has sought to highlight the IoT concept in general through the four sections namely. The IoT based architecture also offers real time realization and analysis of data which can be used across the globe in conjunction with the parameter been monitored through other parts of the world to understand the abnormal behavior of the similar kind of the crop. Our result shows that the proposed system has a very optimal latency for controlling the system as well as high packet delivery rates and accuracy for mitigating the data. The system can further been im-proved by incorporating new self learning techniques which could deployed in the cloud to understand the behavior of the sensing data and can take autonomous decisions.

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