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The Prospect of Precision Farming: Internet of Things (IOT) Context

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ABSTRACT
Agricultural operations started before colonization. Pre-colonial age gave birth to civilization, and farming and later continued as conventional farming practice in Nigeria. Being an agricultural country, Nigeria's farming is reliant on rain, soil, dampness, and environmental challenges. Our farmers metamorphosed into modern state of art technology in cultivation. Worldwide, IoT systems have added their application in many fields and proven to be profitable. It is time that Nigerian farmers initiated precision agricultural systems for greater crop yield. Data from sensors situated in the farm are gotten through the Arduino hardware, conditioned and wirelessly sent to a cloud analytics platform Thing Speak, where they are stored, analyzed, and monitored automatically to ensure they do not surpass set threshold values. The effectiveness of farming lies in a farmer's capability to imagine natural conditions and respond to them in the quickest way possible. Decades ago, the precision of such predictions wasn't so reliable — now, it's astonishingly high thanks to immediate data collection and distribution. The Precision agriculture system can be managed from anywhere with aid of networking technology. Continuous research and development in precision Agriculture & Internet of things IoT technology can be cutting-edge technology in data compiling and resource optimization.
Keywords: SMART (S-Specific, M-Measurable, A- Attainable, R-Realistic T-Time Bound) Precision, Soil moisture sensor, Humidity sensor, Temperature sensor, Wireless Sensor Network (WSN), Arduino, Networking, WIFI and IoT (Internet of Things).

INTRODUCTION
The recognition of the techniques of precision farming can give raise to the deteriorating conventional agricultural sector. The use of smart approaches like precision farming, efficient water management, soil moisture, and humidity monitoring are accurate methods to effect greater yield per acre of land. Precision agriculture evades the improper and excess utilization of pesticides and fertilizers and allows the farmer to use land according to its quality and nature. Precision farming is a plausible salvager at a time when the water bodies in Nigeria are reducing at a rapid rate due to extraordinary demand by the agricultural and industrial

sectors. Farmers still shift or adhere to conventional practices and delay in implementation may further minimize the GDP in Nigeria. Recently farmer/herder clashes are imminent in the country since the Pandemic Covid-19 had made most able-bodied men and women back out from farming as it's no longer lucrative. The youths can implement smart agriculture systems as it takes lesser time than conventional farming and the productivity is geometrically enhanced with fewer security issues.

Subsisting Agricultural Practices

To the generality of rural people, agricultural activities keep being one of their main livelihood strategies. Production of food crops is not reliant on any formally acquired knowledge of farming but is mainly based on indigenous agricultural knowledge passed from generation to generation through experience and careful observations. Low-income farmers, especially in rural areas, adopt conventional farming techniques to cultivate their food crops and these are specifically tailored to suit their environs. Family members are the cardinal source of farm labor with the male folks principally accountable for tilling activities while the entirety of planting, weeding, and harvesting activities are solely the duty of women. Crop preservation to resist pests is done through local methods where farmers blend some concoctions of pest control made from traditionally made ingredients to curb losses. Besides, there are no climatic control, moisture dampness, or water management, they rely on rain and the outflow of water upstream to downstream and the artificial waterway. As agriculture became more labor-exhaustive, proficient people migrated to the cities for livelihood and a favorable lifestyle, leaving conventional agriculture very expensive and hazardous. To transform unviable conventional farming into lofty-crop-yielding and money-spinning, a smart agricultural system is suggested.

Suggested Systems

Local agriculture is more labor-exhaustive, and perilous, and culminates in frustration due to reduced harvest and environmental degradation. Subsistent farmers are not informed of the benefits of the precision agricultural system that big fish and corporate organizations are relishing. Thanks to the pandemic Covid-19 and its attendant crisis as regards herders' intrusion into farmlands necessitating the mechanization of both livestock and crop farming. This automation led to the advent of internet of things IoT technology in Nigeria. Concerning agriculture, IoT (Internet of things) consists of a group of technologies that utilize sensors, cameras, and other devices to transform every element and action connected to farming into data [1]. Through software algorithms, big data engineers can employ data from climatic measurements, soil moisture contents measurements, plant health, mineral status, chemical applications, pest presence, and many others to extract knowledge about the farm at different degrees of granularity. In this IoT model, sensors can be located on the farm – on the ground, in water, in vehicles, etc. to get data. The assembled data is saved in the cloud system or server and accessed by the farmer via the internet or their mobile phones. Farmers can utilize the information from most agriculture IoT products to build workable decisions around planting, irrigating, harvesting, and many other farming activities.

LITERATURE SURVEY

Precision farming refers to a method or a practice that ensures that the farming procedure is more accurate and controlled for raising livestock and growing crops. It is realized through the application of IT and objects like sensors, autonomous vehicles, automated hardware, control systems, robotics, etc. In the lexicon of agriculture, IoT (Internet of Things) comprises a team of technologies that makes use of sensors, cameras, and other devices to change every element and action involved in farming into data [3]. Through software algorithms, important data engineers can make use of data from weather measurements, soil moisture contents measurements, plant health, mineral status, chemical applications, and pest presence to draw out knowledge about the farm at different levels of granularity.

Farmers can apply the information from most agriculture IoT products to take agricultural decisions about planting, irrigating, harvesting, and many other farming activities. Recently, precision agriculture has been identified as one of the most renowned applications of IoT in the agricultural sector and a large number of organizations have begun adopting this technique around the globe [4].

The products and services delivered by IoT systems comprise soil moisture probes, VRI optimization, virtual optimizer PRO, etc. VRI (Variable Rate Irrigation) optimization is a method that optimizes the success of irrigated crop fields with soil variability, thereby increasing yields and improving water use efficiency [5].

METHODOLOGY

a. Use of Wireless Sensor Networking System

Wireless Sensor network (WSN) in the buildup of smart and precision farming comprises distributed autonomous sensor nodes applied to watch over and control environmental situations, such as temperature and light intensity, at various locations collaboratively. The recorded data is passed through the network to the main location where it is further analyzed and/or stored [2]. Communication and transmission of data between the sensor and the cloud-based data analytics are carried out using a wireless sensor network. It can be used as a remote controller in providing inputs for seeds, fertilizers, pesticides, etc. The WSN application helps the data collection process by the farmers for cultivation and in the input feeder control system on agricultural machinery. The failures and breakdown issues such as malfunction of sensors, power supply-related issues, and information security may be an area of concern in the Wireless Sensor networking systems [8].

b. The various inputs and outputs to the systems are specified and described.

Soil nutrient data from a soil mosture sensor, and humidity, and temperature information from the DHT-11 sensor is extracted and adjusted by an Arduino Uno microcontroller. These analog signals form the main input to the system. The system works by utilizing a group of programs in the microcontroller that forms a rules engine in association with an event processor. . The event processor ascertains and adopts patterns of simple events in the field as shown in the various ThingSpeak channels to make automatic decisions about the individual inputs to the farm, the amount and the timing. The lower-limit value will be fixed according to the crop. The base (threshold) value will be tagged depending on the demand of the crop specified and predefined in the Thingspeak for each sensor. Whenever a sensor gets to its base value, a message alert is transmitted to the user, and action is performed about it.

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BLOCK DIAGRAM

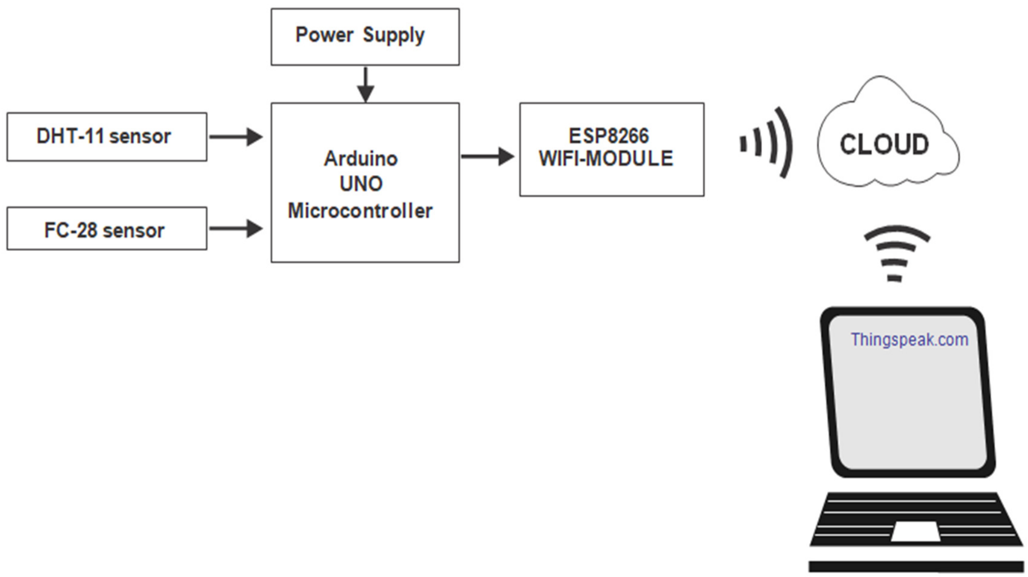

Figure 1: Block Diagram of the System Components

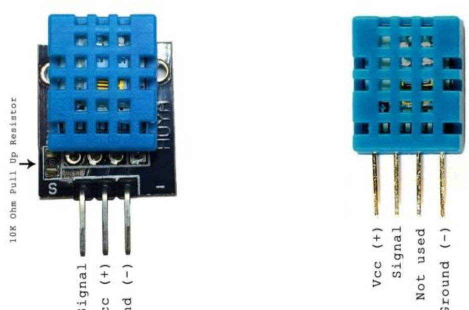

Fig 2. DHT-11 Sensor

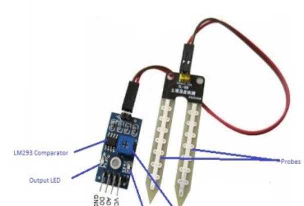

Fig3. Fc-28 sensor

Temperature and Humidity Sensor

The DHT-11 sensor shown in figure 2 senses water vapor by gauging the electrical resistance between two electrodes. A substrate can hold moisture, with electrodes applied to the surface, serves as the humidity-sensing component. Ions are discharged by the substrate when the substrate soaks up moisture. The discharge of ions multiplies the conductivity between the electrodes. The consequent shift in resistance between the two electrodes is equal to the relative humidity. Higher relative humidity reduces the resistance between the electrodes, while lower relative humidity raises the resistance between the electrodes. An

IC bound at the back of the unit transforms the resistance measurement to relative humidity. It also keeps the calibration coefficients and regulates the data signal transmission between the DHT-11 and the Arduino. The temperature measurement in a DTH-11 is achieved by a surface-mounted temperature sensor mounted inside the module. The data transmission from the DHT-11 to the Arduino is realized utilizing just one signal wire. Power is sent to the sensor from separate 5V and ground wires. A 10K Ohm pull-up resistor is expected between the signal line and the 5V line to ensure that the signal level remains high by default. [13]

Moisture Sensor.

An FC-28 Soil moisture sensor is interconnected to the Arduino. This sensor, comprising two probes, measures the volumetric content of water inside the soil and provides the moisture level as output. The sensor can release both analog and digital output and thus can be linked both in the analog or digital modes. The two probes allow the current to move through the soil and then it obtains the resistance value to measure the moisture value. When the soil holds more water, electricity will be conducted because of less resistance. Thus, the moisture level measurement will be greater. Dry soil conducts less electricity, so when there is less water, the soil will conduct electricity poorly because of increased resistance making the moisture level measurement to be reduced.The analog output of the sensor is used when connecting the sensor in the analog mode. The sensor provides a value from 0-1023 when taking the analog output from the soil moisture sensor FC-28. The moisture is measured in percentage, thus the values will be mapped from 0 -100. [13]

Arduino Uno Microcontroller

Arduino is an open-source electronics platform fixed on easy-to-use hardware and software. Through the Arduino board and its microcontroller, data is received from divergent inputs such as, a light shining on a sensor, a finger pressing a button, or a Twitter message - and transform into an output for generating certain actions like publishing something online, activating a motor, turning on an LED. etc. An Arduino user can send a set of instructions to the microcontroller on the

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board using the appropriate Arduino programming language and Integrated Development Environment (IDE). The Arduino uno is a microcontroller board based on the ATmega328P. It consists of 14 digital input/output pins (of which 6 can act as PWM outputs), 6 analog inputs, an ICSP header, a USB connection, a power jack, a 16 MHz quartz crystal, and a reset button. Compatible support the microcontroller; It's just like a plug-and-play device only connect it to a system with a USB cable or energize it with an AC-to-DC adapter or use the battery to commence operation. It is easy to use and inexpensive to replace when it rarely gets damaged. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, Mac, OS, and Linux) written in the Java programming language. It writes and loads programs on the Arduino board [12].

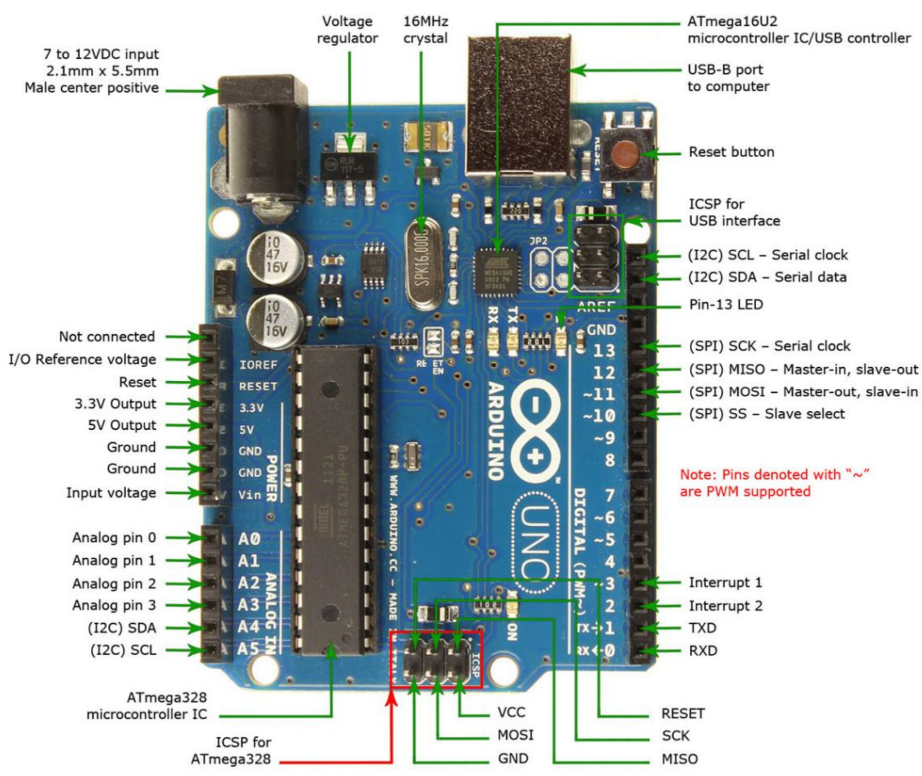

Fig 4 Arduino Uno

PERFORMANCE

The system examines performance using the thing speak.com platform to check the Temperature, humidity, and soil moisture parameters.

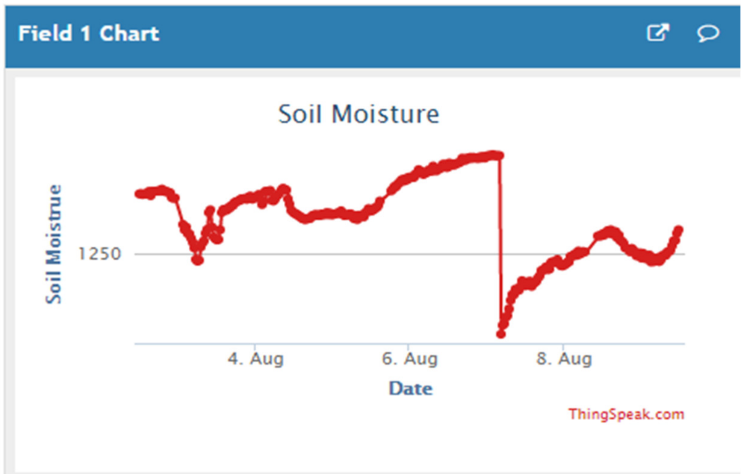

fig5. Soil Moisture Variation

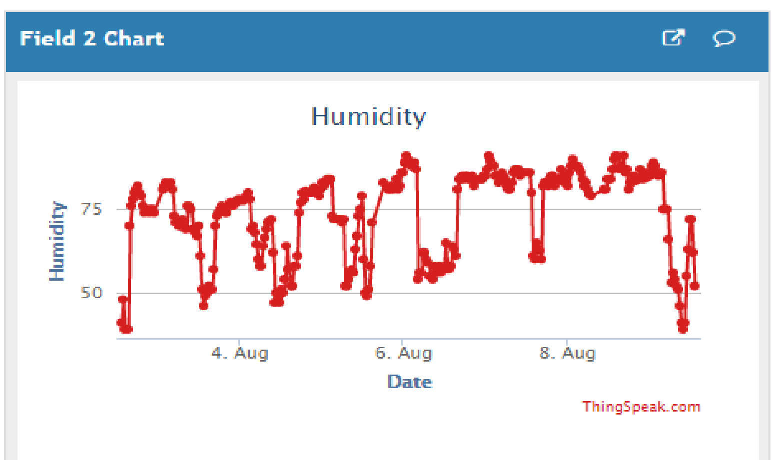

Fig6. Relative Humidity for 3 days

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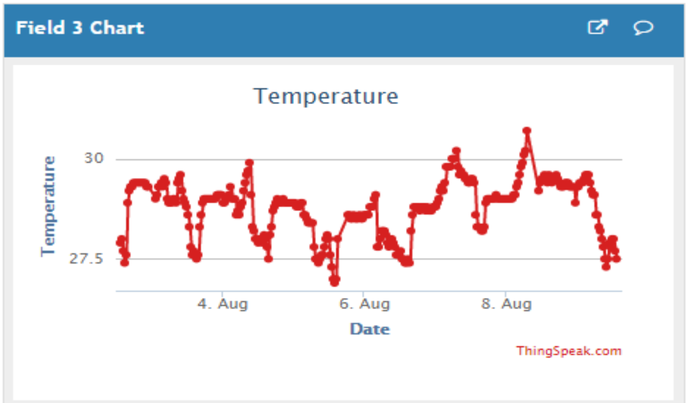
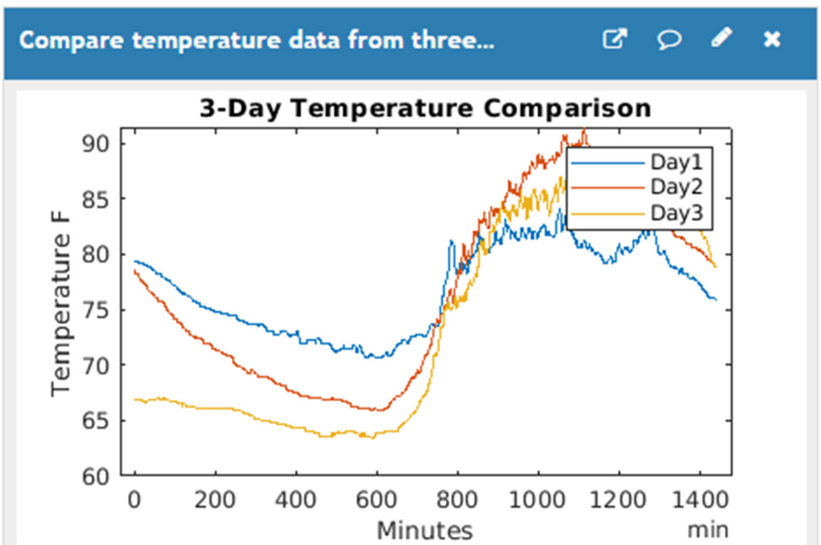


Fig7: Temperature variation

Fig 8:



Temperature comparison over three days.

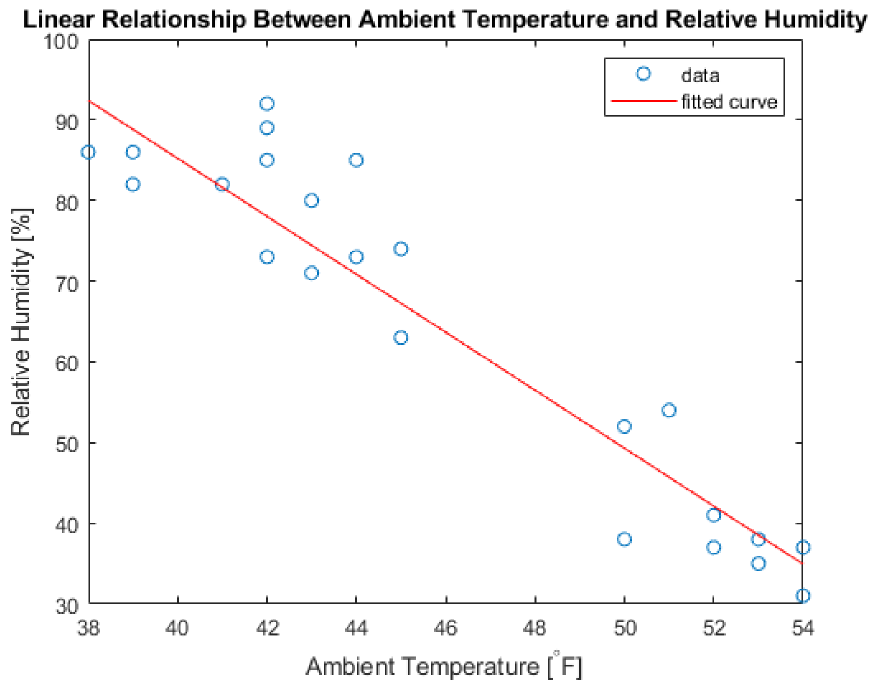


Fig8 Relationship between Ambient temperature and Relative humidity

CONCLUSION

Farming is improved and made smart using IoT technology. The technology permits farmers to review the quality of the soil and the growth of the crop in the soil. With the technology, farmers can solve irrigation problems, temperature problems, humidity problems, and lots more. Sensors for the agricultural parameters and microcontrollers can without difficulty be interfaced with one another and with the assistance of the Internet of Things, and wireless sensor network communication, the challenges faced by the farmers will be drastically minimized and an enhanced communication path for the transfer of operator's data can be realized between different nodes. Thus farmers can manage different equipment related to agriculture and track their crops on smartphones, or on computers. These systems give a high application area for the users to enhance their expertise and ensure increased output of the crops. Adopting these systems will aid to increase tomatoes, yams, cassava, and other agricultural production in Nigeria in the nearest possible future. IoT can control the condition of the yield and growth; it also is capable to check soil, temperature, humidity, etc. [13].

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