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A REVIEW ON FARM MONITORING AND POLLUTION DETECTION DEVICE USING IoT

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Abstract: Farming has been the most important thing since the neanderthal age. Food, shelter and clothes are the basic that a person needs and farming is the root to all. In Early days people used simple and manual tools to grow a crop, such as sticks, hoes, sickle to plant and harvest crops. A few years back farming was a labour-intensive process. Farmers often had to work for long hours and any kind of irregularities in the atmosphere can ruin everything. But later, it became quiet a relief to the farmers, with all those automation techniques, machines, almost half of the work can be done within minutes.

Although that too had a lot of efforts in it, still improper rain can damage the yields and the prices could go high. The solution for that is IoT. With the help of IoT and its sensors the amount of water required in the field can be checked and start the irrigation with just one click. With IoT a farmer can just supervise his farm and IoT sensors can do the rest of the work.

A reference paper that we took into consideration discusses a system that combines software and hardware to allow farmers to monitor and control various aspects of their fields in real-time. The focus is on weather stations and mobile data logging for monitoring, and the relationship between these technologies and Smart IoT-based farm monitoring is explored. In the past, farming has seen the advent of grain elevators, mechanized ploughers, chemical fertilizers, and gas-powered tractors, while the use of satellites for planning tasks became prevalent in the late 1900s. Looking forward, IoT is poised to revolutionize farming and become a new standard in the field, with smart farming becoming increasingly promising thanks to technological advancements in automation.

Keywords: Internet of Things, Agricultural activities, Farming, Sensors, Technology, Smart Computing.

I. INTRODUCTION

Farming is the most critical sector of Indian society, In India almost 58% of the whole population is involved into agricultural activities. Farmers in India faces a lot of challenges like water scarcity, excessive heat, irregular rainfall, and drought in some places. There are several factors that are responsible for it, for instance wasting water, less fertility of soil which is due to improper disposing of plastic, excessive use of fertilizers, global climate change or diseases etc. Developing appropriate interventions in agriculture is absolutely essential to stop these issues. So, the solution is to make use of IOT. Internet of things is actually a network or communication between physical objects which have not been connected before and now connected with the help of Internet. IoT is sending/receiving of data from different devices and making them work accordingly. A proper level of moisture in the soil is vital for best yields. Our model will not only be efficient in providing real time farm data but also be cost efficient at the same time.

1. **Background:** As many farmers struggle financially our product will be proved affordable to them.The next era of Smart Computing will rely on the Internet of Things (IoT), which is currently transforming technology in homes, offices, and various other areas. In agriculture, IoT-based research is focused on making activities smarter and more efficient to improve production. Farmers in India, who face challenges such as small farm sizes, limited technology, trade issues, government policies, and climate conditions, are particularly affected. We wish to reduce this problems by giving our smart farming solution. Our Solution measures the key factors including soil moisture and air quality. This term means the whole amount of water in the pores of ground or on the surface. Soil moisture is critical parameter that must be identified and controlled in agriculture. If there is shortage of water or even if there is excessive water, in both the conditions the farm will get destroyed. It leaves its after-effects on salinity of water and amount of toxicity in the water,

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air content, thickness and structure of ground. Not only that but soil moisture dictates the field quality and determines the crop yield. Hence optimum level of moisture is needed to ensure a high crop yield.

Unlike the other fields of work, the weather is most important element that affects farm products. Weather fluctuation can influence crop growth, total yield, occurrence of pest, need of water and fertilizers but in a proper amount. In different words, farming under open sky relies on weather and changes as per moody conditions, especially nowadays, the climatic change is unpredictable and not under human control obviously. But at-least being aware of it can help a farmer a lot to secure his crops and yields.The App will be a one stop solution to monitor and interact with different sensors which will be the key to determine the yield and changes to be made in the farm. This will not only be a technology that is aimed to provide a smart solution to farming but also is cost effective.

II. DISCUSSION

Materials used:

- **What are sensors?**

Sensors are electronic device that are used to sense data like temperature, motion, pressure, light, proximity and many more from the real environment converts them into electrical signal so that it can be processed for various other applications.
Sensors are critical components in automated systems which allows machines and devices to sense and respond to the surroundings they are present in.

- **Sensors we are using:**

a) Humidity and temperature sensor (DHT-11): these factors plays a vital role in farming. A slight change in these parameters can ruin the crop. It is one of the most important sensor used in IoT. There are some alternative sensors for checking the humidity and temperature, ex- DHT-22, AM-2302, SHT-71
This sensor measures the change occurred in the temperature and humidity and then notifies.

b) **Sensor for identifying moisture level (FC-28):** Soil moisture plays a vital and centric role in making a fertile farm, if the soil is too dry or too moist the crops cannot survive. The accurate measure for the soil moisture ranges between 20-60% only.

c) **Rain-drop sensor:** the raindrop sensor identifies and measures the rainfall in the surrounding per hour. As we know that excessive water can damage the crops if the farm is flooded with water. This sensor allows the farmer to be prepared for various situations. This sensor is easy to install and compatible with farms regular irrigation.

d) **Air quality and Gas sensor(MQ-135):** There are natural gases present in the environment which are necessary for all living beings to survive. But harmful gases and smoke can damage crop growth, although detection is not enough, it needs prevention too but first of all detection of harmful gases must be done so to know what is causing harm to the yields. Air quality sensor is very useful for this purpose.

III.RELATED WORK

IoT Controllers and which one to choose: in this module we will discuss and compare about different types of IoT controllers that can be utilized in various farm related IoT use-cases**:** The most common and most famous is Arduino UNO but it lacks the wireless properties, the next popular controller that comes to mind is Raspberry pi which is not cost efficient. A user- friendly option is Node MCU ESP8266, it consists of wifi module. Since we are making it just as a prototype for instance, we will consider ESP8266, but for large farms its preferable to choose Raspberry pi.

Here is a list of controller boards with their specifications:

1. Raspberry pi: ARM Cortex CPU, 1.2 GHz clock speed, Linux OS, 1-4GB memory, SD Card slot, 5V Operating voltage, SPI, DSI, UART, SPIOCSI, GPIO I/O connectivity[8]
2. Particle Photon: ARM Cortex M3 CPU, 120 MHz clock speed, Real time OS, MB flash, 128 RAM memory, 3.3 V Operating voltage, GPIO I/O connectivity[11]

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3. Discovery STM32MP157C Crypto board: ARM dual Cortex-A7 CPU, runs up to 533MHz clock speed, Zephyr OS, 4GB RAM, 5V Operating GPIO I/O connectivity[12]
4. Esp8266 Node Microcontroller unit (MCU): LTX106 CPU, 26MHz-52MHz clock speed, XTOS, up to 128MB memory, 4Mb storage space, 3.3V Operating voltage, UART & GPIO I/O connectivity.[9]
5. Intel Edison: Intel Atom CPU, 500MHz clock speed, Window/MAC/Linux, 1GB LPDDR3, 3.15-4.5V operating voltage, USB 2.0.[13]
6. Giant board: Cortex-A5 processor, run up to 500MHz,Aruino IDE, 520KB or RAM,4MB external SPI flash, 3.3V operating voltage, UART,SPI and I2C.[10]
7. ESP32:ESP32-SE2-Saola-1, run up to 240Mhz, Arduino IDE, 520K of RAM, 4 MB external SPI flash memory, 3.3V operating voltage, UART,SPI,I2C.[15]
8. Azure Sphere: ARM cortex-A7, 500MHz, Azure Sphere OS, 4MB RAM, 16 MMB flash memory, 3.3V operating voltage, GPIO. [16]
9. Beagle bone Green Gateway: AM3358 1GHz ARM Cortex-A8, 200 MHZ, MAC/Windows/Linux, 512 MBDDR3 RAM, Micro SD card , 3.3V, GPIO.[14]
10. Google dev board: ARM Cortex-A53MP Core platoform,10GHz clock speed, Mendel OS, 1GB LPDDR4,8GBeMMC, MicroSD slot,3.3V operating voltage. [17]
11. Arduino: Atmel/ ARM CPU16MHz Clock speed, RTOS, 32KB memory, 1KB storage , 5V operating voltage, SPI,I2C, UART, GPIO.[7]

IoT Communication Standards: (IoT) refers to the interconnection of various physical devices, vehicles, and other items embedded with electronics, software, sensors, and network connectivity. With the increasing number of connected devices, it becomes crucial to establish a common language and communication standard for seamless and secure data exchange. Several IoT communication standards have emerged over the years, including Zigbee, Z-Wave, Bluetooth, LoRaWAN, NB-IoT, and many others.

Each standard has its own unique features, advantages, and limitations, making it important to carefully select the right standard for a particular application. The choice of IoT communication standard depends on several factors, such as the range of the devices, power requirements, data rates, security features, and cost considerations. As IoT continues to evolve and expand, the need for robust and interoperable communication standards will become increasingly critical for enabling seamless connectivity and unlocking the full potential of the IoT ecosystem.

IV. PROPOSED SOLUTION FOR ABOVE DISCUSSION

As we have discussed local problem faced by farmers either it is lack or scarcity of resources, there can be many solutions for this. One of the solutions can be: an IoT device with sensors which checks for the temperature, humidity, soil's moisture level and many other parameters which are necessary for a crop growth.

In this option of solution an IoT device that will be made with the help of using any microcontroller or microprocessor connected to all the sensors, although a component will be increased if there are only a limited number of analog pins to which the sensors can be connected, the component to resolve this can be a multiplexer or another microcontroller.

Connecting a small LED display would not be a feasible option so the developer can take the help of web server to collect data or fetch data received from the sensors.

After the data is fetched it can be displayed either on a website or it can be a web-based application or an android application with a beautiful interface which can be easy to handle by anyone.

The main goal should be to reduce the computational cost of this proposed model. To make the model more stable and choose the microcontroller and sensors wisely!

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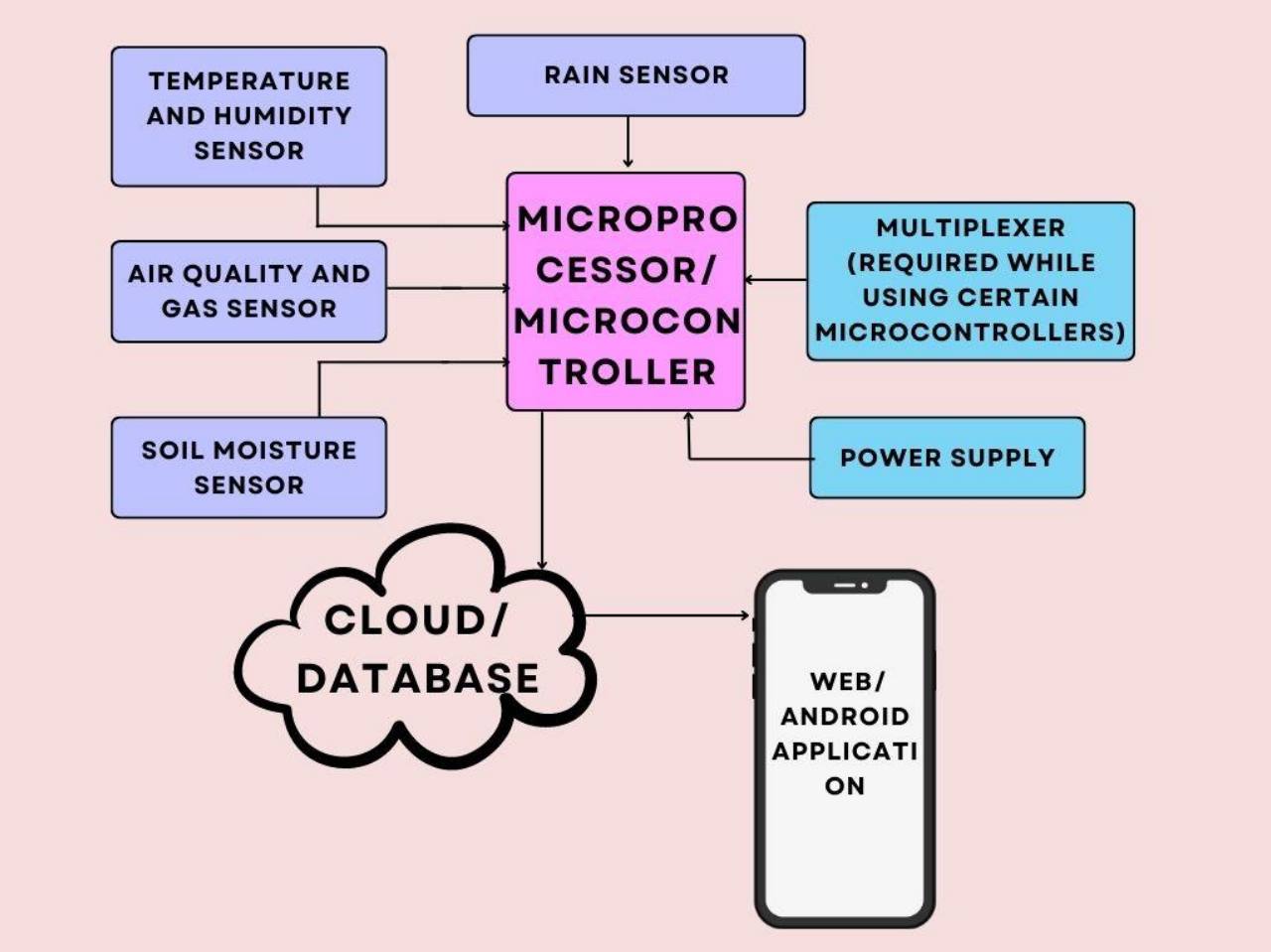

Fig. 1 Block diagram of basic working principle

V. CONCLUSION

Farm monitoring and pollution detection device is emphasized on keeping an eye on the farm or on the crops without physical being present in the farm. This is done by the help of sensors, The android application will fetch the data from the sensors and display it to the user.

Sensors are set to a particular bias value which acts as an activation for particular action, for example DHT-11 and FC-28 is set with a particular value, after reaching to the value, device will send a notification to the user. The project almost removes all possible environmental issues faced by a farmer without harming the nature.

The main goal of this project is to make faming highly transparent to the farmers so that they can easily cultivate the farms and grow crops. This type of automated farming provide efficiency in water usages, great optimization of sensors input and output.

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