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A Cost Effective IoT-Assisted Framework Coupled with Fog Computing for Smart Agriculture

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Abstract—**Organisations must efficiently handle as well as interpret a massive influx of data because of the emergence of technologies like the Internet of Things (IoT) including fog computing. A production strategy known as "smart agriculture" uses technology-enabled knowledge and interaction to monitor fields. Almost 60% of India's companies, to use an analogy, are agriculturally dependent. Improving existing agronomic systems and transforming them into smart agriculture represents the most efficient approach for dealing with agriculture's difficulties. The smart agriculture approach provides useful data collecting, incredibly accurate controls, and automated monitoring techniques. This study put out a fog-based model with IoT additional support which thus is promising to provide a smart agriculture infrastructure that is widely available. Fog platform includes proper data processing of information produced by IoT gadgets used in connected agriculture by bringing computing and data storage close as possible to the network's outermost boundaries. The findings suggests the use of the Web of Science database's literature search for the advancement of the IoT-Fog training sample in the creation of smart agricultural production. When properly implemented and compared to current IoT-based farm systems, the suggested method is more efficient. The outcome indicated that the recommended system enhances the precision of that same existing systems geometrically while reducing system performance, computational efficiency, and statistical significance to substantial levels.**

Index Terms—**Internet of Things, Technologies used in Smart Agriculture, Fog Computing for Smart Agriculture, Proposed Fog based Model for Smart Agriculture.**

I. INTRODUCTION

IoT platforms enable the ultimate gathering, computation, but instead analysis of substantial quantities of sensor data, which enables the creation of sustainable solutions for a range of fields such as health care, industrial production, or otherwise agricultural production. Real-time data processing enables body that is responsible and increased effectivenes [1]. By upgrading conventional farming techniques and enhancing the effectiveness of crop cultivation to satisfy the rising demand, IoT has always had the potential to change the agricultural production. IoT technologies are capable of being utilized to track agricultural yields, climate variability, soil type, and other elements that have a significant effect on agriculture. Making responsible decisions or otherwise optimising resource utilisation using this data will increase efficiency as well as reduce waste. IoT-enabled smart crop cultivation is poised to significantly boost the economic growth and accommodate the demands of an expanding population [2] [3]. The agriculture industry, which is essential to the global financial system, must satisfy the rising need for agricultural products. By making use of intelligent gadgets and technologies, IoT has the opportunity to modernize established agricultural practises, leading to enhanced and fruitful farming techniques. Internet - of - things technologies can enhance a number of agricultural processes, including crop cultivation, irrigation, or rather livestock tracking, resulting in higher yields and more efficient use of resources. For the future of food production and farming, "Smart Agriculture," or the utilization of IoT in agriculture, has enormous potential. By gaining consumer happiness and service levels, IoT paradigm has the potential to revolutionise a number of sectors, including agriculture. The demonstrated The network visualisation of IoT-enabled smart agriculture is shown in Figure 1. The data was gathered as from Web of Science Core Collection database.

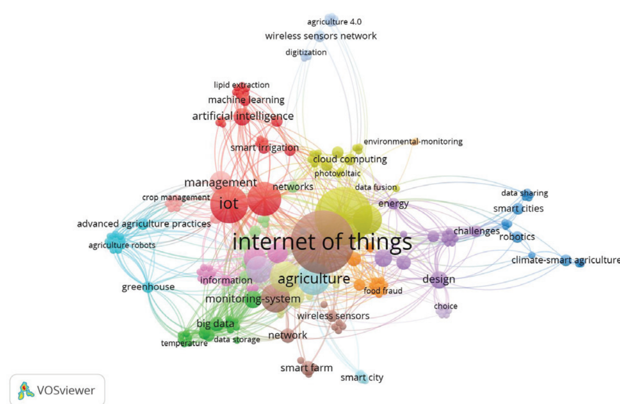

Fig. 1. Network Visualisation of IoT-enabled Smart Agriculture

IoT modelling entails the fusion of various communication methods, including wired and wireless, technologies to create a worldwide network of addressable but rather connected objects. The development of intelligent items that satisfy the requirements of a customer group that is becoming more motivated is made possible by this interconnectivity. The adoption of IoT across various sectors can result in increased productivity, better customer situations, but rather increased performance [4]. IoT is an essential integrated technology that could really support an extensive variety of apps and services, which means it's in addition to a independent system. Extraction of accurate information from complex sensing surroundings is now more difficult because of the extensive use of intelligent devices in IoT environments. This necessitates the creation of sophisticated algorithms, systems for machine learning, or otherwise data processing technology that can manage the differences between groups and sophistication of the data produced by devices linked to the Internet of Things [5] [6]. A highly scalable framework called fog computing had also been created to handle IoT's difficulties. It makes real-time information processing more effective by moving the computing power farther from the information source. This is particularly helpful in situations like the smart grid but instead smart city, where making prompt and precise choices is essential. Fog Computing eliminates the frequency and bandwidth needs of transmitted data by moving the network bandwidth towards the information source, improving system reliability and enabling quicker evaluation. It offers a high performance computing architecture that enhances the model for cloud computing and makes it possible to manage IoT information and offerings in an efficient way possible [7]. Fog computing helps to prevent adversely effecting resources available in the cloud by relocating computing capacity near the information source, enhancing system responsiveness and effectiveness. For the proper implementation of IoT solutions, the connection between fog as well as cloud computing in information management is essential. With the help of fog computing, specific data management and computation storage processes can be moved from the virtualization to either the network's edge, resulting in less data being communicated via the network whereas less strain on the cloud's resources.The demonstrated IoT-enabled smart agriculture's citations and publication report are shown in Figure 2; the data was derived from the Web of Science Core Collection database. As a result, information security and analytics are enhanced, and resources associated with cloud computing are used more effectively [8].

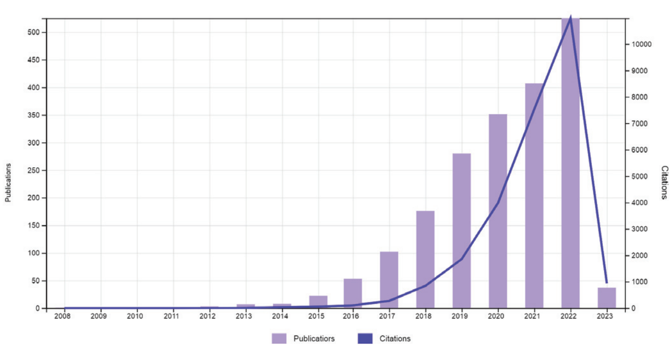

Fig. 2. IoT-enabled Smart Agriculture's Citations and Publication Year-wise Report

By providing compute, storage, connections, prediction, as well as data management local network nodes proximate to that same IoT devices, fog computing provides a link between the cloud or otherwise end-devices like IoT nodes. This enables computing, storage, communications, and evaluation to take place not only in the server but also while data travels along the IoT-to-cloud journey. Fog Computing boosts the general performance of IoT systems by enable the processing of information that is closer to the source, which lowers latency and bandwidth needs for data transmission. Fog computing distributed architecture ensures that crucial data management and situation tasks are completed promptly and effectively, facilitating the successful implementation of IoT solutions [9] [10]. Fog computing bridges the gap among its server as well as smart environments by offering technology, information, telecommunications, and interoperability on the networked devices close to the Internet of things. Because of this, after data is delivered to the cloud, computation, processing, information exchange, selection, and process automation take place simultaneously within the cloud and along the Internet - of - things journey. By applying these reliable estimates to the IoT devices, cloud computing decreased the latency overall bandwidth needs of transmission of information, increasing performance of the system and permitting quicker selections. Also, it provides a framework for distributed systems that improves cloud computing and enables the management but instead preparation of enormous amounts of data generated by IoT devices [11]. The production of food is being challenged by rising food demand, climate change, as well as water shortage, among other issues. With the goal of boosting profitability and productivity throughout the agricultural sector, new technologies but instead solutions are being created to address these issues, including automation, and situation systems. These developments seek to enhance how we cultivate and agricultural crops, utilize things, and make wise selection [12]. Smart agriculture is a kind of agricultural that combines cutting-edge technologies in order to improve agricultural production as well as effectiveness. These technologies include information technology, distant sensing, and proximate data collection. PA endeavors to eliminate adverse environmental effects like the loss of soil and water water contamination while maximizing the utilization of inputs like water, fertilizer, and seeds [13]. The farming community is increasingly using sensors in gardens to collect real-time data on many variables that influence crop development and welfare. By gathering and analyzing information from a variety of sources, gardeners or otherwise horticulturists can make better informed choices about farming techniques, improving yields and influencing to more farming practices. Those other sensors are capable of measuring a variety of parameters, including humidity, soil reflectivity, pH levels, nutritional quality, as well as water characteristics. Farmers use the data gathered by these instruments to support their choices on, among other items, hydration, fertilization, and insect control. Although these requirements are now simpler to use, their usefulness is still constrained because they are frequently not suited to the particular requirements of each farmer. Emerging technologies are already being developed to meet this situation and give farmers additional individualized and specialized solutions, enabling them to maximize their resources and increase agricultural yields [14] [15].

A. *Technologies used in Agriculture*

Agricultural production uses a wide range of technology to boost effectiveness, production, and environment. The following are some of the most popular technologies.These innovations are assisting farmers in lessening their additional impacts while improving productivity, cutting waste, and increasing yields. Over moment, agriculture has changed substantially, and the use of new technologies is causing the sector to advance even more. Increased efficiency and production in agriculture are being brought about by the fourth agricultural economy, often known as the ”Digital Agricultural Revolution,” which may have favorable effects on social stabilization and continuing economic advancement [16] [17]. The effectiveness of information transfer in agriculture is increasing because to the convergence of the Zigbee wireless network again with Internet of Things . The demonstrated The overlay visualization of IoT-enabled smart agriculture is shown in Figure 3. The data was gathered as from Web of Science Core Collection database.

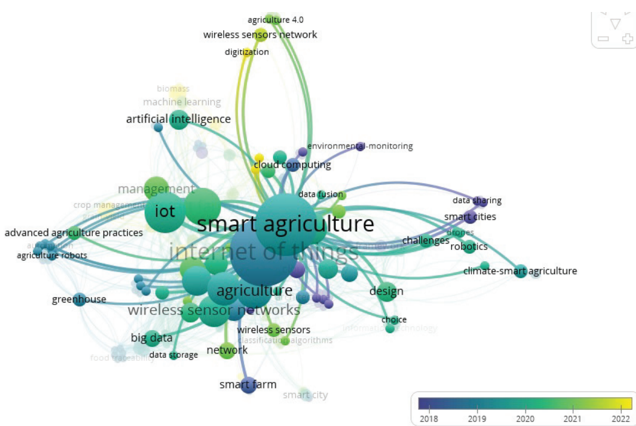

Fig. 3. Overlay Visualization of IoT-enabled Smart Agriculture

The development of micro-controller technologies has enabled it to be possible to regulate and monitor numerous aspects of economic productivity in significant, especially field development and the usage of fertiliser and water. The relevancy of the information becoming generated is further enhanced by the use of telescopes for accurate monitoring as well as operation. These developments are advancing the sector and propelling the ”technology agriculture transformation” [18]. Monitoring this same working atmosphere in which crops develop is a crucial component of contemporary agriculture. Actual data on numerous climatic parameters, including as temperatures, dryness, Carbon dioxide concentration, brightness, soil moisture content, temperature, and land Soil ph, may be gathered and evaluated by employing various multiple connections through the agriculture production IoT. This aids in regulating and controlling the environment in which crops develop, resulting in increased yields and general agricultural efficiency [19]. Agricultural production makes use of a wide variety of available information to assist in decision-making and boost productivity in the sector. These data sources, which include autonomous farmers, cultivators, robotic systems, helicopters, sensor systems, and transmitters, gather a variety of farming data, including details about the surroundings and the state of the soil. The information gathered from these sources may be utilized to regulate a variety of actuators, including lighting, automatic windows, both water and soil nutrition pumping systems, ventilation systems, and water heaters, in the hope of enhancing overall agricultural output [20] [21]. In the agricultural production, technology is used widely with an emphasis on increasing efficiency and profitability while lowering costs, time, and human factors. An important part of this is played by IoT, which enables the technology of numerous agricultural processes like water distribution, soil observation, fertilizer application, and animal monitoring by using sensors. Smart greenhouses use a wide range of technology to protect plants from adverse weather, including remote electronic objects, computers with internet access, sensors, camera systems, and embedded processors. These developments are advancing the sector and fostering a more efficient and environmentally sound methodology to agriculture [22].

B. *Fog Computing for Smart Agriculture*

Automatic process can be used in many different contexts to increase automation and are made up of a wide range of parts. These networks frequently share three traits, especially fog computing, which uses modest processing configurations adjacent to IoT devices rather than the huge, widely dispersed network infrastructure of cloud computing. As a result, geographic IoT applications have a less carbon footprint and even more effective, delay-sensitive services. Fog computing has applications in a wide range of industries, including multiplayer gaming, medicine, and agricultural production [23]. In an effort to restrict the quantity of data sent to the cloud and then to enable real difference, the fog computing is a crucial element in smart systems as given in Figure 4. It is in charge of performing on-site customer information filtering and interpretation. It is an advantageous strategy for usage IoT-based applications that need real-time operations, such farmland observation and smart grid solutions, because of its proximity to that same edge-users, public networks, and compatibility for mobility. These qualities aid in enhancing the service they provide for embedded applications and offer farmers as well as many other users quick, effective services [24].

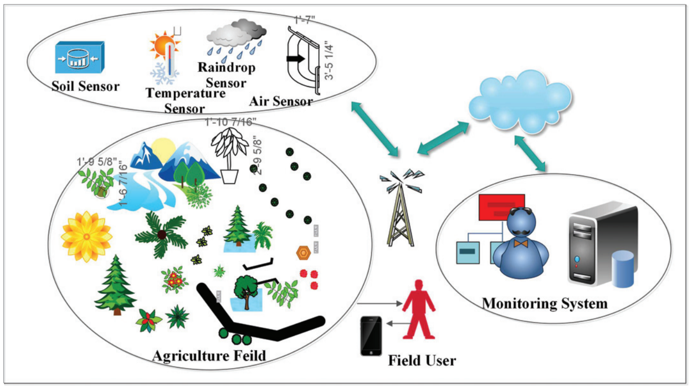

Fig. 4. Fog Computing for Smart Agriculture

II. Related Work

For resolving agricultural concerns and advancing a nation's growth, agricultural production approaches must be transformed thru the agricultural technology. The suggested framework supporting sensor networks alongside the Internet of Things in agricultural applications offers a useful data gathering, accurate control, and models are equipped. By monitoring moisture, temperatures, and pressure, this sustainable farming method enables producers to make better choices and increase yields. The objective is to improve agriculture with advancements in technology to render it more economical, affordable, and effective [25].

The authors of [26] paper represent technique offers an affordable and adaptable method for deploying soft sensing classifiers remotely utilizing IoT technologies. It is a practical and affordable solution for farmers as well as agricultural groups since it uses inexpensive hardware and even a fully accessible computer language. The solution's complex nature also permits greater flexibility and modification, allowing farmers to modify the structure according to their unique demands. With the help of affordable, adaptable, and approachable approaches, technology will be made available to people who require it, which will help to enhance agricultural production.

Agriculture describes how farmers employ human-made instruments to generate food while also controlling their surroundings. One possibility is that farmers continue to struggle to monitor and care for their crops, making the creation of a connected sensor system for crop production based on IoT necessary. The intelligent agriculture system aims to evaluate but instead tracks the problems faced by farmers in the interest of improving commodity productivity. By placing several sensors, it was possible to generate necessary information for agriculture activities, which was then shown in the motion sensors for users to utilize in making judgements about things like how to undertake agricultural production [27].

With the use of several sensors, IoT-based Infrastructure has been extensively used in agricultural operations to monitor productivity conditions and automate appropriate agricultural practises. In the hope of improving quality and yield through analytical farming decisions, these sensor nodes are used in the agroecosystem to obtain information on crops, houses, remote monitoring, dryness, water management, and more. Yet, monitoring technology's limited sequencing, energy, transmission, and memory capacities could have a negative impact on agricultural output. These IoT-based sustainable agricultural sensors must be secured from hostile arguments in additional to being productive [28].

Agricultural production is one among the economic fields that requires urgent attention rather than advancement because it has a significant potential and makes optimal use of resources. This study outlines a technique for IoT-based agricultural monitoring that is economical. The four layers of the prescribed word document for smart agricultural monitoring include accelerometers, sensors as well as data level, terms of qualifications, edge computing, and finally, the smart data level. The method used here uses an Arduino-designed connected device to analyse soil moisture, degrees, humidity, and additional important minerals. The sensor node additionally includes a motorised and a wi - fi or bluetooth module [29].

The significant number of complex and expensive, connectivity Internet of Things monitors that have the capability to remotely track and share information about crop, precipitation, and environmental conditions has had an implication on this, among other possibilities. This makes it feasible to manage available resources, for as a result of sacrificing water for agriculture and substances. Alternatively, because of recent developments in digital advanced technologies, crops may very well be capable of sharing enhanced agricultural equipment and produce better predictions for the future based on actual events rather than hypothetical ones. This would enable farmers to eradicate plant disease infestations together with crop-related respiratory disease [30].

Improved information and demonstration Individuals, techniques, technology, and small details can all be directly supported by the Internet of Everything (IoE). It provides a potent instrument for converting information into actionable information. Given the growing impact of the digital IoT throughout each sphere of society, implementing IoE for an efficient agricultural methodology makes perfect sense. A certain study [31] aims to accomplish following. It instead presents a smart IoE-based precision agriculture model as a revolutionary AgriTech instrument which promotes successful communication with all IoT-based equipment (IoESA). Moreover, it promotes a practise known as Soil-Smart Agriculture (SSA), which use sensors to assess soil nutritional value and offer farmers with the most precise information [31].

Agriculture and smart sensors are expected to have a significant positive impact on the diversified farming activities. The IoT's exponential expansion in connection has led to the development of better agricultural systems. Agricultural production as well as farming practices is expected to have a significant positive impact on the various agricultural work. The current solutions, which are informed by popular cloud resources, cannot handle the enormous volume and variety of data produced by connected IoT devices. In an effort to minimize latency but rather support quick selection on newly created data, it is essential to shift systems integration towards the point of manufacturing capacity. Several fog-based approaches will be introduced, which would also aid with being. An IoT-Fog based agricultural information system might be significantly more successful for efficient scalability and extremely fast data rates for making informed decisions throughout real time. The technology of the suggested technique was recently demonstrated and described. An AgriFog implementation has been designed and modelled using iFogSim [32].

The principal revenue earner for the people in developing nations may have historically been agricultural. According to demands of customers, the IoT-enhanced crop production centred around greenhouses may possibly provide greater yields and better quality. The deployment of Wireless Sensor Nodes (WSN), automated systems, remote data processing data centers computer technology, and network services through user apps implemented as part of IoT will enable the effective utilization of the readily available finances. This research aims to design an IoT-based system enabling agricultural enterprise operation that appears to be extensible but is instead cost - effective, particularly order for developing countries and rural areas to monitor and handle connectivity, such as the internet or otherwise natural energy. The acquired data may afterwards be studied through further climate as well as weather conditions, enabling the planning of something like the productive and reasonable crop to be maintained over a period of time [33]. Predefined applications of wireless network infrastructure like IoT and fog computing (FC) are advancing quickly. When compared to some Sensor networks, such as some sensor devices, smart houses, and smart online ordering, standardisation, bandwidth utilization, and orientation knowledge and understanding appear to be features contemporary IoT lacks. The explanation of services include storage, computation, and network adapters to the edge of networks is made possible by the combined effects of IoT with FC, which provides these activities. This study [34] examines the security threats associated with IoT and FC and underlines the benefits of their collaboration [34].

III. Proposed Fog based Model for Smart Agriculture

A. System Architecture

The solution being proposed makes use of a microcontroller (NodeMCU) with an ESP8266 Wi-Fi module embedded on top of it. Bluetooth technology is implemented on a smartphones as the user interaction. The usage of a DC motor, a sensor for soil moisture, a both temperature and humidity sensor (DHT11), and rain sensing sensors. Whenever the DC motor is switched ON, a water pumped attached to this DC motor pushes water to that same crops. The sensor for soil moisture determines the soil's relative humidity. NodeMCU makes a decision regarding whether one should water this same crop based on the amount of moisture. The watering of just the crop is commenced by NodeMCU turning the Motors ON when the soil's relative humidity must be below threshold value and has been turned OFF as soon as there is sufficient moisture in the soils by utilising the relevant functions and conditionals mostly in code generated for the NodeMCU working. The climate's both temperature and humidity values are provided by the humidity as well as temperature sensor, which helps assess whether one crop is suited for development. Figure 5 depicts about the proposed model for smart agriculture.

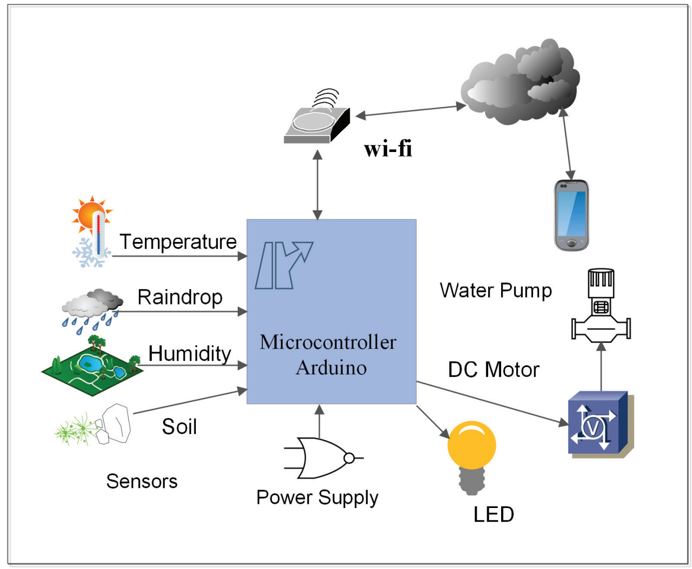

Fig. 5. Proposed Model for Smart Agriculture

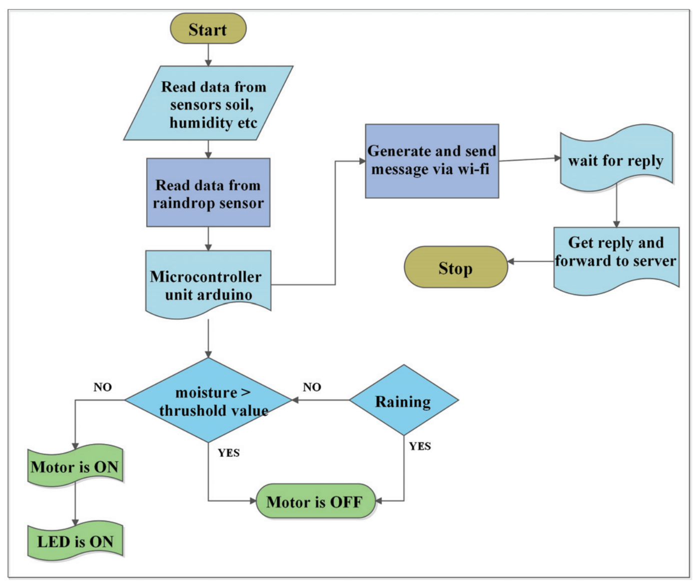

Fig. 6. Proposed Model for Smart Agriculture: Flow Chart

B. System Implementation

The technique is being implemented by directing sensors modules further towards the agriculture. The hardware setup seems to be using an Arduino alongside an additional number of sensors to collect data from the field. The techniques and applications implemented for the tests are discussed in the paragraphs that follow.

C. Steps of Implementation

- Step 1 (Set basic Programmable Devices Up): Create a software for each configured device, together with Arduino, GSM , ESP-01 Serial into Wi-Fi Configuration, and point - to - multipoint device. Everytime write a system that would allow the Arduino to turn on something like a relay, communicate by sending and receiving signals over most of the ESP-01 Wi-Fi control system, and collect audio input information obtained from the sensors. To ensuring that each ESP-01 Wi-Fi configuration can be easily identified and connected, the ESP-01 Wi-Fi components should be configured with a special ID and maybe even a shared password. They must additionally be set up to be capable of transferring and receiving information. The ESP-01 should offer the router's login information and password so that they can still quickly access it and share information.
- Step 2 (Implementing the programs in the Arduino platform) The Arduino programming can be made to regularly check from starting and to act as a rectifier by processing the data in every Arduino's design and providing it with a special network identifier.
- Step 3 (Sensor Conditions Integration). Every Arduino is continuously connected towards the sensors. A variety of times, one MQ-02 and an additional TEMT6000 will be linked to the high temp signal of something like the sensors using the Arduino's A0-A7 pins. The VCC as well as GND pins of each sensor are going to have been connected to the 5v and GND Arduino pins, respectively.
- Step 4 (Connecting Relay module): The digital connections through and near the signal generator will be connected to that same D49 and D35 pins somewhat on Arduino. The 3.3v and GND pins of the Arduino will receive data from the VCC and GND pins of the analog pin.
- Step 5 (Setting up the ESP-01 Wi-Fi module): With the ESP-01 component, the entire first pin should be used mainly for sending signals, while the last pin serves as a means of receptions. The equalizer pin must be connected to a particular one of the Arduino's receiver pins, and thus the receiver pin itself must be connected to the connected pin via that Arduino configuration. Always integrate pins 5 and 6 to the 3.3-volt port on the exact same Arduino, and input signal 4 at all times.
- Step 6 (Powering up all the devices): The major parts of it's proposed framework that would be transformed into energy sources directly are the Arduino and communication module. The Arduino should always be connected via a 5v 2.5 voltage regulator adaptor. Due to the SIM808's high electricity consumption, a voltage regulator with a voltage range of 7 to 12 volts is necessary for it to function. The router's power source is commonly 12 volts, irrespective of its model.

IV. Results and Analysis

IoT platforms provide communication services, monitoring, and descriptive statistical resources. The data from those in the examined field is transferred onto an identical cloud platform via a gateway layout, where it is instantaneously exhibited and suggestions are made and provided via network infrastructure. The MATLAB inquiry runs MATLAB code to transmit data, illustrate it, or perform other types of analysis. The proposed method uses a measurement device to collect field instantaneous information such as weather, humid, wind speed, and soil moisture. These monitor and control instances are part of the cloud device ensuring identification and quantification. Figure displays the results of plotting the data for moisture content, temperatures, humid, and overall quality of air. The central server serves as a representation of the performance testing of acquired agricultural experimental data. Figure demonstrates how the observations have changed. The uncertainty of the sensor data obtained in various circumstances is shown and portrayed on the graph. Figure 7 is used to gauge soil moisture, Figure 8 to sensor temperature, Figure 9 to monitor relative humidity, and Figure 10 to monitor air quality. To demonstrate the meaningful comparison of three days' worth of temperatures and establish the relationship among both relative temperature and atmospheric velocity, a MATLAB procedure similar to the MATLAB code is performed.

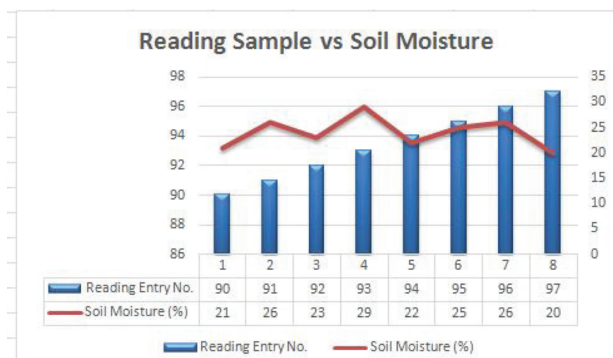

Fig. 7. Reading Sample for Soil Moisture(%) from Agriculture Field

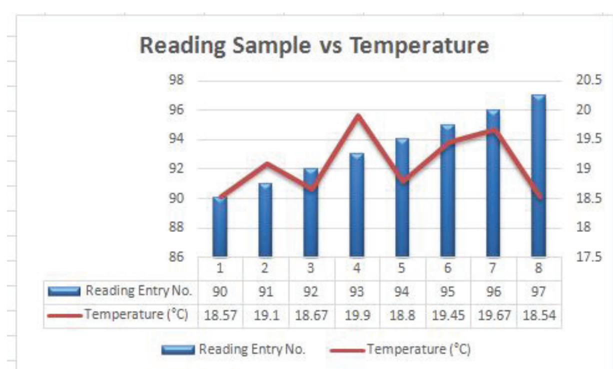

Fig. 8. Reading Sample for Temperature from Agriculture Field

TABLE I
READING SAMPLE FROM AGRICULTURAL FIELD

Reading Sample	Soil Moisture (%)	Temperature (°C)	Humidity (%)	Wind Speed(m/s)
90	21	18.57	61	6.5
91	26	19.1	73	4.2
92	23	18.67	65	6.1
93	29	19.9	77	5.8
94	22	18.8	70	4.9
95	25	19.45	72	5.7
96	26	19.67	75	5.9
97	20	18.54	59	3.5

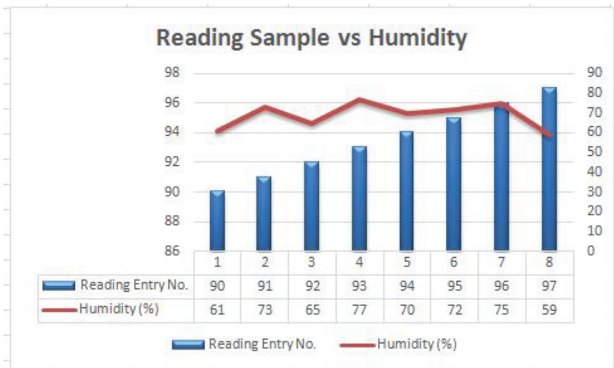

Fig. 9. Reading Sample for Humidity(%) from Agriculture Field

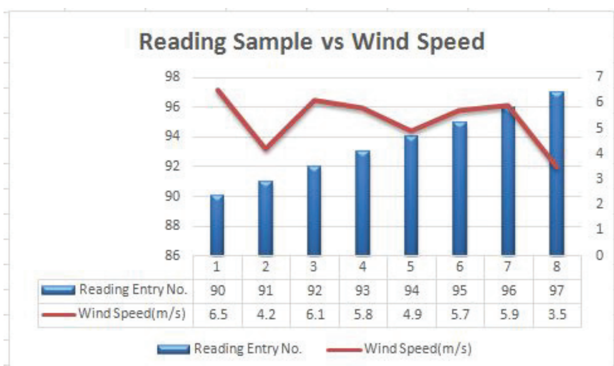

Fig. 10. Reading Sample for Wind Speed(m/s) from Agriculture Field

When evaluating the system's overall effectiveness, four performance measurements are taken into account. Given that they're not aware of the relevance of standard deviation in performance analysis, many performance analyzers have undesired reactions to it. The standard deviation is a key indicator of how consistently the evaluations performed in efficiency test results are examined. Equation (1) compares the substantially similar cloud platform with the different cloud platforms based on standard deviation besides the total amount of response.

$$STDEV(x_n) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2} \qquad (1)$$

For the sake of determining the effectiveness of the entire system, the performance and standard deviation for this kind of specific cloud platform and these few different pieces of communications infrastructure are also being evaluated. Equation (2)'s Error Rate differentiates the incoming data, which primarily comes from communication systems. The error rate is calculated as nothing more than a performing data collected by calculating the percentage of inconsistent pairings containing data items across the specified input set data types received through all of that source. The results of error rate predictions have been connected to these estimated implications [35].

$$ErrorRate = \frac{x-y}{x} * 100\% \qquad (2)$$

The investigation of the suggested method for response time but instead standard deviation when using different cloud platforms is shown in the Table II. The scheme's exhibited standard deviation and response time, which are implemented in the identical cloud platform, are 8.83 milliseconds as well as 7.67 milliseconds, respectively. These measurable implications are now connected to findings from a variety of cloud-based techniques [25]. Even if the method is effective for evaluating agricultural productivity, the efficiency of the proposed model is acknowledged in comparison to earlier framework research methods.

TABLE II
PERFORMANCE MEASUREMENT OF THE PROPOSED SMART AGRICULTURAL SYSTEM

Perfoemance Matrices	Exiting Cloud Platform	Proposed Fog Platform
Standard Deviation	10.63	8.83
Response Time	13.57	7.67
Error Rate	1% *Approx*	0.72% *Approx*
Accuracy	89.5%	93.6%

V. CONCLUSION

To address the demands of an ever-growing population, smart agriculture seems to have become increasingly important. IoT collects key information from farm fields with the help of sensors and sends it through safe environments that include identical cloud storage. Fog computing facilitates access such as data processing, gathering, and security, primarily on agricultural producing platform based like alert and intelligent fertilize. In this study, a proposed IoT-based platform for monitoring and overseeing agricultural water sources is made. The Internet of Things demonstrates useful meaning for enabling farmers and proposes an appropriate infrastructure to support smart agriculture by bolstering optimized design. Every agricultural technology is able to attain its objectives with the assistance of real-time information and recommendations. The cloud platform involves collecting, processing, or more appropriately, analysis of data while also storing it. Use the detected monitoring system to figure out the foretasted weather and, consequently, the degree of soil humidity. The users carry out some other irrigation process by making predictions based on the essential information currently being gathered. The conclusions of tests and analysis show how useful the proposed scheme is for real-time monitoring throughout irrigation agriculture circumstances. The use of this infrastructure in agricultural fields may have an effects on users by increasing crop yields and productivity.

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