ABSTRACT

Smart agriculture is an innovative approach to farming that incorporates Internet of Things (IoT) technologies to increase efficiency, productivity, and sustainability in agricultural practices. With the global population increasing at an unprecedented rate, there is a growing need to produce more food with limited resources, and smart agriculture is an answer to this challenge. IoT devices such as sensors and cameras can be used to monitor soil moisture, temperature, humidity, and other environmental factors in real-time. This data can be analyzed and used to optimize irrigation schedules, fertilization, and pest control. This helps farmers to reduce water usage, minimize chemical application, and increase crop yields. In addition, IoT-enabled precision farming techniques can be used to achieve higher accuracy in planting and harvesting, reducing waste and increasing efficiency. This data can be used to plan planting patterns and monitor crop growth, leading to more precise and efficient use of resources. Smart agriculture can also help to reduce the environmental impact of farming. By monitoring and controlling water usage, farmers can reduce their carbon footprint and minimize water pollution. Smart irrigation systems can be designed to avoid overwatering, which can lead to soil erosion and nutrient depletion. Another benefit of smart agriculture is that it can help to increase transparency and traceability in the food supply chain. IoT technologies can be used to track the movement of crops from farm to fork, enabling consumers to make informed choices about the food they eat. This can also help to reduce food waste and increase food safety.

Keyword: IoT, database, Fingerprint, server, sensors, microcontroller.

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1. INTRODUCTION

Agriculture is a vital sector of the economy that has been transformed by modern technology. Smart agriculture is an innovative approach that uses advanced technologies to increase crop yields, reduce waste, and optimize resource usage. One of the key technologies used in smart agriculture is the Internet of Things (IoT).

The IoT involves connecting devices to the internet to enable remote monitoring and control of various agricultural processes. One popular device used in IoT-based smart agriculture is the NodeMCU ESP8266 microcontroller. The NodeMCU ESP8266 is an inexpensive and easily programmable device that can connect to the internet via Wi-Fi. It is equipped with multiple input/output (I/O) pins that can be used to connect various sensors and actuators, allowing it to collect data and control devices remotely.

To further enhance the capabilities of IoT-based smart agriculture systems, a MySQL database can be used to store and analyze the data collected by the NodeMCU ESP8266. MySQL is a popular open-source relational database management system that can handle large amounts of data efficiently. By storing data in a MySQL database, it becomes easier to manage, process, and analyze the data, allowing farmers to make informed decisions about their agricultural processes. The combination of the NodeMCU ESP8266 and MySQL database can be used in a variety of smart agriculture applications. One such application is precision irrigation, where sensors connected to the NodeMCU ESP8266 can measure soil moisture levels, and data can be sent to the MySQL database for analysis.

The data can then be used to make decisions about when and how much to water crops, optimizing water usage and improving crop yields. Another application is precision fertilization, where sensors connected to the NodeMCU ESP8266 can measure soil nutrient levels, and data can be sent to the MySQL database for analysis. The data can then be used to make decisions about when and how much to fertilize crops, reducing waste and improving crop yields. In addition to precision irrigation and fertilization, IoT-based smart agriculture systems using NodeMCU ESP8266 and MySQL database can also be used to monitor and control greenhouse conditions, track livestock health and location, and predict weather patterns to optimize planting and harvesting times. In conclusion, IoT-based smart agriculture is a promising approach that can help farmers increase crop yields, reduce waste, and optimize resource usage. The NodeMCU ESP8266 microcontroller and MySQL database are valuable tools that can be used to implement smart agriculture systems that are efficient, cost-effective, and scalable. By using these technologies, farmers can make informed decisions about their agricultural processes and achieve sustainable growth.

Figure 1.1 Home page of website [3]

2. LITERATURE SURVEY

To implement this mechanism in the project, we have studied different works and papers on different software and smart agriculture projects. The first and foremost important thing for smart agriculture is to receive the different kind of data with the help of sensors then updating the data to the database. To store the information of a user's data a RDBMS (Relational Database Management System) can be used. In this project we have used the MySql Database. MySQL Database is a fully-managed database service, powered by the integrated HeatWave in-memory query accelerator. It is the only cloud-native database service that combines transactions, analytics, and machine learning services into MySQL Database, delivering real-time, secure analytics without the complexity[1]. The microcontroller that we are using is Nodemcu esp8266, NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (microcontroller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits[2]. Node.js is built against modern versions of V8. By keeping up-to-date with the latest releases of this engine, we ensure new features from the JavaScript ECMA-262 specification are brought to Node.js developers in a timely manner, as well as continued performance and stability improvements[3]. A Ide is used to run this software in this project Microsoft's Visual Studio Code is used. Visual Studio Code is a lightweight but powerful source code editor, It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages and runtimes (such as C++, C#, Java, Python, PHP, Go, .NET)[4].

3. METHODOLOGY

This project is identifying sensing the data from the field then the data is being sent to our microcontroller which is nodemcu esp8266. Once the microcontroller has received the data then it is using a nodejs script to send it to the mysql server. After the successfully storing the data into the database the user is accessing the data through website which is being done through user by his finger impression and the OTP sent to his mobile number. So basically, these are the two main steps which are used in the authentication. But before authentication the user has to be registered to the bank and his information must be stored in the database. Thus, the whole mechanism of the biometric based ATM authentication system is divided into two main stages:

- Enrolment Stage
- Authentication Stage

3.1 DATA SENSING

Data sensing is a crucial aspect of implementing a smart agriculture system using IoT. In a smart agriculture system, sensors are used to collect data from the environment and send it to a microcontroller such as NodeMCU ESP8266 for processing and analysis. The data collected can be used to make informed decisions about agricultural processes such as irrigation, fertilization, and pest control.

Here are some examples of sensors used in data sensing in smart agriculture using IoT:

- Soil moisture sensors: Soil moisture sensors are used to measure the amount of water present in the soil. These sensors can be placed at different depths in the soil to provide a detailed understanding of the moisture content. The data collected from these sensors can be used to determine when to water the crops, how much water is required, and when to stop watering.
- DHT 11 sensor: Temperature and humidity sensors are used to measure the temperature and humidity of the environment in which the crops are growing. These sensors can be placed inside or outside the greenhouse, and the data collected can be used to control the environment in which the crops are growing.
- Rain sensor: Rain sensors are used to know whether it is raining or not.
- PIR sensor: Passive Infrared (PIR) sensors are commonly used in smart home automation, security systems, and other IoT applications. These sensors detect changes in infrared radiation, which are emitted by all objects with a temperature above absolute zero.

3.2 USER LOGIN/REGISTRATION

In this phase of the given project we have designed a user interface. The user can login to the project or if the user is new then he/she can register themselves to the project. We have designed

a database in such a way that once a user tries to login to the system it matches the username and password with the same data which i

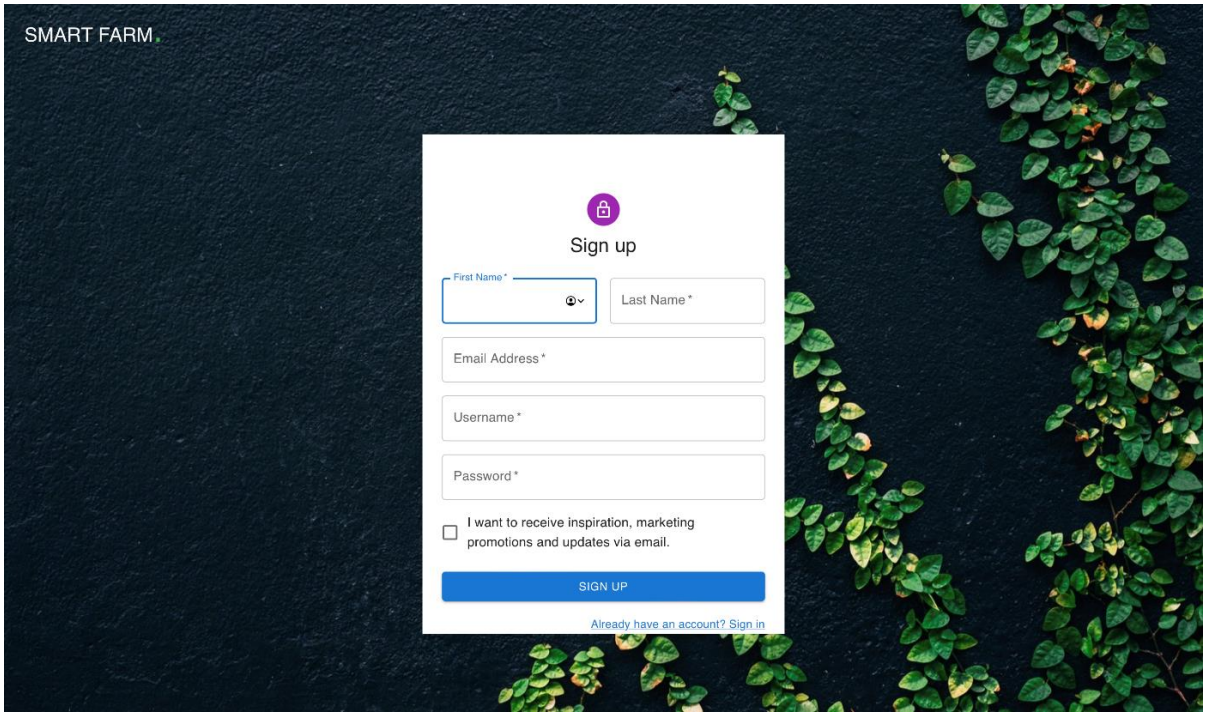


Figure 1.2 Sign Up page

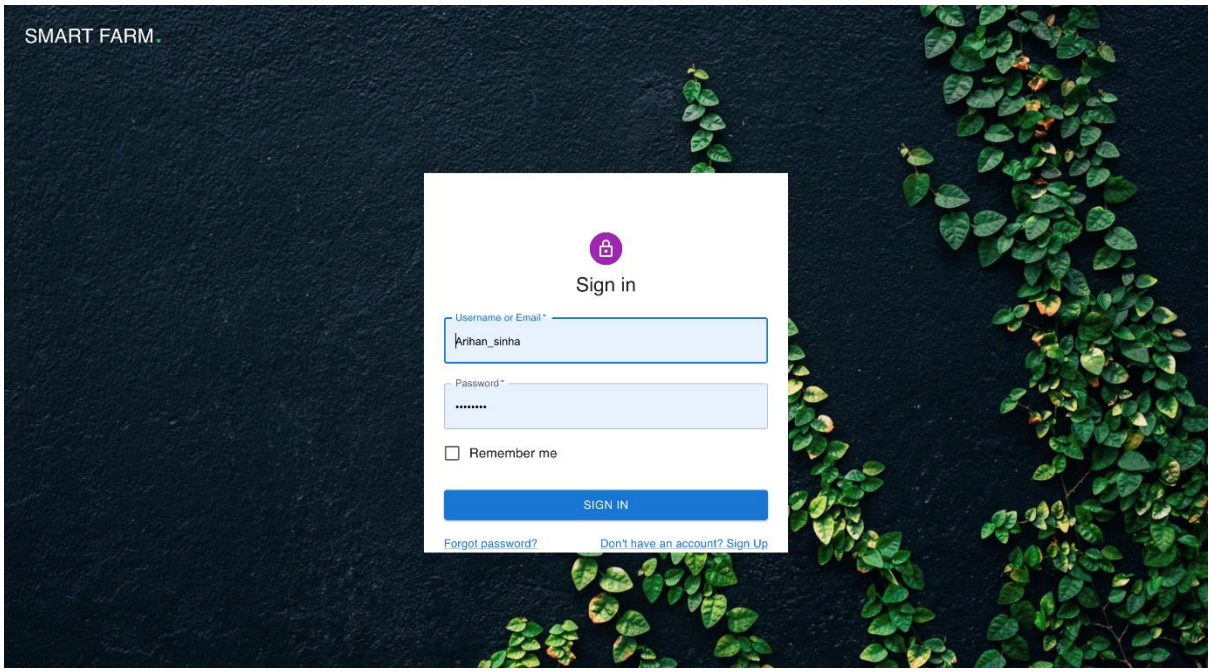


Figure 1.1 Sign In page

3.3 DATA FETCHING

Data fetching is an essential aspect of implementing a smart agriculture system using IoT. In a smart agriculture system, data is collected from sensors placed in the environment and stored in a database for further processing and analysis. The data can be fetched from the database for real-time monitoring and analysis to make informed decisions about agricultural processes. Here are some examples of data fetching in smart agriculture using IoT:

- Real-time monitoring: The data collected from the sensors can be fetched from the database in real-time for monitoring the environmental conditions in which the crops are growing. This information can be used to make informed decisions about irrigation, fertilization, and pest control, among other agricultural processes.
- Historical data analysis: The data collected from the sensors can be used to analyse the historical trends in environmental conditions in which the crops have grown. This information can be used to optimize the agricultural processes and improve crop yield.
- Alerting and notifications: The data collected from the sensors can be used to set thresholds for environmental conditions. When these thresholds are crossed, alerts can be sent to the farmer, notifying them of the issue. For example, if the soil moisture level drops below a certain threshold, the farmer can be alerted to water the crops.
- Predictive analytics: The data collected from the sensors can be used to develop predictive models that can forecast future environmental conditions. This information can be used to plan agricultural activities such as sowing, harvesting, and storage.

4. ALGORITHM

Step 1: The user must register himself on our platform.

Step 2: User data will be stored in the MySQL server.

Step 3: Sensors will be sending the data to the Nodemcu.

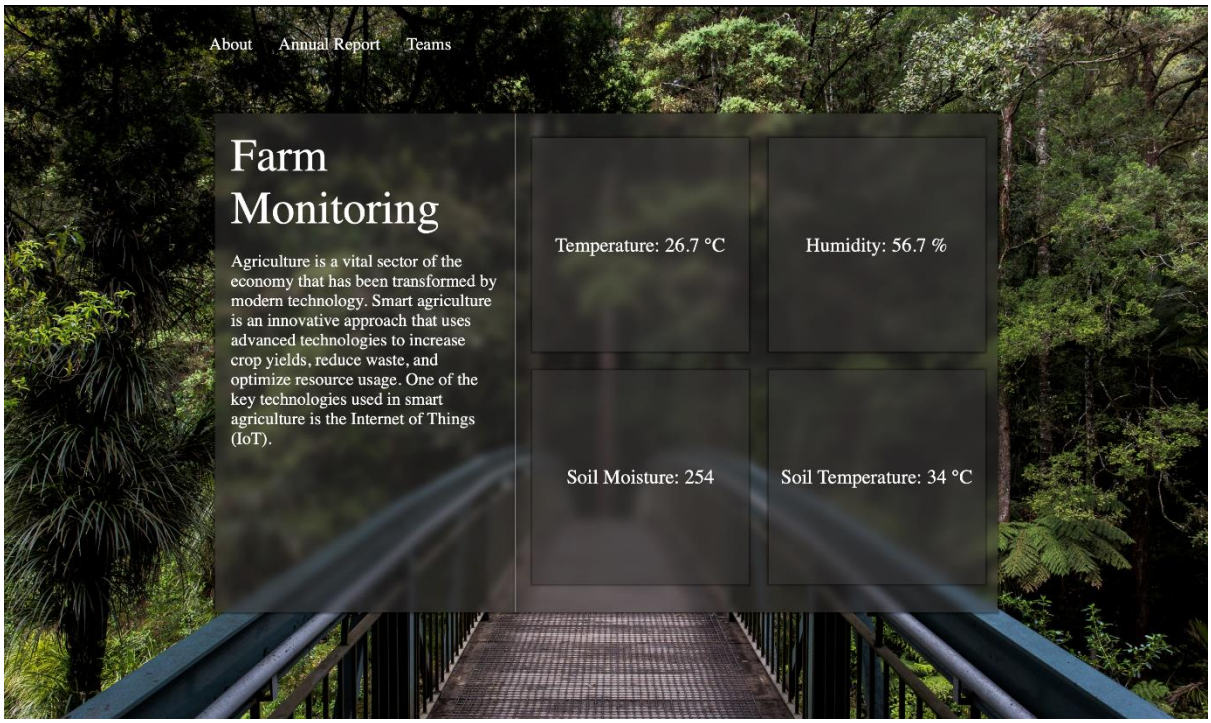
Step 4: Sensor data will be sent to the MySQL server using NodeJS where it will be stored continuously.

Step 5: Data will be fetched to the website using another NodeJS script.

Step 6: Now the user will be able to get the data by just signing in to the website.

5. RESULT

This project is designed mainly to provide a effective, efficient & productive way to user so that they can get the important data of their field and use the data analytics. Once the user register/login to the website then they can get the data of their field.



6. CONCLUSION

In conclusion, smart agriculture using IoT is a modern approach to farming that leverages advanced technologies such as sensors, devices, and data analytics to improve efficiency, reduce costs, and increase productivity. IoT enables farmers to monitor various aspects of their farms in real-time, including soil quality, weather conditions, plant health, and livestock health.

Smart agriculture using IoT offers several benefits, including:

- Increased Efficiency: IoT-enabled devices and systems can automate routine tasks and provide real-time insights, allowing farmers to optimize their farming practices and reduce waste.
- Improved Productivity: Smart agriculture systems can help farmers maximize crop yields and increase the productivity of their farms.
- Reduced Costs: IoT devices can help farmers reduce water and energy usage, optimize fertilization and pest control, and prevent waste, resulting in cost savings.

- Enhanced Sustainability: Smart agriculture can help farmers reduce their environmental impact by using resources more efficiently and reducing waste.

  Overall, smart agriculture using IoT is transforming the agricultural industry by enabling farmers to make data-driven decisions, optimize their farming practices, and increase profitability. The continued development of IoT technologies is likely to drive further innovation in the field of smart agriculture, helping farmers to meet the challenges of an ever-changing global food system.