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Iot In Modern Agriculture

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Abstract: *The Internet of Things (IoT) describes a global network of intercommunicating devices which integrates the ubiquitous communications, constant computing and ambient intelligence. The interconnection of the abundance of communication standards residing within the IoT through hybrid/integrated architectures to form a large-scale, heterogeneous and distributed network of objects is the core of the IoT vision and its most pressing difficulty. Now a days, IoT is most useful in several real time applications and agriculture is one of the important fields to improve as it is the backbone of a developing nation. In a previous couple of decades, there is fast development in innovation of checking agricultural parameters keeping in mind the end goal to enhance the farm field. Different rural parameters like light, soil moisture, temperature, and humidity and so on, are checked and controlled by observing and controlling units. In present day greenhouses, the cabled estimation point is little hard to relocate once they are introduced and in addition it makes the system costly and vulnerable. This work surveys some of this observing framework and may enable the farmer to think about pertinent agricultural parameters to enhance the homestead field.*

Keywords*: IoT, Green house, distributed networks, WSN, agriculture.*

I. Introduction

Farming is an essential part in India's economy. More than 58 percent of the population in the country relies upon farming as their essential methods for business. According to the advised estimates by the Central Statistics Office (CSO), the offer of agriculture and associated areas is assessed to be 17.3, percent of the Gross Value Added (GVA) during 2016-17 at 2011-12 costs. Hence advancement in this field turned into a test to the specialist and creating numerous more systems to yield crop even in any season. The idea of polyhouse is produced relying upon this parameter and still there is a need of mechanical improvement in this field [1].

Precision agriculture is an innovative technology, wherein the yields are developed in controlled environment. Underscoring the need of precision farming, an electronic system is intended to give warm solace to the yields of polyhouse environment, wherein ubiquitous technology, Wireless Sensor Network (WSN) is conveyed. To understand the foundation of remote sensor organizes, a remote sensor node is planned utilizing inserted reasoning.

Benefiting promising highlights of AVR ATmega 8L microcontroller, the remote sensor node is intended to screen the warm status of the polyhouse condition in spatio-worldly space. The accuracy temperature sensor LM35 is utilized to peruse the warm status. In addition, the signal conditioning circuit is wired about TLC 271, which works on one power supply just and displaying high information impedance with rail to rail include. An analog signal is digitized with on chip analog to digital (A/D) converter with 10 bit resolution. The controlling unit is intended to actuate the warmer and also ventilators. To ensure wireless communications, the Zigbee display from Digi Corporation is conveyed as RF module. The sensor nodes are aligned to the genuine unit and its execution is affirmed by contrasting the outcomes and standard advanced thermometer. Every sensor node is doled out with network ID and it discusses the information with the individual ID in star topology. The present remote sensor organize is conveyed in the polyhouse to screen warm status. It works persistently and correctly to hold control on temperature of the space with awesome reliability [1, 2].

The Internet of Things (IoT) is an overall system of intercommunicating devices. It coordinates the ubiquitous communications, invasive computing and ambient intelligence. IoT is where ‘things’, particularly ordinary items, for example, every single home machine, furniture, garments, vehicles, streets and brilliant materials, and so forth are decipherable, conspicuous.

Procedures of AIPA 2012, INDIA Internet of Things (IoT) and Cloud Computing for Agriculture: An Overview 293 locatable, addressable and as well controllable by means of the Internet. This will give the premise to numerous new applications, for example, energy monitoring, transport safety systems or building security. These visions will most likely change with time, particularly as synergies between Identification Technologies, Wireless Sensor Networks, Intelligent Devices and Nanotechnology will empower various propelled applications. Imaginative utilization of advances, for example, RFID, NFC, ZigBee and Bluetooth, are adding to make an incentive for stakeholders of IoT. The IoT will interface the world's objects in both sensory and intelligent manner through consolidating mechanical advancements in thing identification (labeling things), sensors and wireless sensor networks (feeling things), embedded systems (thinking things) and nanotechnology (contracting things). In 2005, Wal-Mart and the U.S. Division of Defense requested that their real temporary workers and providers stamp their shipments with RFID labels for stock control. The blast of the RFID showcase in 2005 denoted the beginning of the reasoning about the Internet of Things. As per SRI Consulting Business Intelligence, the advances of the Internet of Things are the accompanying:

• **Enabling Building Blocks:** The accompanying technologies straightforwardly add to the improvement of the IoT: Machineto-machine interfaces and conventions of electronic communications, Microcontrollers, Wireless communications, RFID technologies, Energy harvesting technologies, Sensors, Actuators, Location technology (GPS), Software.

• **Synergistic Technologies:** The accompanying technologies may increase the value of the IoT: Geo-labeling/geo-storing, Biometrics, Machine vision, Robotics, Augmented reality, Mirror worlds, Telepresence and adjustable autonomy , Life recorders and personal black boxes, Tangible UIs, Clean technologies 2.1 Prerequisites of IoT Applications in Agriculture.

The Accessible, Affordable, Interactive crowd sourcing platform for maintainable farming would give a way to sharing data with respect to customary sustainable agricultural methods, techniques, devices, tips, and so forth and permit interactively and offline data entry for combined data transfer. Tending to the nourishment security/water security with supportable horticulture, the arrangement must give supplementary data/administrations, for example, third-party agricultural, micro-finance services, and so forth for agriculturists. It should likewise give a brought together vault to an variety of information, for example, conventional supportable cultivating procedures, crop diseases, and so forth coming through different sources, permit intuitive cultivating, simple access to users over different devices, for example, cell phones, IVR, PCs and kiosks in addition to providing giving multi-lingual help of traditional practices with present day value.[3,4]. The system should meet the accompanying necessities:

Robust Models: The trademark highlights of horticulture segment, for example, diversity, multifaceted nature spatio-fleeting inconstancy, and vulnerabilities must be considered in building up the correct sorts of items and services.

Adaptability: The size of agricultural farms varies from small to large and henceforth the solutions ought to be versatile. The testing and arrangement occur in stages and accordingly the engineering ought to have the capacity to scale up incrementally with fewer overheads.

Affordability: Affordability is the way to progress. The cost must be suitable with significant advantages. The standardized platforms, tools, products and services can bring the cost down with expanded volumes.

Manageability: The issue of maintainability is indispensable on account of exceptional monetary weight and furious worldwide rivalry.

II. Advances for the Internet of Things

The Internet of Things is a mechanical upheaval that speaks to the fate of registering and interchanges, and its improvement relies upon dynamic specialized advancement in various critical fields, from remote sensors to nanotechnology.

Initially, with a specific end goal to associate regular articles things and devices to substantial databases and systems and in reality to the system of systems (internet) a straightforward, unpretentious and financially savvy arrangement of thing recognizable proof is vital. At exactly that point would data be able to about things be gathered and handled. Radiofrequency identification (RFID) offers this usefulness. Second, data collection will profit by the capacity to identify changes in the physical status of things, utilizing sensor technologies. Embedded intelligence in the things themselves can additionally upgrade the energy of the system by lapsing data handling abilities to the edges of the system. At last, propels in scaling down and nanotechnology implies that smaller and smaller things will be able to interact and connect. A combination of these improvements will make an Internet of Things that interfaces the world's items in both a sensory and an intelligent way.

Indeed, with the advantage of integrated data handling, industrial products and regular objects will go up against shrewd qualities and capabilities. They may likewise go up against electronic identities that can be questioned remotely, or be furnished with sensors for detecting physical changes around them, even particles as small as tidy may be labeled and organized. Such improvements will turn the only static objects of today into recently unique things, embedded intelligence in our surrounding, and animating the making of innovative products and completely new services. [3, 5, 6]

RFID technologies utilizes radio waves to differentiate things, is viewed as one of the essential empowering influences of the Internet of Things. Despite the fact that it has here and there been marked as the next generation of standardized identifications, RPID networks offer considerably more in that they can track things progressively to yield imperative data about their area and status. Early uses of RPID incorporate programmed thruway toll gathering, inventory network administration (for expansive retailers), pharmaceuticals (for the anticipation of duplicating) and e-health (for quiet observing). RPID per users are presently being installed in cell phones. Inserted insight in things themselves will disseminate preparing energy to the edges of the system, offering more prominent potential outcomes for information handling and expanding the strength of the system. This will likewise engage things and devices at the edges of the system to take free choices. Smart things are hard to characterize, yet suggest a specific handling force and response to outer jolts. Advances in smart homes, smart vehicles and individual mechanical autonomy are a portion of the main regions. Research on wearable figuring (counting wearable portability vehicles) is quickly advancing. Researchers are utilizing their creative energy to grow new devices and appliances, for example, intelligent ovens that can be controlled through telephones or the internet, online coolers and networked blinds [6, 7]
The Internet of Things will draw on the usefulness offered by these techniques to understand the vision of a completely intuitive and responsive network environment.

III. The Application of IoT Technology in Agriculture

The greenhouse production environment measurement and control system is an example of loT technology application in agriculture. The critical temperature, humidity and soil moisture signals are collected instantaneously in the agriculture production process, which is transmitted by wireless networks through M2M (machine to machine) support platform. It is to gain instantaneous data of agriculture production environment using SMS (Short Messaging Service), internet, WAP (wireless application protocol) pattern, so that the terminal can master the information to guide the production.

IV. The System Structure

The agriculture greenhouse production environment measurement and control system is made up of terminal link, business link and M2M support platform. Wire sensors can connect with communication terminal directly and then communicate with M2M support platform. Wireless sensors can communicate the M2M support platform through Radio Frequency. Operation management is accuse of the service support platform and the agriculture production monitoring system can get the greenhouse instantaneous data which can send to the mobile terminal through SMS gateway. The structure of agriculture greenhouse production environment measurement and control system is shown as in Fig. 1.

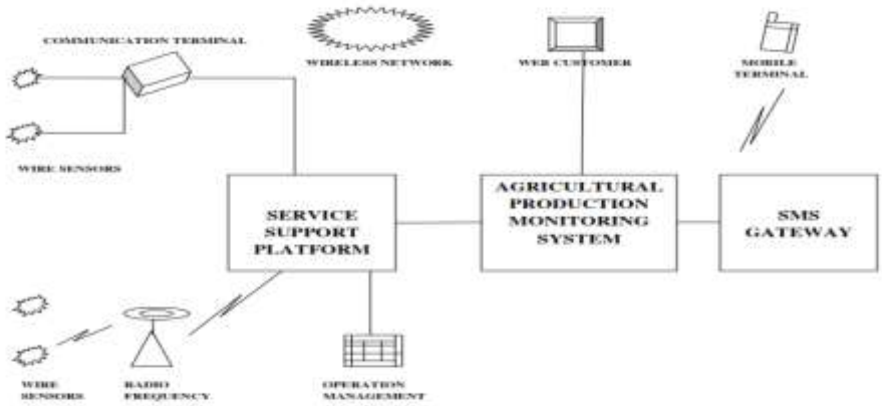

Fig1 Control System Architecture for Monitoring Agriculture production

V. Selection and Design of Hardware

The terminal connection is comprised of wireless communication terminal and collection of sensors. The sensor can get the greenhouse creation ongoing information, for example, temperature signal and humidity signal. The estimation of these physical factors can change into a low-voltage electrical signal through the transmitter and the transmission to the wireless communication terminal. The temperature and humidity sensor can measure the greenhouse temperature and humidity, the normal value is shown in Fig.2 [11, 12].

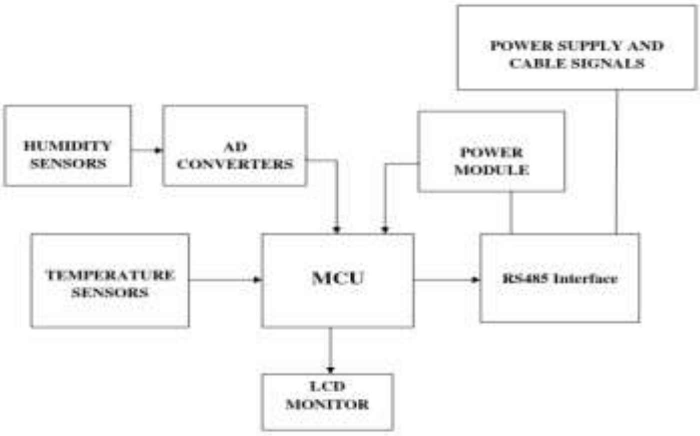

Fig.2 MCU based Sensor Data Measurement

The system software incorporates site monitoring system data acquisition software, remote data acquisition receiver software and web application software. The site monitoring system data acquisition includes user interface module, network communication module, data collection module, data processing module and system configuration module. Remote data acquisition receiver is consists of user interface module, network communication module, system configuration module and database access module, which can communicate with the site monitoring system data acquisition software through the network communication module with TCP/IP protocol. The web application software include three parts of user authentication, data access, data query and download, which access the database through ADO.NET and the remote data acquisition can communicate with the database through ADO.NET. The user terminals can get the ongoing observing information from the web page [13].

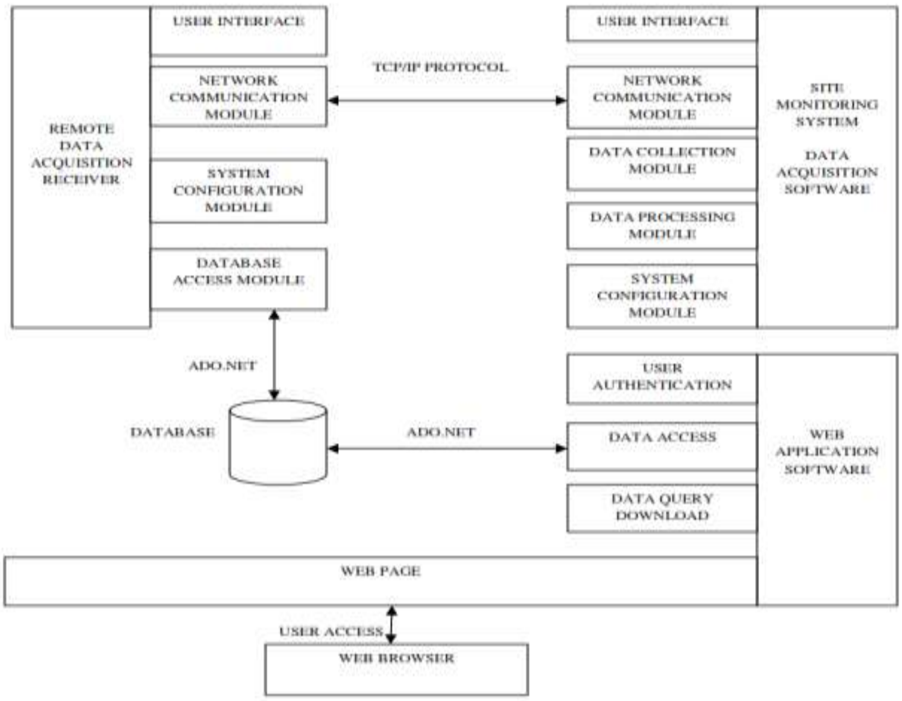

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Fig.3 Functional Structure of the System

The parts of a business for customers take after the directing belief system of straightforward, clear, engaged and intended to indicate portable. It demonstrates customer's data in a page and the data incorporate every green house and for every location point constant information of air temperature and humidity, soil temperature, 24-hour, seven days, or a month's bend et cetera. Customers can set alert alarm value and the information can be sent to the customer's mobile phone by means of SMS when the information is more than caution esteem. Customers are allowed to set the number of terminals and get SMS alarms to cell phone number. The detail functional structure of the system is given in Fig.3. Administration stage is additionally saved for the portable exposure window, can be incorporated climatic condition, agriculture information and advertising [14]. .

VI. Result Analysis

The environmental parameters such as temperature, humidity and soil moisture were recorded from various environments and compared at against the lower and upper optimal respective values. It was known that most of the time values from the open field and greenhouse were lower or higher than the optimal levels with the greenhouse including more values inside the required optimal levels. The values within the optimal range were never changed as opposed to the ones exceeding the limits [15].

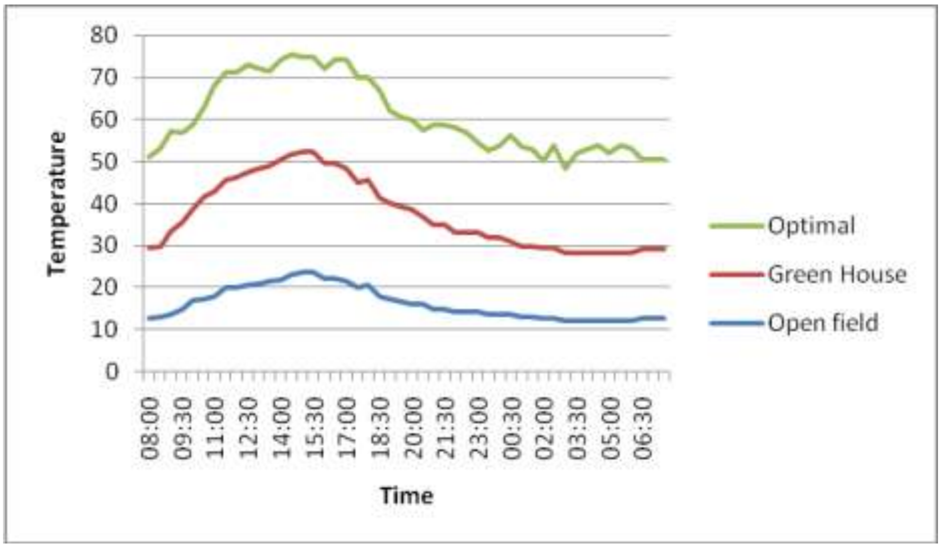

Fig. 4 Comparing Temperature of Open field, Greenhouse and Optimal Temperature

There were more greenhouse temperature values that fell inside the set optimal temperature level when compared with those from the open field. Temperature ascended as from 8.00 a.m. up to around 3.00 p.m. This happened in light of the fact that the sunlight based was up as right on time as 7.00 a.m. what's more, begun to fall towards the evening (Fig.4) [14,15].

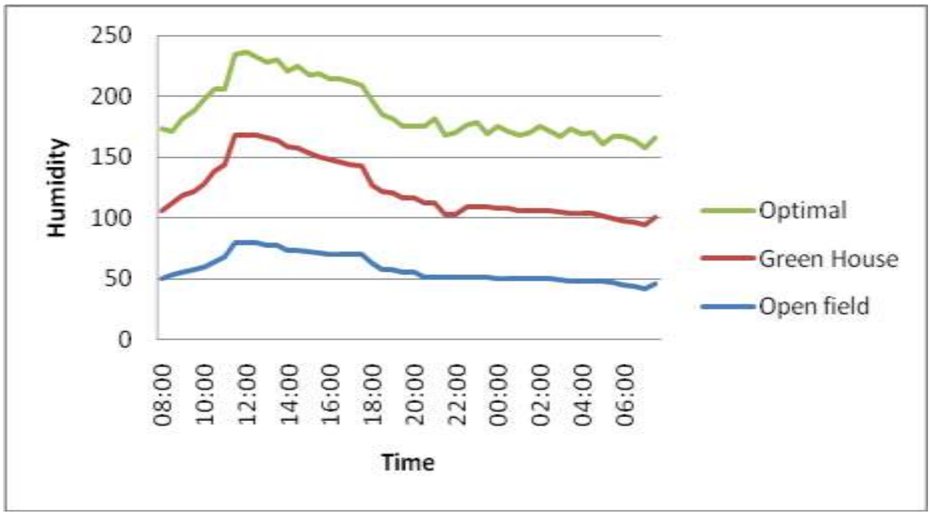

Fig. 5 Comparing Humidity of Open field, Greenhouse and Optimal Humidity

Most greenhouse humidity values fell within the set optimal humidity level as compared to those from the open field. Humidity started to rise as from 11.00 a.m. This happened because tomatoes were irrigated at 10.00 a.m. and the sun was already up resulting to a rise in humidity (Fig .5) [14, 15].

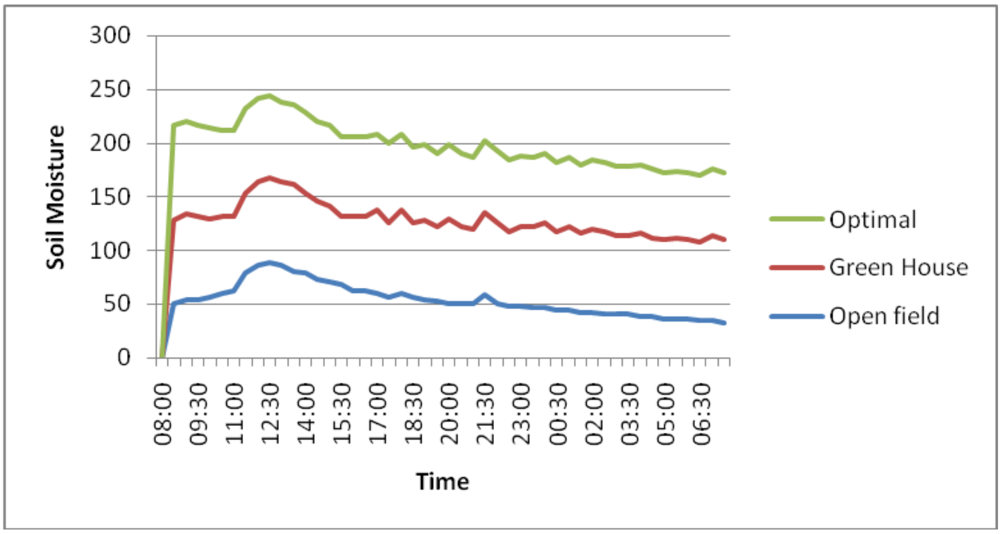

Fig. 6 Comparing Soil Moisture of Open field, Greenhouse and Optimal Soil Moisture

Most greenhouse soil moisture values fell within the set optimal soil moisture level as compared to those from the open field. The soil moisture started to rise as from 10.30 a.m. This happened because tomatoes were irrigated at 10.00 a.m. and the sun was already up resulting to a rise in soil moisture levels. This continued to fall for the rest of the day as tomatoes were not irrigated again (Fig. 6) [14, 15].

VII. Conclusions

The text has studied on the loT technology application in agriculture, and selected mobile wireless communication technology to achieve greenhouse-site monitoring. Remote monitoring system with internet and wireless communications combined is proposed. At the same time, taking into account the system management, information management system is designed. The collected data by the system provided for agricultural research and management facilities. Research shows the greenhouse monitor system based on loT technology has certain precision of monitor and control. According to the need surrounding monitor, this system has realized the automatic control on the environmental temperature, humidity factors. And the system has offered a good growth condition, it is easy to operate, the interface is friendly, offering the real time environmental factors in the greenhouse. It can revise environmental control parameters, the system realize the operation online and also have these characteristics: run reliably, high performance, improve easily.

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