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Smart Agriculture Monitoring System using IOT

Prof. V. A. Aher[1], Miss. Kadam Rutuja[2], Miss. Kadu Gauri[3], Miss. Yadav Shital[4]
Professor. Department of Electronics and Telecommunication Engineering1
Students. Department of Electronics and Telecommunication Engineering[2,3,4]
Pravara Rural Engineering College, Loni, Maharashtra, India

Abstract: *Climate changes and rainfall has been erratic over the past decade. Due to this in recent era, climate-smart methods called as smart agriculture is adopted by many Indian farmers. One of the important applications of IOT is Smart Agriculture. It reduces wastage of water, fertilizers and increases the crop yield. Smart agriculture is an automated and directed information technology implemented with the IOT (Internet of Things). IOT is developing rapidly and widely applied in all wireless environments. In this project, sensor technology and wireless networks integration of IOT technology has been studied and reviewed based on the actual situation of agricultural system. Temperature sensor, Humidity sensor and Rain sensor which senses the temperature, moisture content in the soil. A combined approach with internet and wireless communications, Remote Monitoring System (RMS) is proposed. Major objective is to collect real time data of agriculture production environment that provides easy access for cultivation and increases the crop yield. By monitoring the field using the IP address Nutrient deficiency in the soil are detected and rectified.*

Keywords: Internet of things, Wireless sensor network, Arduino, GSM Module, Smart Agriculture

I. INTRODUCTION

The word 'Agriculture' springs from the Latin word 'Ager' means Land or field and 'Culture' means cultivation. It means the science and Art of manufacturing crops and livestock for economic purpose. Agriculture is an art of raising vegetarian from the soil for the use of mankind. Agriculture is that the mile stone within the history of human civilization, thanks to agriculture man settled at particular place. Agriculture is one amongst the oldest and prime activities of the human being. It's remained a vital source of land. In spite of growing industrialization and urbanization within the world, nearly one-half working population still engaged in agriculture. In developing Countries agriculture sector has been a major source of employment and it's contributed to the economy. The fundamental aim of agriculture is to lift stronger and more fruitful crops and plants and to help them for their growth by improving the soil and supplying the water. Agriculture is a backbone of Indian economy. In India about sixty four percent of the total population is dependent on agriculture for their live food. The agriculture activities in the world are closely controlled by Physical Factors. Indian agriculture is not an exception for this, today India is facing two main problems concerned with agriculture. The first is meeting the increasing demand of food and other is supplying Agro products for ever increasing population and the second is uneven development of agriculture and changing pattern of agriculture land use. India tried to be self-sufficient in agriculture through the five-year plans. After independence by taking systematic efforts due to the unique importance, agriculture gets more and more attention in every five-year plan and top priority is given for the development of agriculture in our Country. The study of land and agriculture from the geographical point of view gained more importance after 1950. At the beginning of 1970 and later on the green Revolution brought of remarkable change in the field of agriculture, due to this India become not only self-sufficient in food grains but it could also expert a small quality of it. The process of agriculture development is not properly channelized because of uneven rainfall, unavailability of basic infrastructure facilities and unbalance allocation of resources. The green revolution is succeeded only in the areas of irrigation. In spite of lot of efforts by Government, the small farmers could not get the benefit of it. This creates a large gap between small and big farmers and imbalanced is created. To reduce this gap. Systematic planning is required for this purpose it is necessary to have the detailed information of the region. Many countries like India, majority of the population depends on farming, and its national income comes from farming. In spite of this and even the modern technology is found everywhere, the agriculture area is following the old conventional technology. Our farmers still resort to traditional methods like manual distribution of seeds, two crops per year pattern, unscientific systems of cultivation. The monsoons are irregular, and unevenness of availability of water throughout the year poses a major. problem. All this leads to inadequate yield and low productivity. The implementation of scientific methods in the field of

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agriculture can bring about radical changes in the productivity of crops, due to improved efficiency in the farming techniques. Of the various advantages that IOT brings to the table, its ability to innovate the current scenario of farming methods is absolutely ground-breaking. Mostly, we come across ideas that suggest a wireless sensor network that collects data from the various sensors present in the field and sends the data to the main central server. This method focuses on studying the environmental factors to improve crop yield. But it turns out, monitoring environmental factors alone are never adequate to increase productivity of crops since a lot of other factors have a role to play.

II. LITERATURE SURVEY

A Sustainable Agriculture System Using IOT

Ramya Venkatesan and Anandhi Tamilvanan explains about a Sustainable Agriculture System Using IOT. This work developed a system a system which will automatically monitor the agriculture fields. As well as performing live video streaming for monitoring the agriculture field from the server itself, through raspberry pi camera. The agriculture fields are monitored for environmental temperature, humidity at soil moisture sensor. IOT and wireless sensor node helps to decrease the efforts, for observing the agricultural fields. IOT also avoids the loss of agriculture parameters database and save in the storage device or cloud for long life. It also provides continuous monitoring in all places including the critical areas. Agriculture product rely on environment factory like relative humidity, PH of soil, temperature etc. The proposed system model is developed in order to get more yields by identifying the causes.

A Model for Smart agriculture using IOT

Prof K.A.Patil, N.R.Kale proposes about a model for Smart Agriculture using IOT. Climate changes and rainfall has been erratic over decade. Due to this, climate smart methods called smart agriculture is adopted by many farmers. In the existing system, village farmers may have planted the same crop for centuries, but over period, weather patterns and soil conditions and epidemics of pests and disease have been changed. By using the proposed system approach, which senses the local agricultural parameters, identify the location of sensor, transfer the data crop fields and crop monitoring. The Received updated information allows the farmers to cope with and even benefit from these changes. The Complete real-time and historical environmental information is expected to help to achieve efficient management/monitoring and utilization of resources.

Smart Agriculture System using IOT Technology

Muthu Noori Naresh, P.Muna swamy explains about the Smart Agriculture System using IOT Technology. In the existing system agriculturists used to figure the ripeness of soil and presumptions to develop certain kind of products. They didn't think about the level of water, dampness and climatic conditions. The profitability relies totally upon the last phase of the harvest in which they depend. In this proposed system, they improved the efficiency of the product which appraises the nature of the harvest. To go up against the challenges in the field, IOT is used in providing accuracy and conservative cultivation. They also used wireless sensor networks in precision Agriculture by separating the solitary plants for checking in the tens or several square feet .Also used different kinds of sensors such as Temperature sensor, Humidity sensor, Soil moisture sensor, Water level sensor and ARM processor.

IOT Based Monitoring System in Smart Agriculture

S.R. Prathibha, ANupama Hongal, M.P.Jhothi explains about the IOT Based Monitoring System in Smart Agriculture. The farmers are still using traditional methods for Agriculture, which results in low yielding of crops and fruits, so the crop yield can be improved by using automatic machineries. But by using IOT, we can expect the increase in production with low cost by monitoring the efficiency of the soil, temperature and humidity monitoring. In existing System, they used only the traditional methods for the crop yield. But in the proposed system, the combination of traditional methods with IOT and wireless sensor networks can lead to agriculture modernization. The developed System is more efficient and beneficial for farmers. The application of such system in the field can definitely help to advance the harvest of the crops and global Production.

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Smart Agriculture Monitoring System using IOT

P.Lashitha Vishnu Priya ,N.Sai Harshith ,Dr. N. V. K. Ramesh explains about the Smart Agriculture Monitoring System using IOT. The implemented framework comprises of different sensors and de-vices and they are interconnected by means of remote correspondence modules. The sensor data is been sent and received from client end utilizing Internet connectivity which was enabled in the Node MCU mo the same time. dule- an open source IOT platform. This system is used to maintain the optimal conditions of the irrigation system effectively. The data can be viewed on the Thing Speak app or any web page. The farmer can go through each and every information regarding the levels, at what time it's been functioning, any fluctuations appearing or not, whether the operations are been performed in time. The foremost function is to monitor the crop growth using digital means. This will provide the accurate values of various parameters upon which growth depends. Besides, this model will help the farmer to monitor more than one land at the same time. Monitoring through this system requires less man power, people with physical disabilities can be employed for monitoring fields.

Smart Farming using IOT

Amandeep, Arshia Bhattacharjee, PaboniDas, et.al., proposes about the Smart Farming by the aid of automation and IOT technology. We aim to implement a smart GPS based remote controlled vehicle that performs various tasks like monitoring fields to prevent thefts, scaring birds and animals, sensing soil moisture content, spraying fertilizers and pesticides, weeding, sensing soil moisture, etc. Smart irrigation, by usage of optimum amounts of water, depending on the requirement of each crop type and the soil will be executed. Finally, we plan on enforcing smart warehouse management, with temperature and humidity sensing for the benefit of the products being stored, and detection of presence of any invader who tries to steal from the warehouse. Controlling and monitoring of all these operations will be through a remote smart device with Internet connectivity and the operations will be performed by interfacing sensors, ZigBee modules, with micro-controller.

III. PROPOSED SYSTEM

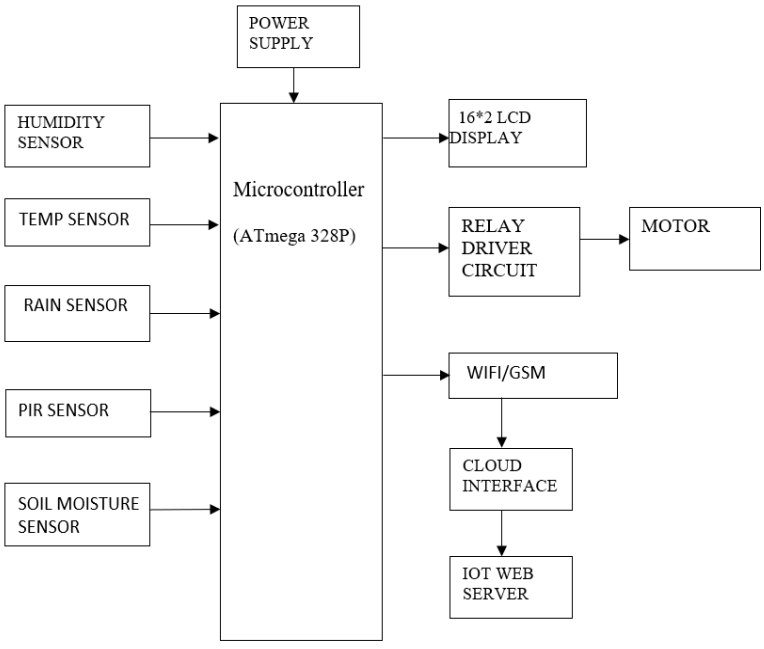

Figure 1: Block Diagram

This project presents proposed model for Smart Agriculture to develop real time monitoring system for soil properties like Temperature, Humidity and moisture, crop yield identification using SMS based Alerts. It will also be possible to control various operations of the field remotely from anywhere, anytime by mobile as well as web application. The IOT based agricultural monitoring system has been used to maximize the yield of crop by monitoring the environmental parameters and thus providing the required information to farmer remotely. This system can be implemented in any type of agricultural

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field with varying soils. The use of IOT over the other technology one aides for deploying it in any type of environment for monitoring, making it flexible and robust. The proposed system is developed for the goodwill of farmers. The system greatly reduces the human interaction, labour cost and wastage of water.

3.1 Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts117 12
- Digital I/O Pins: 14 (of which 6 can provide PWM output)
- PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)
- UART: 1 • I2C: 1
- SPI: 1 • Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader • SRAM: 2 KB • EEPROM: 1 KB

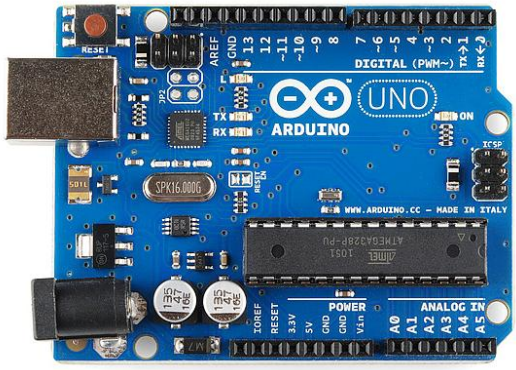

Figure 2: Arduino uno

3.2 Humidity sensor

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long-term stability. uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and outputs a digital signal on the data pin (no analog input pins needed). It's very simple to use, and libraries and sample codes are available for Arduino and Raspberry Pi. This module makes is easy to connect the DHT11 sensor to an Arduino or microcontroller as includes the pull up resistor required to use the sensor. Only three connections are required to be made to use the sensor - Vcc, Gnd and Output.

It has high reliability and excellent long-term stability, thanks to the exclusive digital signal acquisition technique and temperature & humidity sensing technology

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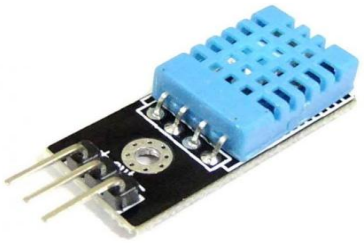

Figure 3: Humidity Sensor

3.3 GSM Module (SIM800)

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send.

A. Features of SIM800A

- Bands: GSM 850MHz, EGSM 900MHz, DCS 1800MHz, PCS 1900MHz
- GPRS class 2/10
- Control via AT commands (3GPP TS 27.007, 27.005 and SIMCOM enhanced AT command set)
- Supply voltage 3.4-4.4V
- Coding schemes: CS-1, CS-2, CS-3, CS-4 Tx power: Class 4 (2W), Class 1 (1W)
- Small package: 23 * 23 * 3mm
- Low power: down to 1mA in sleep mode.

Figure 3: GSM Module

3.4 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

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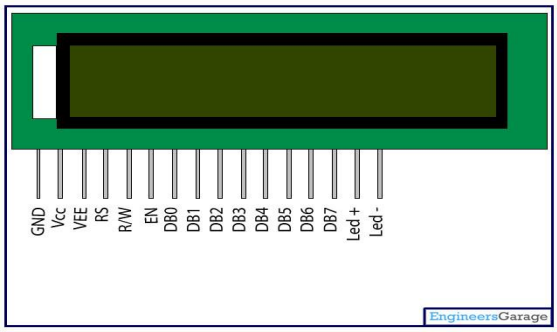

Figure 4: LCD Display

3.4 Soil Moisture Sensor

Soil moisture sensor is a sensor which senses the moisture content of the soil. The sensor has both analog and digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principal of open and short circuits. The output is high or low indicated by the LED. When the soil is dry the current will not pass through it and so it will act as open circuit. Hence the output is said to be maximum. When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short and the output will be zero.

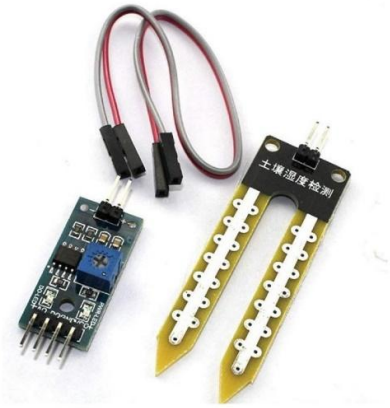

Fig. 5: Soil Moisture Sensor

3.5 Temp Sensor (LM35)

The LM35 sensor is highly used because its output voltage is linear with the Celsius scaling of temperature. It has a wide operating rang. The maximum output is 5V.The output will increase 10 mV 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. It consumes minimum amount of electricity. Thus, it is energy efficient. It is every efficient in horticulture. It is user friendly to use.

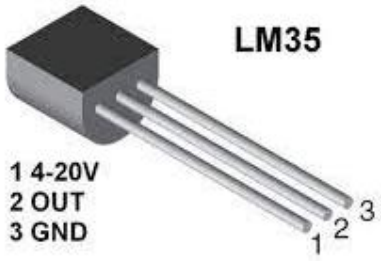

Figure 5: LM35 Temp Sensor

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3.6 IOT

Internet of Things (IoT) is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.

IoT makes virtually everything "smart," by improving aspects of our life with the power of data collection, AI algorithm, and networks. The thing in IoT can also be a person with a diabetes monitor implant, an animal with tracking devices, etc ThingSpeak is IoT Cloud platform where you can send sensor data to the cloud. You can also analyze and visualize your data with MATLAB or other software, including making your own applications. The ThingSpeak service is operated by MathWorks. In order to sign up for ThingSpeak, you must create a new MathWorks Account or log in to your existing MathWorks Account.

IV. CONCLUSION

IoT will help to enhance smart farming. Using IoT the system can predict the soil moisture level and humidity so that the irrigation system can be monitored and controlled. IoT works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management and control of insecticides and pesticides. This system also minimizes human efforts, simplifies techniques of farming and helps to gain smart farming. Besides the advantages provided by this system, smart farming can also help to grow the market for farmer with single touch and minimum effort.

This paper describes automated irrigation system using IOT. Internet on things and cloud computing collectively makes a system that control agriculture sector effectively. This system will sense all the environmental parameters and send the data to the user via cloud. User will take controlling action according to that this will be done by using actuator. This asset allows the farmer to improve the cultivation in a way the plant need. It leads to higher crop yield, prolonged production period, better quality and less use of protective chemicals.

V. FUTURE SCOPE

The project has vast scope in developing the system and making it more user friendly and the additional features of the system like:

- By installing a webcam in the system, photos of the crops can be captured and the data can be sent to database.
- Speech based option can be implemented in the system for the people who are less literate.
- GPS (Global Positioning System) can be integrated to provide specific location of the farmer and more accurate weather reports of agriculture field and garden.
- Regional language feature can be implemented to make it easy for the farmers who are aware of only their regional language.

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