Smart Farming: Present and Future

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Abstract: **- In India regarding 70% of population depends upon farming and one third of the nation's capital comes from farming. Problems regarding agriculture are continually prevent active the event of the country. The sole answer to the present downside is wise agriculture by modernizing the current ancient ways of agriculture. Therefore the paper aims at creating agriculture sensible mistreatment automation and IoT technologies. The Wireless Sensors Network (WSN) is wide wont to build call support systems. The main advantage is implementation of WSN in Precision Agriculture (PA) can optimize the usage of water fertilizers whereas increasing the yield of the crops and conjointly can facilitate in analyzing the climatic conditions of the sector. This system includes varied options like GPS primarily based remote controlled observation, wet & temperature sensing, intruders scaring, security, leaf condition and correct irrigation facilities. It makes use of wireless sensing element networks for noting the soil properties and environmental factors ceaselessly.**

Key Words **— Internet of Things, Sensors, Wireless Sensor Network (WSN), Precision Agriculture (PA)**

I. INTRODUCTION

Internet of things (IoT) is a cloud of interconnected physical devices, which can communicate with each other over the Internet. [2] Internet of Things is a broad term that describes the interconnection of different daily life objects through the internet. In the concept of IoT every object is connected with each other through a unique identifier so that it can transfer data over the network without a human to the human interaction. [3] India is agriculture oriented country. 69% of Indian population has agriculture as their main occupation or side business. [5] Most projects signify the use of wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. There are number of other factors that decrease the productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems. [1] 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. We have used Temperature sensor, PIR sensor, Humidity sensor, Soil moisture sensor, PH sensor, Water level sensor, and Obstacle sensor. These sensors have been installed in the agriculture field to collect the data, and thus data is mitigated into the cloud with the help of IoT hub (Thingspeak). [2] 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.

This paper aims at making agriculture smart using automation and IoT technologies. [4] The advancement in the technology will help farmers increase the crop gain. The new concepts in the technologies now a days are (i)Internet of Things (IoT) (ii) Wireless Sensor Network (WSN) (iii)Precision Agriculture (PA). Also with the use of sensor, application on the mobile phones and the transfer of useful data generated by the system will make it easy to use. [5] Applications in agriculture include soil and plant monitoring, greenhouse environ monitoring and control systems, monitoring of food supply chain, monitoring of animals, etc.[7] In this system we use various sensors for measuring the status of the soil. The pH sensor, humidity sensor, water level sensor and moisture sensor are the sensors which measures the status of the soil. The pH sensor measures the acidic or basic nature of the soil. The moisture sensor is used to measure the volumetric water content in the soil. The humidity sensor measures the amount of water vapour in the air. The water level sensor measures the water level. The analog signals are sending to the microcontroller and process. [8]

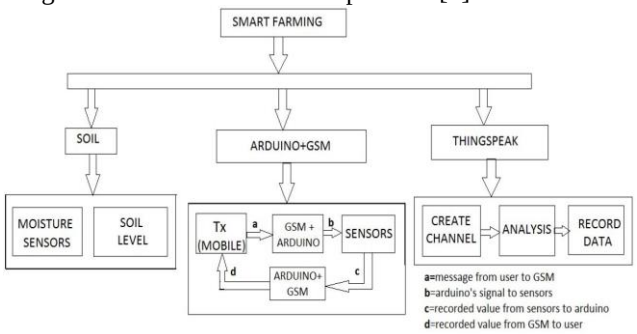


Fig.1: Block Diagram of Smart Farming

II. CONCEPT OF 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/or controllable via the Internet. Internet of Things will connect the world's objects in both a sensory and intelligent manner through combining

technological developments in item identification, sensors and wireless sensor networks, embedded systems and nanotechnology.

This will provide the basis for many new applications, such as Energy monitoring, transport safety systems or building security. This vision will surely change with time, especially as synergies between Identification Technologies, Wireless Sensor Networks, Intelligent Devices and Nanotechnology will enable a number of advanced applications. Innovative use of technologies such as RFID, NFC, ZigBee and Bluetooth, are contributing to create a value proposition for stakeholders of IOT. In 2005, Wal-Mart and the U.S. Department of Defense demanded that their major contractors and suppliers mark their shipments with RFID tags for inventory control. The explosion of the RFID market in 2005 marked the dawn of the thinking about the Internet of Things. [7]

III. LITERATURE SURVEY

The existing method and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method the farmers they themselves verify all the parameters and calculate the readings. This idea proposes a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology. [1] Monitoring of soil moisture and groundwater levels using ultrasonic waves to predict slope failures used an ultrasonic waves to predict the slope failures when there is a heavy rainfall, and they have used a method of monitoring of soil moisture has used wireless sensor networks to design the monitoring of agriculture, at the same time the system is based on the real time monitoring of agriculture environmental information such as temperature, humidity and the light intensity. WSNs also help to know the real time data related to the agricultural field and the condition of the crop, so the farmers can make sure that they are ready to face the future conditions related to their agricultural field. [2] The technological development in Wireless Sensor Networks made it possible to use in monitoring and control of greenhouse parameter in precision agriculture. After the research in the agricultural field, researchers found that the yield of agriculture is decreasing day by day. However, use of technology in the field of agriculture plays important role in increasing the production as well as in reducing the extra man power efforts. Some of the research attempts are done for betterment of farmers which provides the systems that use technologies helpful for increasing the agricultural yield. [4] Increase in number of sensors is suggested by the author to improve the accuracy of the data collected. However it might raise the issue of more power consumption as more nodes has been deployed. Approach to provide the real time information to the farmers about the land and crops is defined in the paper. In the year of 2017 concepts of IoT, cloud-computing, Mobile computing are used in smart agriculture in paper. [5]

IV. PROPOSED WORK

In the field section, various sensors are deployed in the field like temperature sensor, moisture sensor and PIR sensor. The data collected from these sensors are connected to the microcontroller through RS232. In control section, the received data is verified with the threshold values. If the data exceeds the threshold value the buzzer is switched ON and the LED starts to blink.

This alarm is sent as a message to the farmer and automatically the power is switched OFF after sensing. The values are generated in the web page and the farmer gets the detailed description of the values. In manual mode, the user has to switch ON and OFF the microcontroller by pressing the button in the Android Application developed. This is done with the help of GSM Module.

In automatic mode, the microcontroller gets switched ON and OFF automatically if the value exceeds the threshold point. Soon after the microcontroller is started, automatically an alert must be sent to the user. This is achieved by sending a message to the user through the GSM module. Other parameters like the temperature, humidity, moisture and the PIR sensors shows the threshold value and the water level sensor is used just to indicate the level of water inside a tank or the water resource.[1]

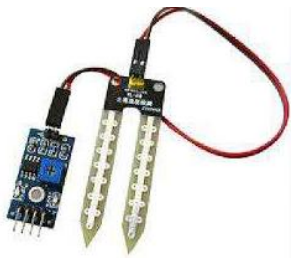
Therefore, considering the current need of agriculture and previous drawbacks we propose a system which integrates the control of all the deployed systems in a single system. This will make it easy to handle and better understanding of the results by naive users. As well as it will keep the farmer updated by the notifications for almost every related event that occurs in the field. [5]

V. PROPOSED HARDWARE

1) GSM MODULE:

GSM Modem can accept any GSM network operator SIM and it can act just like a mobile phone with its own unique phone number. The necessity to use this is it can use RS-232 protocol which can be easily connected to the controller. It can be used like a phone where it can send and receive SMS and make a call. The SMS is sent through the terminal to the numberusing AT Commands.It is operated in 900/1800 MHz. [1]

2) SOIL MOISTURE SENSOR:



Soil moisture sensor is a sensor which senses the moisture content of the soil. The sensor has both the analog and the digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principle of open and short circuit. The output is high or low indicated by the LED. The sensor is platinum coated to make the efficiency high. The range of sensing is also high. [1]

3) TEMPERATURE SENSOR:

The LM 35 sensor is highly used because its output voltage is linear with the Celsius scaling of temperature. It does not provide any external trimming. It has a wide operating range. The maximum output is 5V. The output will increase 10mV for every one degree rise in temperature. The range is from -55 degrees to +150 degrees. There are three terminals as Vcc, Ground and the analog sensor. [1] The LM35 is precision IC temperature sensor. Output voltage of LM35 is directly proportional to the Centigrade/Celsius of temperature. The operating temperature range for LM35 is −55˚ to +150˚C. [4]

4) PIR SENSOR:

PIR sensors don't detect or measure heat, instead they detect the infrared radiation emitted or reflected from an object. It is used to detect the movement of people, animals or other objects. They are commonly used in burglar alarms and automatically activated lighting systems. When a human passes in the field, the temperature at that point will rise from room temperature. The sensor converts the resulting change into a change in the output voltage and this triggers the detection. [1]

5) HUMIDITY SENSOR:

The DHT11 is a basic, low-cost digital temperature and humidity sensor. It gives out digital value and hence there is no need to use conversion algorithm at ADC of the microcontroller and hence we can give its output directly to data pin instead of ADC. It has a capacitive sensor for measuring humidity. The only real shortcoming of this sensor is that one can only get new data from it only after every 2 seconds. [4]

6) OBSTACLE SENSOR (ULTRA-SONIC):

The ultra-sonic sensor operates on the principle of sound waves and their reflection property. It has two parts; ultra-sonic transmitter and ultra-sonic receiver. Transmitter transmits the 40 KHz sound wave and receiver receives the reflected 40 KHz wave and on its reception, it sends the electrical signal to the microcontroller. The speed of sound in air is already known. Hence from time required to receive back the transmitted sound wave, the distance of obstacle is calculated. Here, it is used for obstacle detection in case of mobile robot and as a motion detector in ware house for preventing thefts. The ultra-sonic sensor enables the robot to detect and avoid obstacles and also to measure the distance from the obstacle. The range of operation of ultra-sonic sensor is 10 cm to 30 cm. [4]

7) ZIGBEE MODULE:

ZigBee is used for achieving wireless communication between Node1 and Node2. The range for Zigbee is roughly 50 meters and it can be increased using high power modules or by using network of modules. It operates on 2.4 GHz frequency. Its power consumption is very low and it is less expensive as compared to other wireless modules like Wi-Fi or Bluetooth. It is usually used to establish wireless local area networks. [4]

8) PH SENSOR:

PH is a measure of the acidity or alkalinity of a water solution. The acidity or alkalinity of a water solution is determined by the relative number of hydrogen ions (H+) or hydroxyl ions (OH-) present. pH measurement is based on the use of a pH sensitive electrode (usually glass), a reference electrode, and a temperature element to provide a temperature signal to the pH analyzer. Although the range of pH measurements is defined to be 0 to 14 pH.

9) WATER LEVEL SENSOR:

Sensors Technology has developed analog type continuous measurement water tank water level Sensor and display. Instrument for continuous water level monitoring, display and data recording. Sensors Technology has developed analog type continuous measurement water tank water level Sensor and display instrument for continuous water level monitoring, display and data recording

10) RASPBERRY PI:

The Raspberry Pi is small pocket size computer used to do small computing and networking operations. It is the main element in the field of internet of things. It provides access to the internet and hence the connection of automation

system with remote location controlling device becomes possible. Raspberry Pi is available in various versions. Here, model Pi 2 model B is used and it has quad-core ARM Cortex-A53 CPU of 900 MHz, and RAM of 1GB. it also has: 40 GPIO pins, Full HDMI port, 4 USB ports, Ethernet port, 3.5mm audio jack, video Camera interface (CSI), the Display interface (DSI), and Micro SD card slot.[4]

VI. PROPOSED SOFTWARE

1) PROTEUS 8 SIMULATOR:

Proteus 8 is one of the best simulation software for various circuit designs of microcontroller. It has almost all microcontrollers and electronic components readily available in it and hence it is widely used simulator. It can be used to test programs and embedded designs for electronics before actual hardware testing. The simulation of programming of microcontroller can also be done in Proteus. Simulation avoids the risk of damaging hardware due to wrong design. [1]

2) AVR STUDIO VERSION 4:

It is used to write, build, compile and debug the embedded c program codes which are needed to be burned in the microcontroller in order to perform desired operations. This software directly provides .hex file which can be easily burned into the microcontroller.

3) DIP TRACE:

Dip race is EDA/CAD software for creating schematic diagrams and printed circuit boards. The developers provide multi-lingual interface and tutorials (currently available in English and 21 other languages). DipTrace has 4 modules: Schematic Capture Editor, PCB Layout Editor with built-in shape-based auto router and 3D Preview & Export, Component Editor, and Pattern Editor.

4) SINAPROG:

SinaProg is a Hex downloader application with AVR Dude and Fuse Bit Calculator. This is used to download code/program and to set fuse bits of all AVR based microcontrollers.

5) RASPBIAN OPERATING SYSTEM :

Raspbian operating system is the free and open source operating system which Debian based and optimized for Raspberry Pi. It provides the basic set of programs and utilities for operating Raspberry Pi. It comes with around 35,000 packages which are pre-compiled softwares that are bundled in a nice format for hustle free installation on Raspberry Pi. It has good community of developers which runs the discussion forms and provides solutions to many relevant problems. However, Raspbian OS is still under consistent development with an main focus on improving the performance and the stability of as many Debian packages as possible.

VII.SYSTEM ARCHITECTURE

This system has useful applications in Farm as well as Green House. The central system is the heart of this architecture, as it does half of the work of system. Central system is responsible for communications between nodes and central server and database management as well as communication with the outer world.

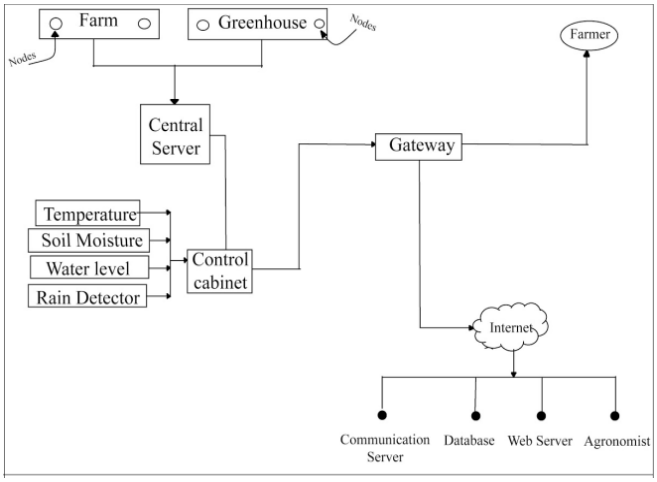


Fig 2 : System Architecture

Central System consists of three main entities those are Communication Server, Database and Web Server. Control cabinet provides the easy access to the nodes, which consists of Temperature sensor, Soil Moisture sensor, Water Level sensor, Rain detector sensor. The data sensed by the nodes is transferred to the central system by central server. Any warnings or notifications are communicated with farmer via gateway provided. Agronomist is contacted by central system in case of unusual activities.

VIII. E-AGRICULTURE PROCEDURE

1) Logic for measuring the status of the soil

To measure the status of the soil, pH sensor, humidity sensor, water level sensor and moisture sensor has been used. The pH sensor measures the acidic or basic nature of the soil. The moisture sensor is used to measure the volumetric water content in the soil. The humidity sensor measures the amount of water vapour in the air. The water level sensor measures the water level of the Sand.

2) Logic for Automatic Motor Detection

The signals are sending to the microcontroller. If there is any lack of water level in the soil, the microcontroller pumps the water to the desired level by using motor. The desired level is measured by using sensors. The information about the state of the soil is send to the database.

3) SMS Based Information

Bio-medical sensors are attached on the cultivated crops at appropriate positions to collect real time data about their land. These data are then compared to standard threshold values to check if the crop is in normal condition.if the value

has been over increased or decreased means alert SMS can send to the particular person in case of emergency by GSM.

4)Stastical Survey Information

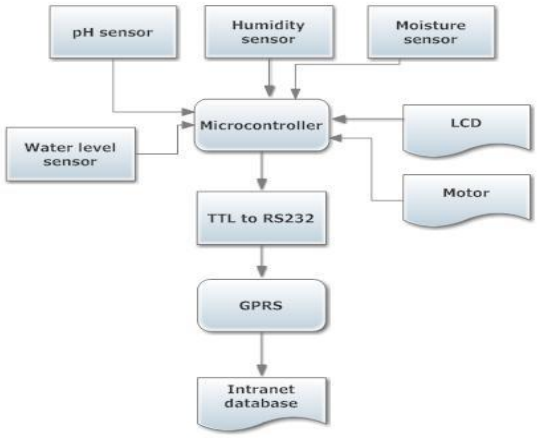


Fig 3.Block Diagram of Smart E-Agriculture

In statistical survey report, GPRS technology is used. Farmers can get the desired information through graph model at any instant of time from any part of world and they can also get the help from experts viewing their problem immediately by without moving anywhere

IX. Application Of IOT In Agriculture

There are several applications of IOT in agriculture, healthcare, retail, transport, environment, supply chain management, infrastructure monitoring, etc. Some of them are listed below:

• *Agriculture:* In agricultural IOT, farmland, agricultural machineries, and fresh agricultural products are integrated with the chips, broadband network and database systems, forming a completely new "agricultural infrastructure". IOT applications in agriculture include food traceability (RFID), soil and plant monitoring, precision agriculture, greenhouse environment.

• *Retail Management*: Retailing has many applications areas of business interest. It includes monitoring customer behavior and preferences, shelf stock tracking, context based advertising and product promotions.

• *Healthcare:* Identification of spurious drugs is a major application in healthcare area. Other application areas are personal health monitoring, telemedicine, assisted living, etc.

• *Security:* Detection of counterfeit goods, banknotes, passports Government public sector: forest monitoring, homeland security, pollution monitoring. Home security, smart home (lighting, entertainment, energy management, assistance. Sports equipment, user performance monitoring, safety etc.

1) Benefits of IOT In Agriculture

The following are the benefits of IOT applications in agriculture:

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.

X. Conclusion And Future Work

For future developments it can be enhanced by developing this system for more benefits. In the past several sensor driven network have been proposed to successfully monitor the large agriculture field. The sensors and microcontroller are successfully interfaced and wireless communication is achieved between various software. By using Internet of Things, majority of Farmers were aware about the monitoring and warning detection method in agriculture. This will facilitate the e-agriculture to assessing the performance of the farmers doing independently. It enables to provide the alert messages and statistical survey report to the farmers by irrespective of location.

XI. References

[1] Dr. N. Suma, Sandra Rhea Samson & S.Saranya. "IOT Base Smart Agriculture Monitoring System" International Journal on Recent and Innovation Trends in Computing and Communication IJRITCC, Volume: 5 Issue: 2, ISSN: 2321-8169 177 – 181, February 2017.

[2] Poojya Doddappa."IOT SENSOR NETWORK BASED APPROACH FOR AGRICULTURAL FIELD MONITORING AND CONTROL" International Journal of Research in Engineering and Technology IJRET , eISSN: 2319-1163 pISSN: 2321-7308, Volume: 05 Issue: 06 Jun-2016.

[3] Raheela Shahzadi . "Internet of Things based Expert System for Smart Agriculture" International Journal of Advanced Computer Science and Applications, IJACSA, Vol. 7, No. 9, 2016.

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

[5] Ojas Savale, Anup Managave, Deepika Ambekar, Sushmita Sathe, "Internet of Things in Precision Agriculture using Wireless Sensor Networks" International Journal Of Advanced Engineering & Innovative Technology IJAEIT, ISSN: 2348 7208, IJAEIT 2015.

[6] Hemlata Channe, Sukhesh Kothari , Dipali Kadam, "Multidisciplinary Model for Smart Agriculture using Internet-of-Things (IoT), Sensors, Cloud-Computing, Mobile-Computing & Big-Data Analysis" Hemlata Channe et al,

Int.J.Computer Technology & Applications, Vol 6 (3),374-382, ISSN:2229-6093.

[7] V.C. Patil, K.A. Al-Gaadi, D.P. Biradar and M. Rangaswamy , "INTERNET OF THINGS (IOT) AND CLOUD COMPUTING FOR AGRICULTURE: AN OVERVIEW" Agriculture 2012 (AIPA 2012).

[8] Mrs.S.Padmadevi, V.Deepigha, "Smart E-Agriculture Monitoring Using Internet Of Things" International Conference on Emerging trends in Engineering and Technology ICETET, ISSN: 2248-9622, pp.47-50.

[9] Hariharr C Punjabi, Sanket Agarwal, Vivek Khithani and Venkatesh Muddaliar. "SMART FARMING USING IOT" International Journal of Electronics and Communication Engineering and Technology (IJECET) Volume 8, Issue 1, January - February 2017, pp. 58–66.

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