Automating, Expanding and Promoting Online Business in 21st Century Via Internet of Things (IOT).

Ayim Chukwuemeka[1],Oliver Ifeoma C.[2],Ugah John[3]

Idris Yinka[4]

[1]Department of Computer Science,David Umahi Federal University of Health Science,Uburu,Ebonyi State,Nigeria.

[2]Department of Computer Science,Akanu Ibiam Federal Uwana,Afikpo,Ebonyi State,Nigeria.

[3]Department of Computer Science Ebonyi State University Abakaliki,Ebonyi State,Nigeria.

[4]Deparment of Computer Science Alex Ekwueme Federal University Ndufu Alike Ikwo,Ebonyi state,Nigeria.

ABSTRACT
In the 21st century, the convergence of technology and business practices has given rise to innovative approaches for automating, expanding, and promoting online businesses. One such transformative technology is the Internet of Things (IoT), which offers unparalleled opportunities for connectivity, data collection, and automation. This research focuses on leveraging IoT to enhance online business operations, using the Smart Agriculture System as a case study. The study explores the potential of IoT in automating agricultural processes, optimizing resource usage, and increasing crop yields. By integrating IoT devices and sensors with cloud-based platforms, the system collects real-time data on soil moisture, temperature, humidity, and other critical parameters to predict the suitability of a farm land for better crop growth and yield. This data is then analyzed to provide actionable insights, enabling farmers to make informed decisions and automate irrigation and fertilization processes. Furthermore, the research examines how the implementation of such IoT systems can be used as a model for promoting online business in agriculture and other sectors. The findings demonstrate that IoT not only improves operational efficiency but also creates new opportunities for business expansion by offering advanced data analytics and remote monitoring capabilities. The study concludes that IoT-driven automation and data analysis can significantly enhance the productivity and sustainability of online businesses. The Smart Agriculture System serves as a practical example of how IoT can revolutionize traditional industries, providing a framework for future research and development in the field of IoT-enabled business automation.

I.   INTRODUCTION

The Internet of Things (IoT) stands out among 21st-century technological advancements for its potential in connectivity, automation, and data-driven decision-making. IoT is a network of interconnected devices that exchange data, integrating physical and digital worlds [1]. This technology automates and promotes online businesses, offering a competitive edge in the digital economy [2] .

In agriculture, IoT addresses challenges by optimizing resources, enhancing crop yields, and ensuring sustainability. The Smart Agriculture System integrates sensors to monitor soil moisture, temperature, and humidity, enabling precise interventions [3]. The system predicts the viability of a farm land for planting and growing black beans. By automating irrigation, predicting crop yields, and managing fertilization, IoT improves agricultural efficiency and productivity [4].

II.   LITERATURE REVIEW

Agricultural IoT enhances efficiency, productivity, and sustainability through precision farming and real-time decision-making. This review focuses on how IoT automates and promotes online business models.

2.1 IoT in Agriculture

IoT sensors collect real-time data on soil conditions, weather, and crop health, helping farmers make informed decisions about planting, watering, fertilizing, and harvesting, improving crop yields and resource efficiency [4][5]. IoT automates tasks like irrigation and pest control, reducing manual labor and operational costs. Automated irrigation, based on soil moisture data, optimizes water use and plant health [6]. IoT optimizes water, fertilizer, and pesticide use, reducing waste and environmental impact, promoting eco-friendly agriculture[7] and managing energy usage [8].

2.2 IoT and Online Business:

IoT enables remote management, allowing farmers to manage larger areas and diversify operations, providing market insights for tailored products [9]. IoT integrates with e-commerce, enhancing transparency and trust with traceability systems and supporting subscription-based services [10]. IoT data analytics optimize business operations, identify patterns, and enable predictive analytics for demand forecasting [11].

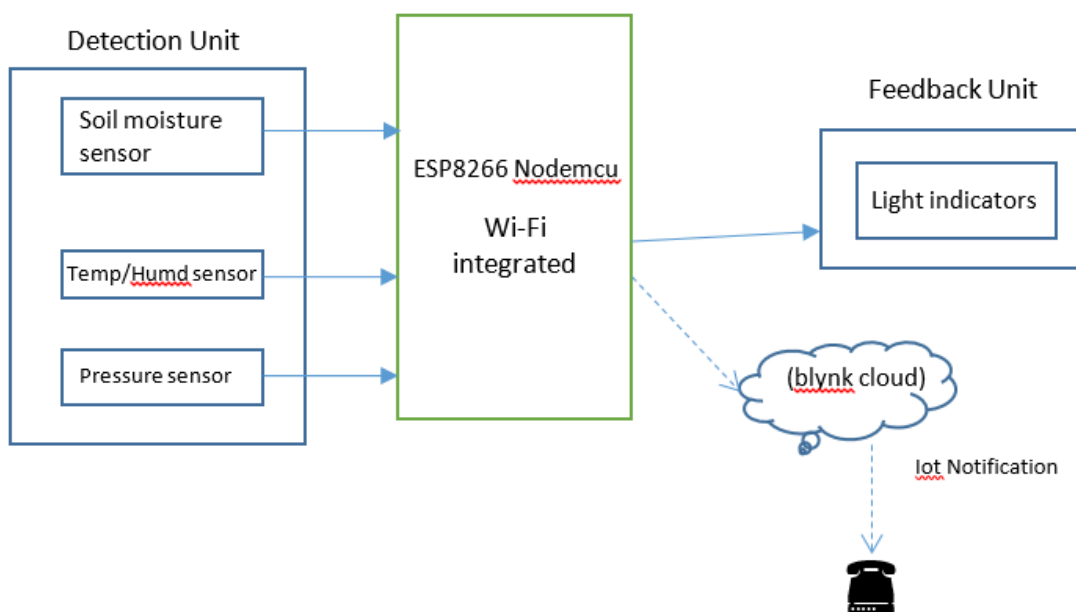## III.   METHODOLOGY

3.1 Block Diagram

Fig1: Block Diagram of the Smart Agriculture System

Figure 1 shows how the system is divided in three parts: the detection unit, the processing or logic unit and the feedback or output unit.

The detection unit is made up of three sensors. Soil moisture sensor monitors and measures the level of moisture in the soil. The temperature / humidity sensor is responsible for measuring the atmospheric temperature and humidity the specified soil sample. The pressure sensor measures the atmospheric pressure of the sample area of land. All the sensor values are sent to the processing unit for analysis and computations.

The processing unit is made up of the ESP8266 Nodemcu which is the microcontroller board programmed to do all logic work. It also integrated a wifi technology to enable the system to send iot

notification to the farmer remotely through the cloud. After processing sensor data, the processing unit triggers the feedback unit.

The feedback unit involves how the system gives the farmers information about the real time value of the sample area. The system uses the wifi technology and blynk cloud android application which is installed on the farmer's android phone to send iot notification to the farmer remotely. In addition, the system will integrate light indicators to communicate to the farmer the different degrees of the sensor data. By this the farmer take informed decisions and hence improves crop yield and production.

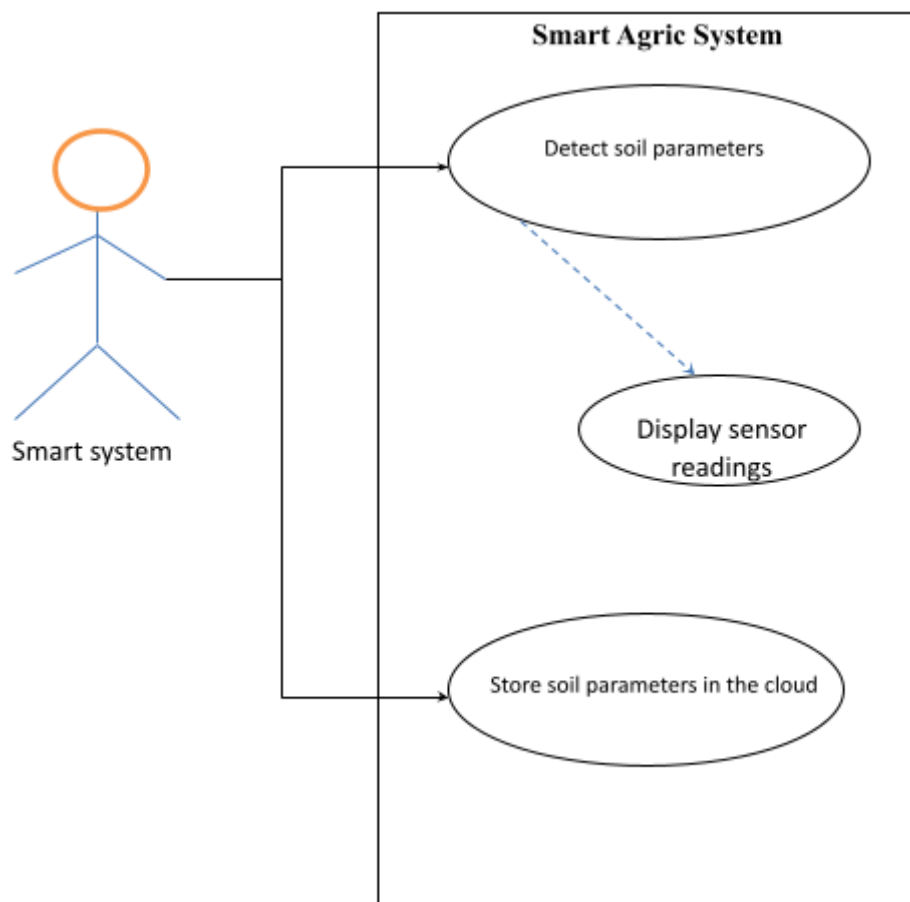The smart agriculture system has also been illustrated using the following use and class diagrams:

Fig2: The Use Case Diagram of the System

The system is required to detect the atmospheric temperature, soil temperature, relative humidity, barometric pressure and the soil moisture level of the specified soil sample. The system then uses its integrated WiFi technology to send sensor real time readings to the farmer's android phone through the blynk cloud.
Class diagram has been used to illustrate the architectural design of the system. Class diagram shows the classes that make up the system. It also shows the composition and associative relationship among them.

From the class diagram below, the system is into composition relationship (◆) with BME 280 Sensor, Dallas temp sensor, soil moisture sensor and Display classes. Also it associates (▲) with Detection and Feedback. This: (0…*) shows the number of times an object associates with another. It simply means "Zero or more times".

Other classes also associate with each other differently. The class diagram is shown in below:
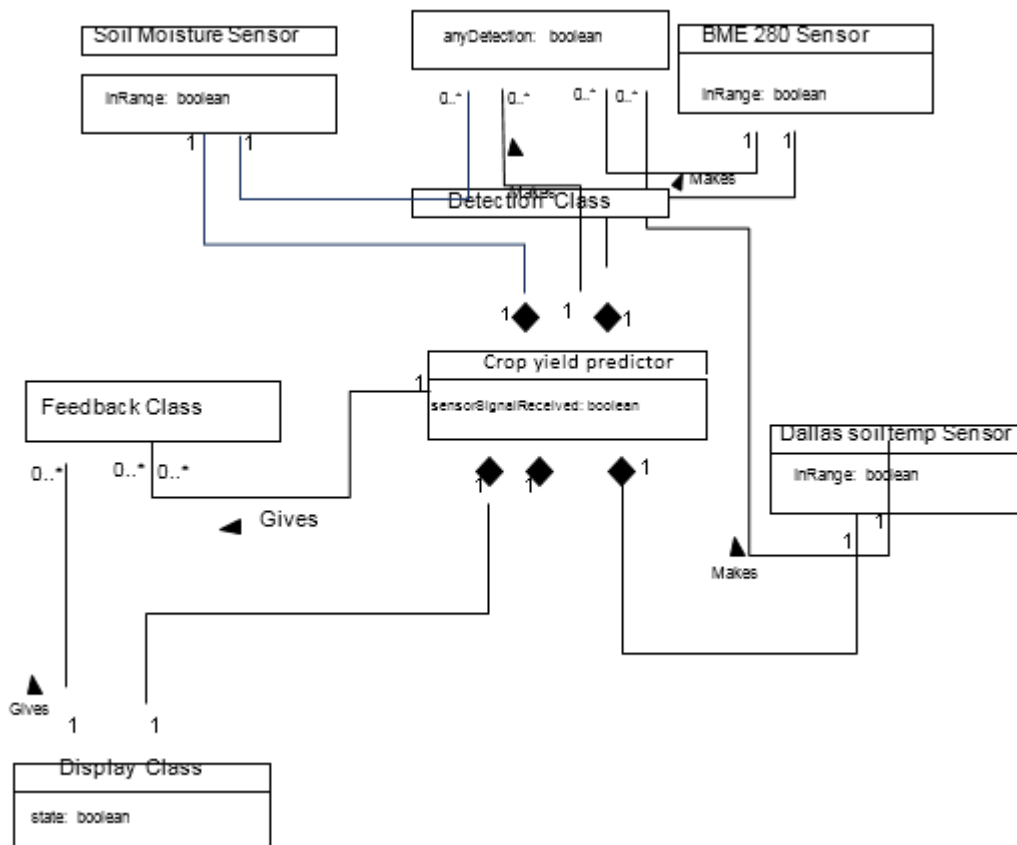
Fig 3: The Class Diagram for the System

3.2 Materials
The following components were used to build the hardware part of the system:
3.2.1 ESP8266 NodeMCU
This is an open-source Lua-based firmware and development board targeted for IoT applications, serves as the main control unit, collecting sensor data, performing analysis, and triggering output units.

Fig 4: Nodemcu Microcontroller

3.2.2 The BME280 sensor module measures temperature, humidity, barometric pressure, dew point, and altitude using I2C or SPI communication, interfaced with the NodeMCU ESP8266 for monitoring these parameters on the Blynk IoT platform.

Fig 5: BME280 sensor module

The DS18B20 is a 1-Wire digital temperature sensor with a unique 64-bit serial number, measuring temperatures from -55°C to 125°C with ±0.5°C accuracy, used in this research to monitor soil temperature changes.

Fig 6: DS18B20 temperature sensor

The soil moisture sensor, with a fork-shaped probe and an electronic module, measures soil moisture by varying resistance based on water content, producing an output voltage that indicates the moisture level, and has both analog and digital outputs for microcontroller integration.
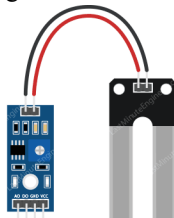

Fig **7:** Soil moisture sensor

3.3 Model implementation

The smart agriculture system has been implemented with all its part assembled for interactions. The Signal pin of the soil moisture sensor is connected to the Pin A0 of the Nodemcu. The SDA and SCL PINS of the BME 280 Sensor are connected to the PINS D2 and D1 of Nodemcu respectively. The signal pin of the Dallas temp sensor is connected to the PIN D3 of Nodemcu. All the positive and negative terminals of all the parts are connected to the positive and negative rails of the breadboard. The system is powered by 9v battery. The LM2596 DC-DC Buck converter has been used to step down the external power source from 9v to 5v which is usable by the Nodemcu. This is because the Nodemcu can only source +3.3v and this is not enough to power sensors like soil moisture sensor, etc. The positive and negative terminals of the battery (external power source) are connected to the +IN and –IN of the converter. Then the +OUT and –OUT of the converter are connected to the VIN and GND pins of the Nodemcu and the bread board rails.

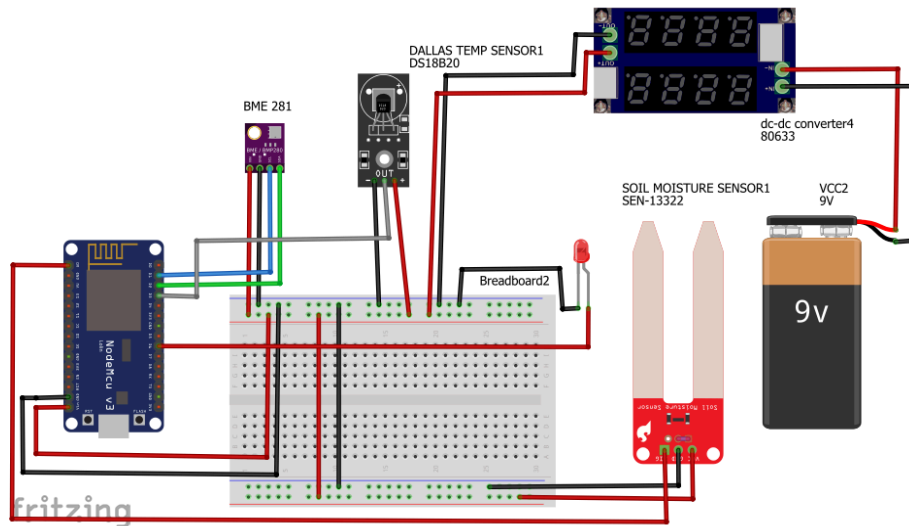All the components of the system have been put together in a casing and finished as shown below:
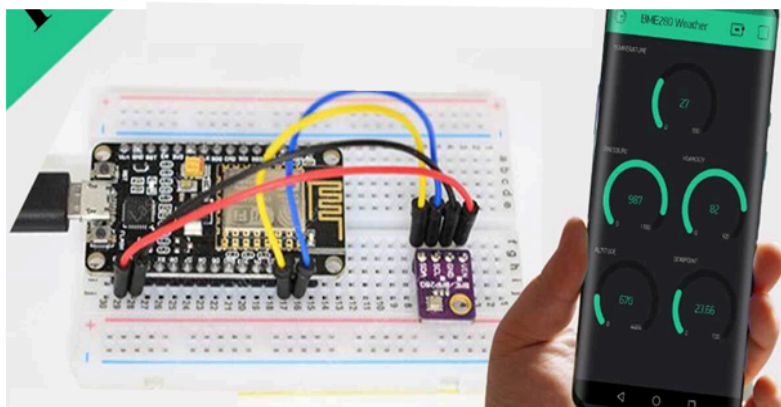
Fig 8: System breadboard view
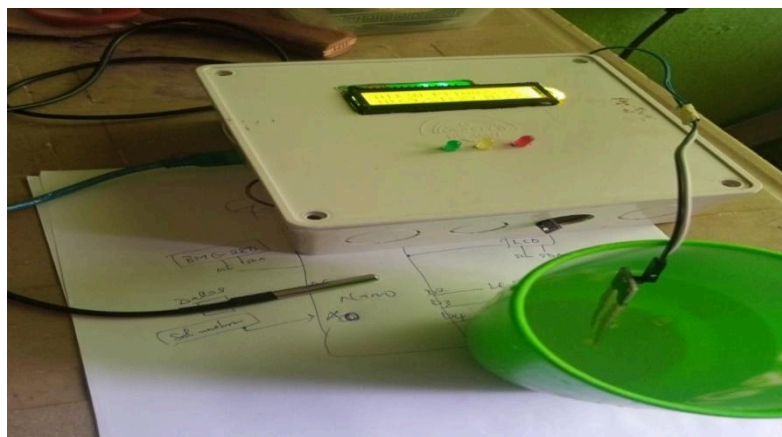

Fig 9: Inner assembly of the system

Fig 10: The outer view of the system

IV. RESULTS

The results have been summarized in table 1.

Table 1: Summary of the Test Carried out on the Smart System

Operations	Expected result	Actual result	Remark

The system was powered on	All components should receive specified input voltage to power on	All components were powered by 9v battery used.	Good
The soil moisture, Dallas Tem, and BME280 sensors monitor the sample farmland for changes in the weather and soil conditions.	The soil moisture, Dallas Tem, and BME280 sensors should monitor the sample farmland for changes in the weather and soil conditions	The soil moisture, Dallas Tem, and BME280 sensors monitored the sample farmland for changes in the weather and soil conditions	Good
Once connection is enabled, the sensor data is sent to the user's mobile app interface in real time. The information is displayed using guage gadgets	The sensor data should be sent to the user's mobile app interface in real time. The information should also be displayed using guage gadgets	The sensor data was sent to the user's mobile app interface in real time. The information was displayed using guage gadgets	Good

The system was tested and all the expected results were equal to the actual results as seen in the table 1 above.

V. CONCLUSION

This research demonstrates that the convergence of technology and business in the 21st century, particularly through the Internet of Things (IoT), offers transformative opportunities for automating, expanding, and promoting online businesses. Using the Smart Agriculture System as a case study, the research highlights how IoT enhances agricultural processes by optimizing resource usage and increasing crop yields. By integrating IoT devices and sensors with cloud platforms, the system collects and analyzes real-time data on critical parameters like soil moisture, temperature, and humidity, providing actionable insights for better decision-making and automated processes. The Smart Agriculture System exemplifies how IoT can revolutionize traditional industries, offering a robust framework for future IoT-enabled business automation research and development.

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