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INTERNET OF THINGS BASED SMART AGRICULTURE TOWARDS MAKING FIELD TALK

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Abstract **— Internet-of-Things (IoT)-based technologies have quickly transformed practically every business, including "Smart Agriculture," which has switched from statistical to quantitative methods. Such radical developments are upending traditional agricultural practises and opening up new opportunities alongside a number of difficulties. This research demonstrates the promise of wireless sensors and the Internet of Things (IoT) in agriculture as well as the difficulties that will inevitably arise when integrating this technology with conventional farming methods. In-depth analysis is done on IoT devices and communication methods related to wireless sensors used in agriculture applications. The available sensors for various agricultural applications, including soil moisture, humidity, and plant development, are listed. We explain how this technology benefits farmers at all stages of crop production, from sowing to harvesting.**

KEYWORDS: **Smart agriculture, IOT(Internet of Things, Sensors.**

I. INTRODUCTION

India's economy relies heavily on agriculture. In terms of farm output, it is second in the world. In India, 57% to 70% of water is used for irrigation. Numerous advantages are anticipated to result from the use of cutting-edge farming tools based on technology. Humans use technology to increase food production, but a number of factors, including illness, soil fertility, and climatic change, can also have an impact. Out of these, disease has a significant impact on how food is produced. In India's economy, agriculture is significant. through preventing photosynthesis, the process through which leaves produce energy to support development and defense mechanisms and influence survival, leaf spot diseases harm trees and shrubs. 58% or more of smallholder farmers rely on.

Smallholder farmers account for more than 80% of agricultural production in the developing countries, and claims of yield losses of more than 50% due to pests and illnesses are frequent. Because of a number of problems, including illnesses on the leaves that are not caught in the early stages, productivity is reducing day by day.

Numerous projects from earlier years have been completed. Bacterial illnesses rapidly slow down a plant's growth, therefore in order to identify these conditions, a system was developed that uses image processing and color space transformation to identify the disease state of a plant without regard to the device it is being used on. early detection of the illness and advice on how to treat it to reduce crop damage to the greatest extent possible. Which pesticides to use for which type of disease is the important task gives the solution to which type of pesticides use. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land from time to time. This process sometimes consumes more water. Automatic irrigation scheduling consistently has shown to be valuable in water use efficiency with respect to manual irrigation based on direct soil water measurements. Irrigation of plants is usually a very time-consuming activity which has to be done in a reasonable amount of time; requires a large amount of human resources. All the steps were executed by humans traditionally.

Nowadays, some systems use technology to reduce the number of workers and to reduce the time required to water the plants. With such systems, the control is very limited and many of the resources are still wasted. Water is one of these resources which is used excessively. Mass irrigation is the method which is used to water the plant. This method represents massive losses since the amount of water given exceeds the plants' needs. The excess water gets discharged by the holes of the pots, or it percolates through the soil in the fields. In addition to the excess cost of water, labor is becoming more and more expensive. With the usage of this device, we can make a path for the development of agriculture. Such that the farmers are facing a huge crisis of water demand they don't get proper water from other states for their irrigation purposes as some region experience a poor rainfall. To utilize the available rainfall water effectively for irrigation purposes and an idea not investing unnecessarily on the fertilizers.

Through this, the farmers could get benefited so that our country will not lose any of the valuable products through farming. Traditional systems like humanoid scarecrows are used even today in an agricultural field to stop birds and animals from disturbing and feeding on growing crops. There are many loopholes in such ideas and so enhancing agricultural security has become a major issue these days. Thus, a system which detects the intruders, monitors any malicious activity and then reports it to the owner of the system. It acts as an adaptable system which provides a practicable system to the farmers for ensuring complete

safety of their farmlands from any attacks or trespassing activities.

Existing System

Existing Systems as a part of literature survey, In the present system, Agricultural land is controlled with few sensors such as soil moisture, humidity and temperature sensor. A soil moisture sensor detects the soil moisture content in the soil and turns on the water motor, but there is no automatic off control of the water motor. In the existing system there is no PIR sensor for motion detection. There are no other sensors such as NPK sensor and pH sensor for predicting the growth of the plant. All the factors such as soil moisture, humidity and temperature, rain prediction, security, growth of the crop as well as its fertility and detection of crop disease is not adopted in a single system so that it could provide each and every information to the farmer about his agricultural field.

Proposed system

This system includes, Smart irrigation, Protection of agriculture field, Pesticide Sprinkling Automation and Continuous monitoring control of field. The soil moisture sensor measures wet content in the soil. When soil moisture sensor goes low, the water pump will be on and it exceeds defined levels of the water motor will turn off automatically. The rain sensor is activated by rainfall, this alerts the farmer of the rainfall and it automatically interrupts the irrigation system. IR sensor detects the motion or unusual movement in the agricultural land which automatically turn on the buzzer in the field making the land protected from intruders. The NPK sensor and the pH sensor helps in determining the growth of the plant. Depending on the growth of the plant pesticide is sprinkled automatically. The NPK sensor, pH sensor, Humidity and temperature sensor all together helps in monitoring the soil fertility, growth of the plant and also can predict the yield. Crop disease will also be detected in our system which can prevent the losses in yield and quantity of agricultural product. In this system, the farmer need not to go their field, instead they can remotely monitor and control the environmental parameters along with the entire system through internet.

II. REQUIREMENT SPECIFICATIONS

Software Requirements:

1. ARDUINO Suite
2. Embedded C
3. Python

Arduino IDE:

The Arduino integrated development environment (IDE - integrated Development Environment) is a cross-platform application for Windows. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment is mainly distributed into three sections are Menu Bar, Text Editor, Output Pane. The figure 1 illustrate the working of Arduino IDE.The most common programming approach is to use the Arduino IDE which utilizes c programming language.

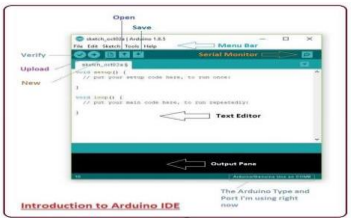

Fig: 1 Arduino IDE

Embedded C:

Embedded C is an extension to C programming language that provides support for developing efficient programs for embedded devices. It is not a part of the C language. C is the most widely used programming language for embedded processors/controllers. When designing software for a smaller embedded system with the 8051, it is very common place to develop the entire product using assembly code. With many projects, this is a feasible approach since the amount of code that must be generated is typically less than 8 kilobytes and is relatively simple in nature. If a hardware engineer is tasked with designing both the hardware and the software, he or she will frequently be tempted to write the software in assembly language. Since a C program possesses greater structure, it is easier to understand and maintain. Because of its modularity, a C program can better lend itself to reuse of code from project to project. The division of code into functions will force better structure of the software and lead to functions that can be taken from one project and used in another, thus reducing overall development time. A high order language such as C allows a developer to write code, which resembles a human's thought process more closely than does the equivalent assembly code. The developer can focus more time on designing the algorithms of the system rather than having to concentrate on their individual implementation. This will greatly reduce development time and lower debugging time since the code is more understandable.

Hardware Requirements:

1. Microprocessor-ARDUINO
2. LCD - 16 x 2
3. Relay
4. Soil Moisture sensor
5. IR sensor
6. NPK sensor
7. Humidity And Temperature sensor (DHT11)
8. pH sensor

MICROPROCESSOR-ARDUINO:

Arduino/Genuino Uno is a microcontroller board based on theATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and

was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. The 5.1 figure illustrate the picture and components of Arduino.

Fig. 2 Microprocessor-ARDUINO

LCD DISPLAY:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCD is used in wide range application including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smart phones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets.

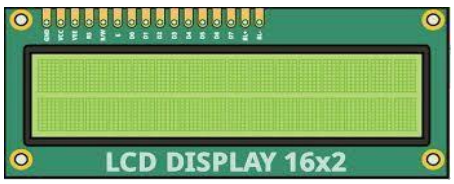

Fig 3 LCD Display

RELAY:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw switches. The relay's switch connections are usually labeled COM(POLE), NC and NO. In order to trigger the laser we use driver relay. Relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Fig . 4 Relay

SOIL MOISTURE SENSOR::

The two copper leads act as the sensor probes. They are immersed into the specimen soil whose moisture content is under test. The conductivity of soil depends upon the amount of moisture present in it. It increases with increase in the water content of the soil that forms a conductive path between two sensor probes leading to a close path to allow current flowing through. FC-28 soil moisture sensor is a simple breakout for measuring the moisture in a soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large

exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the pads will be and will results in a lower resistance, and a higher an out.

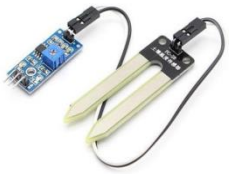

Fig . 5 Soil Moisture Sensor

IR SENSOR:

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people. Such infrared sensors only have to meet relatively low requirements and are low-cost mass-produced items. InfraTec does not supply such products, InfraTec develops, produces and sells pyroelectric detectors.

Fig. 6 IR Sensor

NPK SENSOR:

The soil NPK sensor is suitable for detecting the content of nitrogen, phosphorus, and potassium in the soil, and judging the fertility of the soil. Thereby facilitating the systematic evaluation of the soil condition. Can be buried in the soil for a long time, resistant to long-term electrolysis, corrosion resistance, vacuum potting, and completely waterproof. Soil NPK sensors are widely used in soil nitrogen, phosphorus and potassium detection, precision agriculture, forestry, soil research, geological prospecting, plant cultivation and other fields.

Fig .7 NPK Sensor

HUMIDITY AND TEMPERATURE SENSOR:

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employees. So, in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, nitrogen, argon or pure gas etc… Humidity sensors are of two types based on their measurement units. They are a relative humidity sensor and Absolute humidity sensor. DHT11 is a digital temperature and humidity sensor.

Fig.8 Humidity and Temperature Sensor

PH SENSOR:

A pH sensor determines the alkalinity or acidity of a solution. METTLER TOLEDO offers a broad portfolio of pH sensors for various industries, such as pharmaceutical, chemical, food and beverage, energy, and semiconductor, as well as for water and wastewater treatment. Whether you need a pH sensor in the laboratory or for in-line use, we have suitable sensors that meet all your application requirements.

Fig .9 pH Sensor

III. IMPLEMENTATION

Work flow of application:

A dataflow diagram is a graphical representation of data "flow" through an information system that models its process aspects. A DFD is frequently used as a preliminary step to create an overview of the system without going into great detail, which can then be elaborated upon later. DFDs can also be used to visualize data processing. A DFD describes the type of information that will be input to and output from the system, how the data will be processed, and where the data will be stored. The below sequence diagram illustrate the working of model in the form of flow chart.

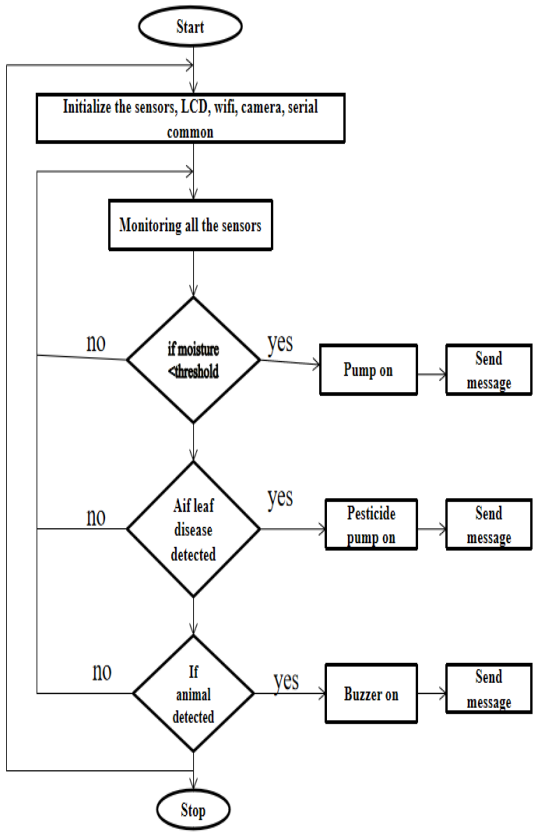

Fig .10 Data flow diagram

IV. CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As it allows for an automated irrigation system, crop disease detection, Pesticide sprinkling automation and Continuous monitoring of the Agricultural field as well as the Climatic factors such as humidity, temperature, and moisture. This technology also detects animal invasions, which are a major cause of crop loss. With the implementation of IoT in agriculture, processes are managed more effectively in the field with the aid of sensors. In this way, farmers are able to monitor crop conditions remotely, and better manage natural resources. Therefore, smart agriculture is much more effective than traditional agriculture. Thus the smart agriculture using IoT will revolutionized the world of farming and it will increase the productivity as well as improve the quality and can save lives of farmer. There is an urgent need for a system that makes the agricultural process easier and burden free from

the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output of our country India, an entirely agro-centric economy. The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country. To save farmer's effort, water and time has been the most important consideration.

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