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IoT Enabled Agricultural Farms, an Efficient Solution forFarming

Surjeet Kumar[1], Prashant Kumar Yadav[2]

[1]*Department of Computer Applications, UNS Institute of Engineering and Technology*
[2]*Department of Computer Science and Engineering, UNS Institute of Engineering and Technology*
Veer Bahadur Singh Purvanchal University, Jaunpur, India

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Abstract

The Internet of Things (IoT) is now the destiny of every field impacting everybody's daily life by making maximum of things sensible. It is an interconnection of different equipment and gadgets which make a self-configuring network. The brand new traits of smart farming with the use of IoT, by day, is turning the face of conventional agriculture methods. The aim of this research work is to propose an environment that can generate messages on different systems to inform farmers. The proposed prototype will assist farmers through getting stay statistics (Temperature, humidity, soil moisture, UV index, Infra-Red sensors) from the farmland to take important steps to permit them to do efficient farming through also increasing their crop yields and saving resources (water, fertilizers). The research proposed in this paper uses ESP32s Node MCU, Breadboard, DHT11 Temperature and Humidity Sensor, Soil Moisture Sensor, SI1145 Virtual UV Index / Infra-Red / Visible Mild Sensor, JumperWires, LEDs, and live records feed may be monitored on serial display and Blynk cellular. This could allow the farmer to manage their crop with the new age in farming.

Keywords: Smart Farming, Internet of Things (IoT), ESP32s, DHT11 Temperature and Humidity Sensor, Soil Moisture Sensor, SI1145 DigitalUV Index / IR / Visible Light Sensor.

1. Introduction: IoT in Human Life

The future of smart computing can be absolutely based on Internet of Things (IoT). It has a vital function in remodeling the "conventional era" from homes to places of work to the "next era anywhere computing". 'Internet of Things' is gaining a critical place in research the world over and mainly in the vicinity of advanced wireless communications. Today, IoT has commenced touching humans anywhere and from the factor of an ordinary person, IoT is laying the muse for the development of numerous merchandise like smart fitness services, smart living, smart training in schools, and automation. And commercially it's far being utilized in production, transportation, agriculture, and business control, and plenty of other fields as we can see in discern 1. (As said by using Nayyar Anand [1])

The most researched area of IoT is agriculture, due to the fact, it's miles clearly a critical area to ensure food protection as the international populaceis increasing hastily. Researchers first started applying ICT primarily based techniques in this zone, which were beneficial on some levels however honestly turned into now not going to resolve our hassle in the longer term. So now, we're exploring IoT as a choice of ICT in agriculture. Agricultural products need

applications like soil moisture tracking, environmental circumstance tracking for temperature, and moisture, deliver chain management, and infrastructure management.

The destiny of agriculture is precision agriculture and it is anticipated to grow at four billion by 2020. Data generated from sensors in the agriculture field can also be used for data analytics, with the intention to help farmers to improve crop yields. So, IoT-based totally smart farming can solve many agricultures-based troubles. The goal of this paper is to introduce an operating product as a way to allow farmers to actual-time facts.

The structure of the paper is as follows: Segment 2 can have the importance of IoT primarily based applications in Farming and its blessings in addition to quick comings of the product based on IoT. Segment 3 may have the sensors, micro-controller, and different hardware objects used to create the product with the quick facts with photographs. As this product is an operating product, there might be pictures of the prototype version. Segment 4 will give us the concept of the running of the product and the test dataset which become measured throughout the trying out of the prototype version. Segment 5 will cowl the conclusion and further scope in the product with the improvements in IoT.

2. IoT in Agriculture

Smart farming is a modern farming technique and management idea with IoT generation to boom the productivity in agriculture. With the usage of smart farming, farmers can efficaciously use fertilizers and other sources to grow a pleasant amount of their product. Farmers cannot be bodily gifts 24 hours of their life for farming. Also, the farmers may not have the information to use unique tools to degree the precise environmental situations for their crops. IoT provides them with an automatic system that can function without any human supervision and can notify them to make a proper selection to deal with the one-of-a-kind type of problems they'll face at some point of farming. It has the functionality to reach and notify the farmer although the farmer isn't always in the sector, which may allow a farmer to manipulate extra farmland, hence enhancing their production.

In an article by way of Prem Prakash [10], it's miles expected that the global populace will reach 9 billion mark by 2050. IoT utility is needed for agriculture to feed such big populace and successfully use the farmland and other resources as these are hard to be available in some places. Due to worldwide warming, unpredictable weather situations is affecting the crops and farmers are facing essential losses. So the IoT Smart Farming application will permit them to take short measures to save that from happening. Gorli Ravi

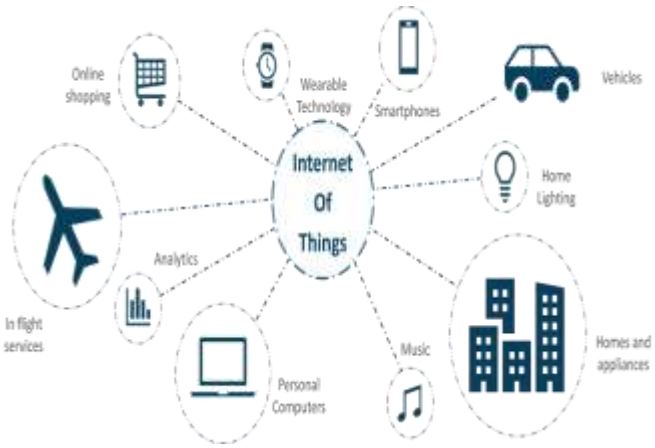

Fig 1. IoT Application in different fields.

[2] they've substantially defined why is smart farming important and what are the essential roles ofIoT that could reform our future.

In, Nayyar Anand and Puri Vikram [1] they used Arduino mega 2560 and then ESP8266 module and displayed statistics on a laptop display screen, as a substitute we used new ESP32 microcontroller and thinking about now not each farmer have laptop, we used Blynk mobile app for stay statistics, that's faster and having greater accuracy. Plus, we've sleep mode to give more existence to the self-tracking system. Advancements also deliver productivity. So, with the assist of IoT, farmers might be able to manipulate farm animals like cow, sheep and different animals as well with their health monitoring also feasible as mentioned by means of S. Jegadeesan [3]. WSN which is likewise the department of IoT also includes the routing algorithms for a community like such more prototypes that is discussed by Vaibhavraj Roham and others [8].

There are costlier alternatives to be had, in [5] and [10] that may automate the farming system as nicely but most farmers will not be able to use that technology due to economic issues. Our prototype charges around five thousand Indian rupees most effective which may be more suitable options for farmer and has dozing mode as properly and in terms of reliability the code has a timer to send readings after each cause time so that the gadget doesn't get redundant inputs and the use of right bucket additionally offers protection from extreme climate conditions. Accordingly, having true excellent sensors, most excellent code, routing algorithms and proper design gives it greater sustainability than the products proposed in [4] and [5].

IoT programs in smart farming also consists of farm car tracking, cattle monitoring, storage trackingand other different farm alternatives. There can be enormous use of smart natural farming that are currently in fashion.

2.1. Advantages of Smart Farming

The use of IoT in farming allows the farmers to analyze and perform the following:

- Remote tracking of farm field.
- Water and different herbal resource conservation.
- Measurement and analysis of crop field minerals which are not seen by necked eyes.
- Improving quantity and quality of crops.

2.2. Disadvantages of Smart Farming

- Agriculture being a natural phenomenon relies totally on nature, and guy expect or control nature should depend on rain drought, daylight availability and many others.
- The smart agriculture will work on the availability of net constantly. Rural or a part of the growing international locations did no longer fulfil this requirement. Moreover, internet is
- Faulty sensor or statistics processing engines can cause mischiefs is smart decision in agriculture which may additionally cause over use of water, fertilizers and other wastage of sources.

3. Proposed Work

We are trying to design and configure an IoTnetwork which monitors the agricultural soiland suggests the necessary action to be takenby the farmer.

3.1. IoT Network Description

This network monitors the farm or greenhouse which is totally based on the measurement and readings of various type of sensors like temperature, humidity, soil moisture sensor, Ultra-Violet light, Infra-Red, soil vitamins and gives different types ofsignals and messages to the farmer. According to these signals and messages the farmer can take necessary decision and proceed for furtheraction. The short actions taken by means of the farmers will assist them (farmers) to increase the productiveness of their farming and right use of natural sources can be executed, to be able to make our product environment pleasant. Our product will increase the amount and high-quality of the plants with the aid of properly monitoring the various situations. It willimplements the different types of IoT devices. The proposed system will work with the idea of “Plug and sense”. Live facts for distinct parameters canbe seen on laptop and android mobile phones also.

3.2. Components used in our network

The following are the basic hardware components used for designing the whole network for soil monitoring:-

- ESP32s Node MCU
- Breadboard
- DHT11 Temperature and Humidity Sensor
- Soil Moisture Sensor
- SI1145 sensor for UV/ IR and visible light index
- LEDs

4. Implementation

Our aim is to create a prototype model, which can be easily installable in the field and is also easy to use as farmers might not have the adequate technical knowledge. With the use of IoT the system will became automated.

In our prototype model, all the sensors and ESP32s are connected via breadboard and the power bank is used for power supply with LEDs. The Blynk app will be used to show humidity and temperature. In the same way we can have different windows to monitor live feed from different sensors, create graphs for further analysis as well.

I. We used ESP32s node MCU, which is wireless and Wi-Fi enable.

II. On breadboard, we connected the ESP and DHT11 temperature and humidity sensor, soil moisture sensor,buzzer, LEDs and SI1145 Digital UV Index / IR / Visible Light Sensor with the help of jumper wires.

III. ESP32 goes to sleep after every 18 minutes, wakes up, takes the reading, upload it on the Blynk app cloud to feed the live data and goes to sleep mode again.

IV. The LEDs retain the state so when the farmer passes through if he didn’t hear the sound or got the notification on phone can look the LEDs to take the necessary steps. Where turning red, blue or violet will give different indications. Same as one buzzer sound signals something, two buzzer means something else.

V. In the prototype model, bucket is used. Here the soil moisture sensor is fitted at the bottom and temperature humidity sensor, Digital UV Index sensor and the buzzer are placed at the top by putting a

whole in the cover.

VI. We give power with the help of a 6000 mAh power bank, so after uploading the code the system works on itself.

The sleep mode also helps to save power to increase the life of the power bank. So, what difference does it make in terms of total duration? To see that we will need power consumption for every component used in the prototype. The details about every component isas follows,

We are using ESP32, which has a power pin of 3.3V as well as 5V, here we connect sensors to 5V pin and the max operating voltage of the sensors are 5V. Now, for the power consumption calculation we need currents as well. Operating current for every component is as follows:

- ESP32s node MCU (Active mode)- 40mA (CPU + electronics)
- ESP32s node MCU (sleep mode)- 3.5 mA(sleep + electronics)
- DHT11-1.5mA
- Soil moisture- 5 mA
- UV light/IR sensor- 2 mA
- LED stipe (12V LEDs)- 1mA

5. Future Work

We had three mediums to inform the farmers, with the assist of LEDs visual alert, with the help of Blynk mobile app that could music stay feed as well and the distinctive alert sound with help of small buzzer as properly.

This product is used to notify farmers to take quick steps, but there is nonetheless scope, the future work may be centered on,

- ESP32s node MCU has wireless competencies in addition to wireless skills i.e. Bluetooth or Wi-Fi. Because of constrained wireless, we couldn't make greater prototypes but in massive farmlands and with Wi-Fi areas or plots, farmers can set up a couple of prototypes like this in an effort to be in some nearby network. The devices are connected with Bluetooth to each other and will have some fundamental node in an effort to acquire information to add it at the cloud.
- In true IoT experience and with the assist of Wi-Fi synthetic intelligence making this complete system of nodes to be able to make the choices on its personal and cause the essential steps to nullify that state of affairs.
- The studies is going on in drone generation as properly, connecting this machine to the drones will offer three-D mapping of the farmlands, for you to be able to monitor crop production and stay conditions as properly. [10]
- We can, in future, connect this complete machine to our dashboard (which is currently in design phase) to get an additional in-depth evaluation with the GSM module and IoT SIM card on our private computer systems.

For that reason, the future of smart farming is shiny. With the assistance of the right generation and government subsidies, this area can truly take our world to the betterment.

6. Conclusion

From our outcomes and literature survey, we noticed that the hardware and substances we used to develop our prototype allowed us to make it possible, as well as cheap.

This product is designed for farmers, which became competitively less priced and easily installable for farmers properly. Accordingly, we will conclude that this prototype will clearly help farmers in small farmland to efficiently reveal their vegetation with the user-pleasant app and other alert means.

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