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Farm Amigo: Introducing Artificial Intelligence and IOT in the Agricultural Sector.

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Abstract

Agriculture is a crucial part of Indian economy. Over 60% of Indian populace based mostly upon agriculture and one third of the financial gain of the nation arises from agricultural practices. Thus, it plays an important role in the development of the country. Various troubles associated to farming is constantly hampering the improvement of the country. Attainable answer for these issues is to choose progressive agriculture practices that includes of contemporary trends. Hence, agriculture will be created good exploitation IoT and alternative technologies. Smart agriculture will increase crop yield, decreases water wastage and unbalanced use of fertilizers.

The Major feature of this project is that it measures the various agricultural parameters affecting the yield and it additionally uses a GPS module to induce the knowledge regarding the location. Secondly it sends all the information to the cloud wherever it can be analyzed. Third this project additionally carries a mobile app providing a straight forward access of information to the farmer. In conclusion this project represents a smart irrigation, Fertilization and monitoring system that helps the farmer.

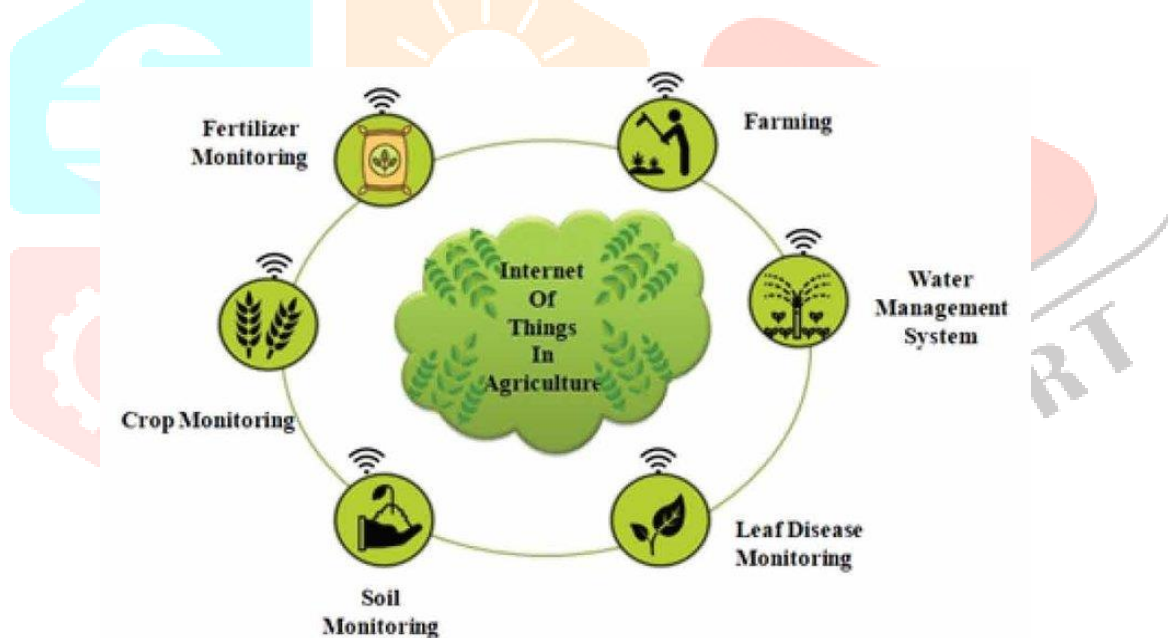
Introduction

Internet of Things (IoT) is the interconnection between a network and physical devices that's reticular computing devices, digital and mechanical machines, individuals or animals' objects detecting sensors, accumulating and transferring data over the Web without any human interaction. Everything is supplied with precise identifier. it's a progressed examination and mechanized frameworks that uses detecting, organizing, huge info and unreal consciousness innovation to convey total framework for an administration. essentially IoT is concerning extending the ability of web on the far side sensible phones and computers.

IoT has modified today's world. sensible cities, smart car, smart homes everything around the world is became a sensible device with the assistance of IoT. It additionally has applications in agriculture, corporate sectors, Hospitals and logistics.

IOT in Agriculture

Internet of Things has capability to rework the lives of individuals within the world in an economical manner. The ever-growing population would bite over three billion in few years. thus, to feed such a huge population, agriculture business needs to adopt IoT. The demand for a lot of food should address challenges that embrace excessive climate conditions, weather modification and completely different environmental affects that results from farming practices.



The fate of Indian agriculture should be worked with understanding and excessive shutdown of technologies that may expand production and also regains the eye of farmers during this industry. Therefore, these smart farming techniques would help farmers to reduce waste and increase capacity. This technology can help farmers to observe field conditions from anyplace with the assistance of sensors and may additionally irrigate, fertilize and monitor fields with an automatic system. It is the application of Information and Communication Technology into the sector of agriculture.

Structure of IOT in agriculture

This system structure contains four layer which are following

1. **Sensor layer-** this layer is automated and work in real time with the purpose of transformation of data related to agricultural field into digital information which would be processed further.
The collected data are: - Sensor information- Humidity, Gas concentration, pressure, temperature, soil moisture, weather condition, wind speed, soil health, virtual photos and other related data.

2. **Transport layer-** this layer's work is to collect and summarize the data of agriculture field and crop condition and send it for processing. It could assume as the nerve center of IOT. This layer includes internet network, smart processing centers, telecommunication management etc.
3. **Application layer-** the work of this layer to analyze and process the data collected from crop field and project data on application interface provided to the farmer and also suggests AI based suggestions to the farmer and allow the farmer to control irrigation, fertilization via video, visuals etc.
4. **Support layer-** this layer allows the farmer to directly communicate with the agriculture professionals and get the specific solution for their crop problems.

Benefits of IoT in Agriculture

The IoT enables the simple collection and management of large amounts of information which are collected by the sensors used and with the help of the association of distributed evaluation administrations, such as cloud storage, maps of agricultural fields, and other information can be accessed from anywhere. This enables live monitoring and end-to-end connectivity. The IoT is considered an important segment for smart agriculture, because with the precise use of sensors and smart devices, farmers could expand production. By using of IOT, farmers can monitor utilization of water, soil, fertilizers, pesticides etc.

Objectives

- To aware farmers with new innovative technology and reduce manual labor.
- To deals with problems inclusive of intense climate situations and advancing weather change, and environmental results due to in depth farming practices.
- To avoid wastage of water, fertilizer, pesticides and increase the productivity of crop.
- To design and connect it with an app and cloud server for end-to-end connectivity.
- To connect with the agriculture professionals to assist the farmers.

Literature review:

- **Er. Vikram Puri, Anand Nayyar, "IoT Based Smart Sensors Agriculture Stick for Live Temperature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology" May 2015.**

This document introduces an IoT-based intelligent device that permits stay tracking of the special agricultural parameters. This model allows farmer to accumulate stay facts of temperature, soil moisture. The Agricultural IoT device conveys the idea of plug and play where farmers can instantly implement an intelligent monitoring system with the aid of using positioning the stick withinside the subject and acquiring stay facts feeds on special clever devices like clever tablets, telephones etc. The information generated by sensors could easily analyze and process by the agricultural experts even in remote regions through cloud computing technologies.

- **J. NagaHarini, Ch.Kiranma, B.AdiLaksh, G.Harshitha, Mrs.T.Vineela, “IoT Based Agriculture Monitoring and Smart Irrigation System Using Raspberry Pi”, International Research Journal of Engineering and Technology (IRJET). Jan 2018**

Many research articles have proved that information should be collected from various sensors and live monitoring performed, but this research article focuses on automating things. This article suggests an automated system for better crop production. It also provides an inexpensive wireless channel containing various sensors to get information about the soil moisture, temperature, and humidity. The authors propose a methodology that recognizes the data path and also suggests an intelligent irrigation system. In the proposed model, multiple sensors are connected to Raspberry Pi, making an efficient wireless sensor network.

- **A.D Bhoi , Laxmi C. Gavade, “N, P, K Detection and Control for Agriculture Applications using PIC Controller”, International Research Journal of Engineering and Technology (IRJET). April 2017**

This work proposes a model to measure soil moisture, temperature, sunlight, N, P and K levels through sensors in the agricultural sector to achieve the impressive result in agriculture. By measuring those parameters farmers can boom the productiveness of the soil as it detects the poor vitamins level within the soil. The traditional method involves manual soil sampling, but this article introduces chemical analysis that consists of three techniques: optical method, conductivity measurement and electrochemical methods. These methods help to measure the primary nutrients.

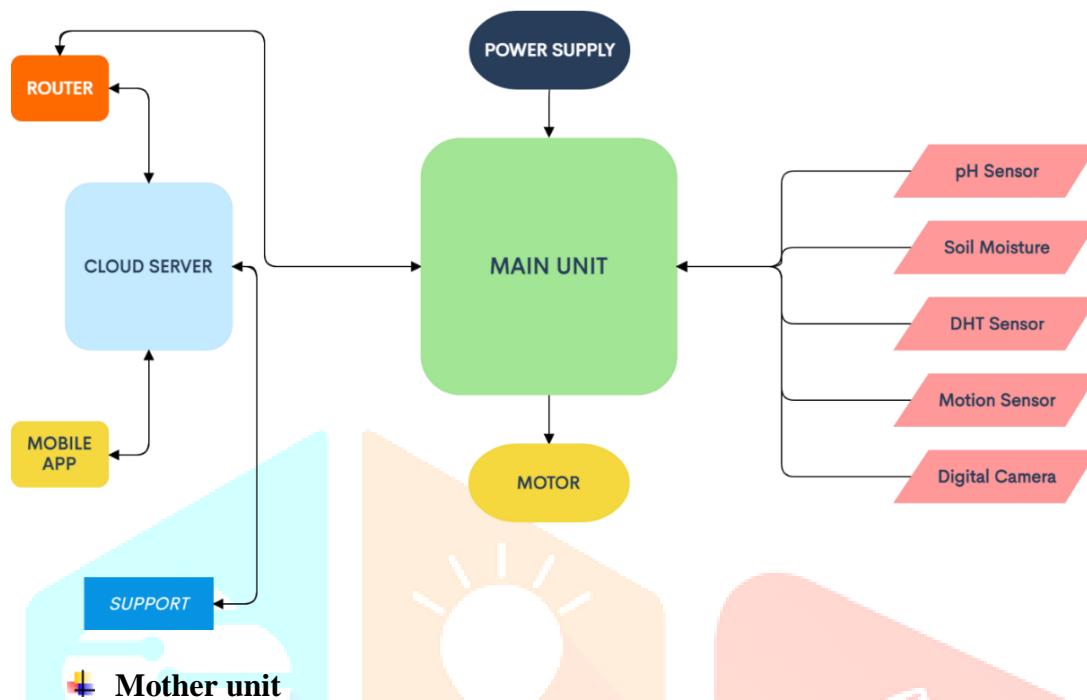
System development

The primary constructing blocks of associate IoT System are Sensors, Processors and applications. that the diagram below is the projected model of our undertaking system which suggests the interconnection of other blocks. The devices are interfaced with Microcontroller, data generated from the sensors are displayed over the mobile app of the user. Mobile app provides an access to the data obtained from the sensors and consequently helps farmer to perform the required action in order to fulfil the wants of the soil. And also offers some automatic controls which make our system more efficient.

Hardware Components

List of tools used for the proper functioning of our system

Flow chart



Mother unit
A mother board with built-in microprocessor, RAM, ROM, WIFI module and all relatable components which a mother board needs. To collect data from the sensors, compute and convert it to digital signal and transmit it to the cloud server or network with the help of Wi-Fi.

Sensors

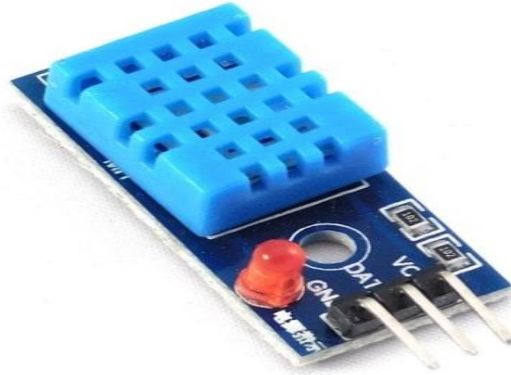
Soil moisture

A Soil moisture detector is one of the reasonably cheap electronic sensor that is used to measure the moisture in the soil. This sensor will work in real time to measure the metered content of water within the soil. This sensor consists of basically 2 parts, one is Sensing Probs and another is the Detector Module. The probes enable the present to go through the soil then it gets the resistance worth per moisture value in soil.



- **DHT sensor**

Digital humidity and temperature sensor is another a low-priced digital sensing element, used for sensing temperature and humidity. This sensor is simply interfaced with a micro-controller compatible to Arduino, Raspberry Pi etc to the live humidity and temperature. Digital humidity and temperature sensor is accessible as a sensor and as a module. The distinction between this sensor and module is that the pull-up resistance and a power-on LED. DHT is a ratio sensor. To live the encircling air this sensor uses a semiconductor unit and a electrical phenomenon humidity sensor.

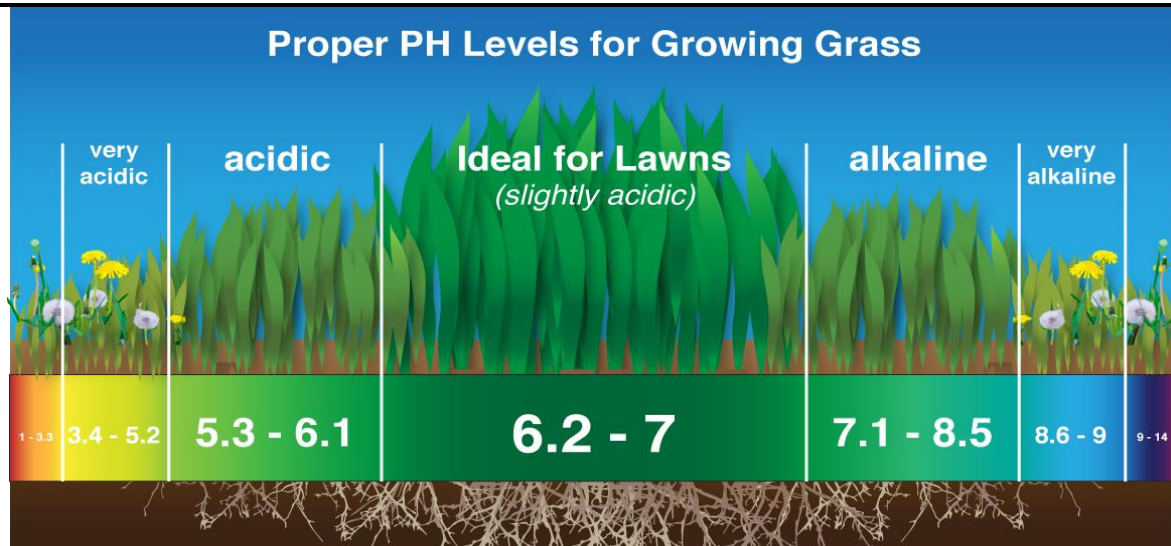


- **Ph meter**

PH sensors are water-proof and dustproof which is used to measure the concentration of hydrogen ion present in the Soil within a range of zero to fourteen in the PH scale with high accuracy up to ± 0.3 PH. This sensor is protected within case and is sealed with High-density epoxy glue which may forestall wetness from coming into the body interior part.



Soil pH measures of the acidity or pH of the soil. A pH worth is really a measures concentration the of hydrogen ion. As a result of hydrogen ion concentration varies over a large vary, a graduated table (pH) is used Most soils have pH values between 3.5 and 10. In higher downfall areas the natural pH of soils usually ranges from five to 7, whereas in drier areas the range is 6.5 to 9.



▪ PIR(Motion) sensor

Passive infrared detector can discover an individual's being on the specific area within the range of sensor. PIR are basically manufactured from a pyro electrical sensor, which may detect levels of infrared radiation. This sensor comes with other various essential uses. One of the major uses of this sensor is to detect any motion made in the area and can also be used to prevent unauthorized bodies from entering in the private land/plot.

▪ Digital Camera

Digital IP based security cameras, conjointly referred to as digital cameras supply the most recent innovation in surveillance technology. the most advantage of IP security camera is that they have a high resolution and supply a high-quality video. A high-quality video permits for facial recognition, or the power to digitally zoom distances of 100+ ft.

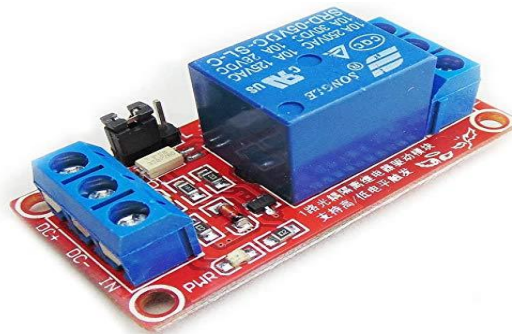
✚ Cellular / Wi-Fi router

Cellular GSM routers allows you to remotely communicate with devices in a network and establish web property for variety of application of applications. GSM routers are designed to supply reliable and high performance even in most demanding and extreme environments. People with traffic applications such as UTC, ANPR and CCTV have taken advantage of cellular routing products to achieve massive cost-savings over traditional methods such as ADSL, fiber or leased lines.

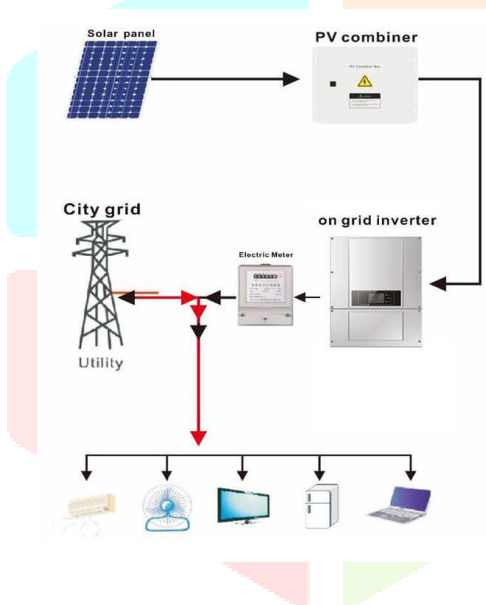


Relay

Relays are the switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. When it is important to operate a circuit by a way of independent low power signal or if different circuits are managed by means of a single signal, then relays are used. So, relay acts as an automated switch that operates on circuit having high current using low current signal.



Off grid Power supply



A system with solar plate, battery, MPPT solar charge controller and power inverter to supply power all sensor and system. This system needs to be on grid and also comes with the solar plate for backup in case of power cutoff, break down and failure.

Working principle

This agricultural modal functions almost automatically. These modal needs respective agricultural field to be located/ marked on Google map with the help of GPS and then a team will visit to the agriculture site at first and then install all required hardware components such as sensors, relay and other components. In order to build the basic understanding the team will start from giving a small demonstration to the farmer and train him/her that how our application and the system works when working in a channel, then connect it to cloud. At this point of time the work of our system starts like soil moisture sensor continuously monitors the moisture level of soil and generates data which is further send to the application.

Therefore, accordingly when the moisture level of the soil falls down then the specific marked level on the AI cloud system sends the instruction to the mother board to start the irrigation system automatically in order to irrigate and raise the moisture of the soil back to the marked level. Ph meter helps the farmer to continuously monitor the health of the soil and give instruction to the farmer that when and how much amount of fertilizer it needs to be distributed over the soil for better growth of plants. Humidity and temperature sensor help the farmers for real-time monitoring of the temperature and humidity in the air.

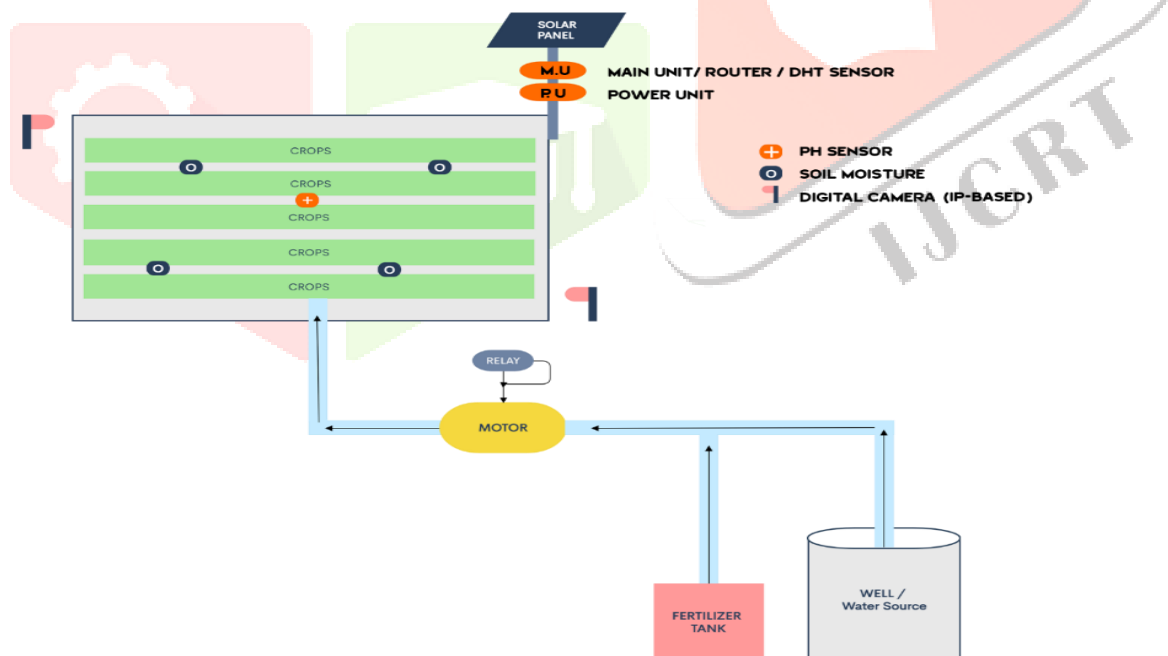
Motion sensor helps farmer for real-time detection of motion in his agriculture field especially in night. The application sends a notification to the farmer when any motion is detected by the sensor when the

owner is away from the field to prevent unusual damage done by any animal or unauthorized bodies. The installed Digital camera helps the farmer to get live footage of the crop and also supports the AI system to monitor and track the health of crops and plants and send the instruction to the farmer when needed. The system comes with a mother unit which computes and transmits all data to the cloud server to compute further by AI and send instruction back to the farmer. The system also comes with on grid power backup to supply of power to all hardware components and has a solar plate for backup in case of power failure.

A cellular router is used for internet connectivity because of unavailability of wired internet system and fiber cables. The farmer needs to upload high quality of crop picture on application on weekly basis to compute the data by the AI system and update the farmers for their crop condition. In addition, this also helps the AI system to locate and track those area of agriculture field where digital camera is not able to reach. Complete system is automated, application will tell you when to irrigate, when to fertilize, when to spray pesticide and when to harvest your crop. In case of any insect attack on crop the application is capable enough to tell you which and how much drug would be needed to spray on the crop. In case of unavailability of that drug in your locality then application will mark your problem and make the drug available and ensures the delivery to be done as soon as possible. If you need any other help/advise you can feel free to call on the helpline and agriculture professionals are there to guide you with your concern related to crop, instructions and any other support. In the application there is a section of crop rates where you can track the rates of your crops in all nears markets and locality and track even government allotted rates.

A special protection case shield will be served for the mother unit to keep it safe from dust, water and bad weather condition to assure the system works properly. The system can auto sync the weather data (WFC) from the internet for AI computing and makes the system to run smooth in exceptional conditions.

Result and conclusion



The planned modal explores the utilization of IoT (Internet of things) within the sectors of agriculture. This model aims in increasing the production of crop yield by serving the necessary nutrients, fertilizer and other vital needs to any soil type. We've got conjointly taken several readings of the soil moisture, temperature and humidness of the agriculture field. Therefore, the collected data can further be used to analyze the crop condition. This system is also providing a back support by agricultural professionals in case of any unprogrammed and unplanned things occurs to the crop. This method is value effective and feasible. It conjointly focuses on optimizing the utilization of water resources and combats problems like

water inadequacy and ensures sustainability. Also the solutions planned during this paper can improve farming methods, increase productivity and result in effective use of restricted resources.

Prototype:



References:

1. https://www.researchgate.net/publication/313804002_Smart_farming_IoT_based_smart_sensors_agriculture_stick_for_live_t_emperature_and_moisture_monitoring_using_Arduino_cloud_computing_solar_technology
2. <https://www.irjet.net/archives/V5/i1/IRJET-V5I1307.pdf>
3. <https://www.ijert.org/implementation-of-iot-based-communication-on-the-agriculture-field-using-tcp-ip-protocol>
4. <https://www.jetir.org/papers/JETIR2007203.pdf>
5. https://www.journal-dogorangsang.in/no_1_NECG_21/64.pdf
6. <https://docplayer.net/202852695-Smart-agriculture-monitoring-system-using-internet-of-things.html>
7. <http://www.jctjournal.com/gallery/25-aug2021.pdf>
8. https://www.researchgate.net/publication/349639006_Internet-of-Things_IoT_based_Smart_Agriculture_in_India_-_An_Overview
9. <https://www.ijert.org/optimized-irrigation-system-using-iot-on-cloud-based-weather-monitoring>
10. <https://ijarce.com/wp-content/uploads/2019/05/IJARCE.2019.8419.pdf>
11. <http://www.ijpab.com/form/2019%20Volume%207,%20issue%204/IJPAB-2019-7-4-160-165.pdf>
12. <https://turkjphysiotherrehabil.org/pub/pdf/321/32-1-5.pdf>
13. <https://www.ijtee.org/wp-content/uploads/papers/v8i7/G5432058719.pdf>
14. https://www.researchgate.net/publication/328539067_SOIL_MOISTURE_SENSORS_IN_AGRICULTURE_AND_THE_POSSIBLE_APPLICATION_OF_NANOMATERIALS_IN_SOIL_MOISTURE_SENSORS_FABRICATION
15. <https://www.diva-portal.org/smash/get/diva2:133543/FULLTEXT01.pdf>
16. <https://www.ijedr.org/papers/IJEDR1605022.pdf>
17. https://www.researchgate.net/publication/293811535_Configuration_Interfacing_and_Networking_of_Wireless_IP-Based_Camera_for_Real-Time_Security_Surveillance_Systems_Design
18. <https://www.ijert.org/research/a-review-paper-on-cloud-computing-IJERTCONV5IS23002.pdf>
19. <https://www.irjcs.com/volumes/vol2/iss5/15.MYJCS10099.pdf>
20. https://www.researchgate.net/publication/261424537_Motherboard_and_user_experience