SMART FARMING SYSTEM USING IOT FOR EFFICIENT CROP GROWTH

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ABSTRACT

This project presents an integrated control system that utilizes an Arduino microcontroller to interface with various sensors and actuators, enabling automated environmental monitoring and control. The system incorporates Light Dependent Resistor (LDR), DHT11 temperature and humidity sensor, soil moisture sensor, DC pump, LED lights, CPU fan, and GSM module, all interconnected through three relays for efficient and flexible control.

The system aims to provide a responsive and intelligent environment by automating tasks based on sensor readings. The LDR sensor detects light levels, and when darkness is detected, the Arduino triggers the relay to activate the LED lights. This ensures adequate illumination during low light conditions, enhancing visibility and safety.

The Android application is designed to facilitate a seamless interaction between three distinct user roles: Admin, Shops (Fertilizer), and Users. The admin role involves secure login, granting access to add and view shops, ensuring efficient management of shop-related data. For Shops (Fertilizer), the app provides login access, enabling them to add products and view user requests, streamlining their operations. Users can register, log in, access thick pick data soil tests, and receive crop recommendations. Furthermore, the app supports recommendations translation into Hindi for user convenience.

Farmers will be able to remotely monitor and control irrigation, nutrient levels, and pest management, reducing resource wastage and improving overall crop health with the application we will provide.

Keywords

LDR, DHT11, soil moisture sensor, Arduino Uno, buzzer, relay, DC pump, LCD, GPRS, Application, Android.

1. INTRODUCTION

Climate and environmental elements such as local microclimate, groundwater content, growing environment temperature, humidity, and light intensity all have a significant impact on agricultural cultivation success.

Thus, it is critical to create technology that can address these issues and ensure that Indonesian horticulture grows more productive in both quality and quantity.

Previously, various research were reported in which they used IoT-based techniques to improve farming. However, a research of IoT-based horticulture that is suitable for Indonesian conditions, in a microclimate farming setting, and ready to be linked with intelligence microclimate farming is still insufficient.

Users can register, log in, access thick pick data soil tests, and receive crop recommendations. Furthermore, the app supports recommendations translation into Hindi for user convenience. Users can also browse and view available shops and products, add items to their cart, and place orders for fertilizers. This multi-functional Android application leverages Android XML and Kotlin to deliver a user-friendly interface, ensuring a seamless experience for all three user roles, enhancing accessibility and convenience for agricultural stakeholders.

2. SMART FARMING SYSTEM USING IOT FOR EFFICIENT CROP GROWTH Model

The proposed method offers an innovative solution through the utilization of an embedded system integrated with various sensors and actuators. By employing an Arduino microcontroller interfaced with LDR, DHT11, soil moisture sensor, DC pump, LED lights, CPU fan, GSM module, and LCD display, the system transforms conventional environmental monitoring and control. The process begins with the LDR sensor detecting darkness, prompting the system to activate LED lights automatically. Meanwhile, the DHT11 sensor continuously monitors temperature and humidity levels, triggering the CPU fan to regulate temperature if thresholds are exceeded, thereby preventing overheating. The soil moisture sensor ensures optimal soil conditions by activating the DC pump to irrigate the soil when moisture falls below a specified threshold. Users can receive feedback on sensor readings from the LCD display. Moreover, the GSM module allows the system to send SMS notifications to a specified recipient in the case of a critical incident, guaranteeing prompt intervention. Notably, the system's embedded nature permits the collection of sensor data for remote monitoring and historical analysis through web server uploads. This transformational approach eliminates the drawbacks of manual methods, offering real-time, automated, and intelligent environmental monitoring and control.

2.1 Benefits of Smart Agriculture using IOT

1. Increasing farmer revenue by growing organic, off-season, and exotic crops in climate-invariant conditions.
2. Scalable agriculture for indoor and outdoor farming, including urban families and huge farmlands.
3. Water is conserved, and nutrients are recycled. Water usage is increased, while outflow into the environment is lowered.
4. Ensures ongoing and sustainable manufacturing.
5. The system is straightforward, dependable, and durable.
6. The hydroponic component functions as a biofilter.
7. Integrated systems require less water quality monitoring compared to isolated systems.

2.2 Methodology

The methodology of the Smart Agriculture System using IOT project involved several steps, which are detailed below:

Literature Review: Conventional methods for environmental monitoring and control, such as manual checking and traditional irrigation systems, have several inherent disadvantages. Manually checking parameters such as light, temperature, humidity, and soil moisture is labor-intensive and prone to errors caused by human ignorance or restrictions. It frequently causes delayed responses to changing conditions, leading in poor resource utilization and potential damage. Traditional irrigation systems frequently abuse water, resulting in waste and increased operational expenses. Furthermore, these methods lack real-time data collecting and remote monitoring capabilities, making it difficult to obtain full information and take prompt action.

Component Integration: The proposed method offers an innovative solution through the utilization of an embedded system integrated with various sensors and actuators. By employing an Arduino microcontroller interfaced with LDR, DHT11, soil moisture sensor, DC pump, LED lights, CPU fan, GSM module, and LCD display, the system transforms conventional environmental monitoring and control. The process begins with the LDR sensor detecting darkness, prompting the system to activate LED lights automatically. Meanwhile, the DHT11 sensor continuously monitors temperature and humidity levels, triggering the CPU fan to regulate temperature if thresholds are exceeded, thereby preventing overheating. The soil moisture sensor ensures optimal soil conditions by activating the DC pump to irrigate the soil when moisture falls below a specified threshold. The LCD display provides users with feedback on sensor readings. Furthermore, the GSM module allows the system to send SMS notifications to a selected recipient during crucial situations, ensuring timely intervention. Notably, the system's embedded nature permits the collection of sensor data for remote monitoring and historical analysis through web server uploads. This transformational approach eliminates the drawbacks of manual methods, offering real-time, automated, and intelligent environmental monitoring and control.

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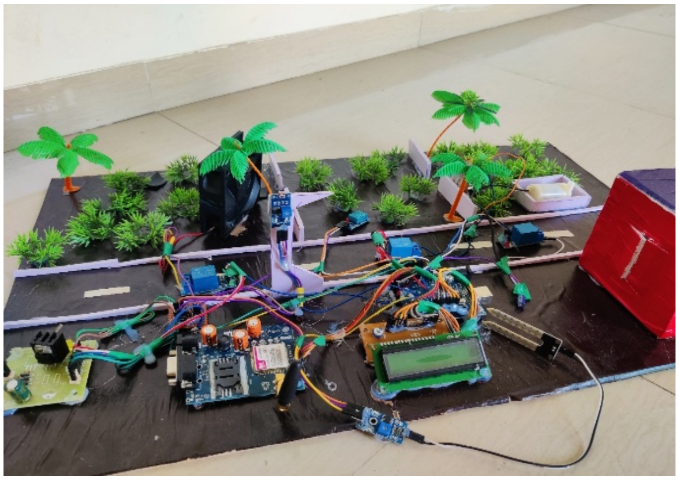
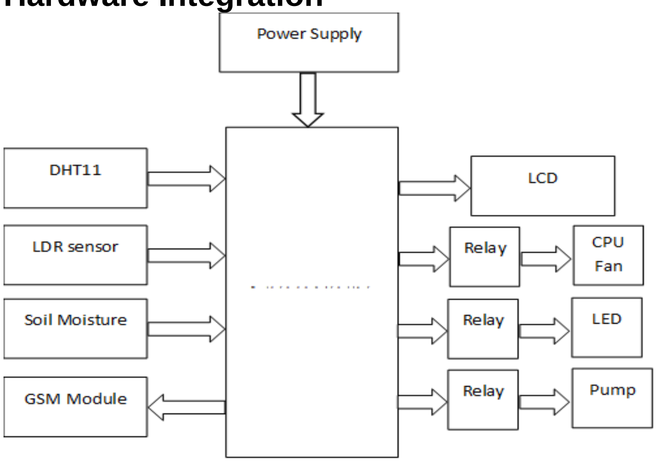
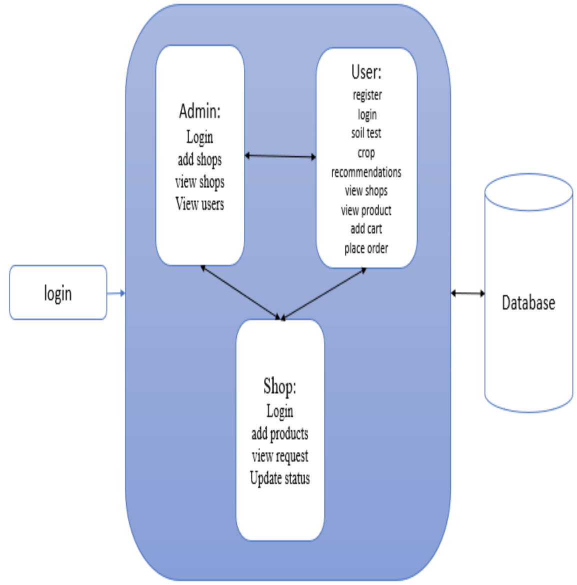


3. System Architecture

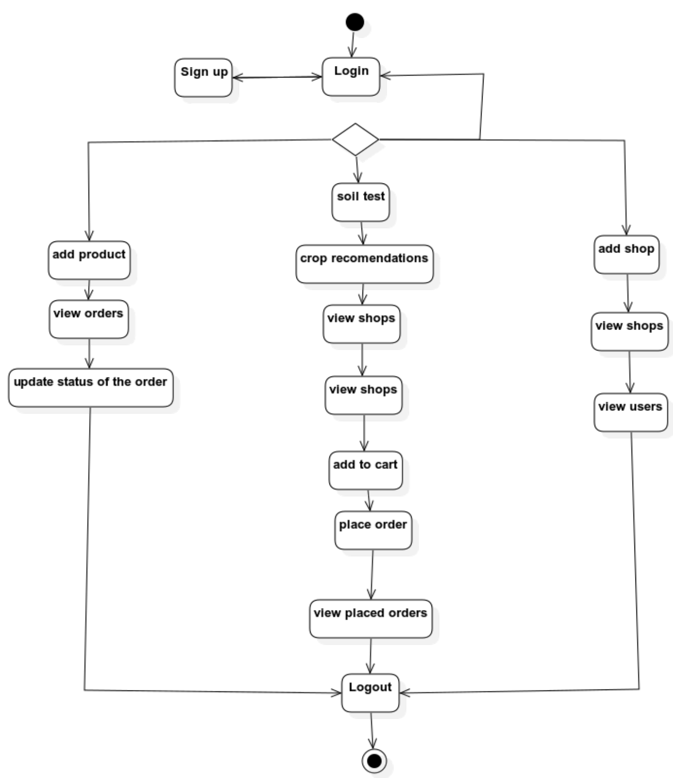
Hardware Integration



Software Connectivity



Software Flow



4. LITERATURE SURVEY

Karan Kansara, Vishal Zaveri, Shreyans Shah, SandipDelwadkar and KaushalJani

In Sensor based Automated Irrigation System with IOT mentioned about using sensor based irrigation in which the irrigation will take place whenever there is a change in temperature and humidity of the surroundings. The flow of water is managed by solenoid valve. The opening and closing of valve is done when a signal is send through smicrocontroller. The water to the root of plant is done drop by drop using rain gun and when the moisture level again become normal then sensor senses it and send a signal to microcontroller and the value is then closed. The two mobile are connected using GSM. The GSM and microcontroller are connected using MAX232. When moisture of the soil become low moisture sensor sense it and send signal to microcontroller, then the microcontroller gives the signal to mobile and it activate the buzzer. This buzzer indicates that valve needs to be opened by pressing the button in the called function signals are sent back to microcontroller. Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features.

Joaquin Gutierrez, Juan Francisco Villa-Medina, and Alejandra Nieto-Garibay, Miguel Angel Porta-Gandara

In Automated Irrigation System Using a Wireless Sensor Network and GPRS Module mentioned about using automatic irrigation system in which irrigation will take place by wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. It takes a measure of temperature and moisture using sensor and controlled by microcontroller. The WIU has also a GPRS module to transmit the data to a web server via the public mobile network. The information can be remotely monitored online through a graphical application through Internet access devices. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability and it is feasible system. But due to Zigbee protocol this system becomes more costly.

VandanaDubey, NileshDubey and ShaileshsinghChouchan

In Wireless Sensor Network based Remote Irrigation Control System and Automation using DTMF code mentioned about using automated irrigation system for proper yield and handled remotely for farmer safety. Wireless sensor network and Embedded based technique of DTMF (Dual Tone Multiple Frequency) signaling to control water flow for sectored, sprinkler or drip section irrigation. Circuit switching instead of packet switching used by SMS controlled devices available currently in the market. The farmer can use his cell phone or landline phone for the purpose of starting and controlling the irrigation and the pesticide spraying, just by dialing and sending the DTMF commands over the GSM network. This system will be very economical in terms of the hardware cost, power consumption and call charges. Farmers have to control (on/off) the valves time to time (even at night) which increases the running cost because every time we have to make a call to on or off the valves and it is also very inconvenient. Farmers are unable to know the status of power supply at the field.

G.Nisha and J.Megala

In Wireless Sensor Network Based Automated Irrigation and Crop Field Monitoring System mentioned about using wireless sensor network based automated irrigation system for optimize water use for agricultural purpose. The system consists of distributed wireless sensor network of soil moisture, and temperature sensors placed in the crop field. To handle the sensor information Zig bee protocol used and control the water quantity programming using an algorithm with threshold values of the sensors to a microcontroller for irrigation system. The system continuously displays the abnormal condition of the land (soil moisture, temperature level). Using a GSM modem with GPRS facility feature provides the information to fanners and interface with PIC 18F77 A microcontroller. The Irrigation system is automatic and manual mode. This system increase the crop fields, improve the crop quality, increase the energy and reduce the non-point source pollution.Due to PIC microcontroller the length of the program will be big because of using RISC (35 instructions).

Kavianand G, Nivas V M, Kiruthika R and Lalitha S

In Smart drip irrigation system for sustainable agriculture mentioned about using fully automated drip irrigation system which is controlled and monitored by using ARM9 processor.PH content and the nitrogen content of the soil are frequently monitored. For the purpose of monitoring and controlling, GSM module is implemented. The system is used to turn the valves ON or OFF automatically as per the water requirement of the plants. The system informs user about any abnormal conditions like less moisture content and temperature rise, even concentration of CO_2 via SMS through the GSM module. The moisture sensor output will help to determine whether to irrigate the land or not depending upon the moisture content. Along with moisture sensor the temperature sensor output can also be taken into consideration while irrigating the land. If the moisture content of soil is very low and the temperature is very high then there is need of irrigation for plants, but the time for which irrigation will be provided is different for different temperature range. Small amount of water is lost through deep percolation if the proper amount is applied.ARM processor is that it is not binary compatible with x86. This means you not going to be running windows any time soon. There are several Unixoperating systems that can run on ARM however, such as Linux and BSD.

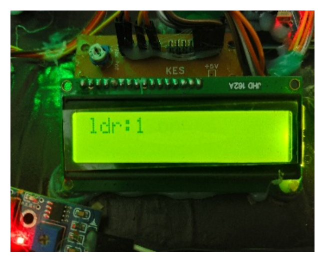
5. Results section

As a proof-of-concept project, the Smart Farming System using IoT for Efficient Crop Growth created a prototype An electronic sensor board is installed at the Agriculture site to monitor the air, water, and soil conditions. The results are stored in a monitoring database. This database will also be coupled with the IOT, which contains weather data for the agriculture area. This study is limited to the design and implementation of a monitoring system.

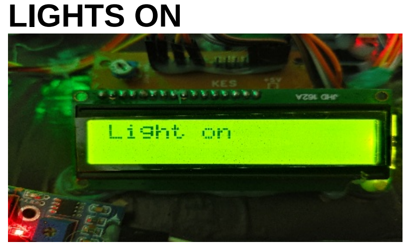
From the proposed method we get the proper growth of the crop.

Readings from hardware components

1. LDR



LIGHTS ON



2. Moisture

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Water automatically turn on its flow

3. Temperature and Humidity

When temperature increases gradually

4. All types of notifications

Message Sent

Lights on

Sending Data

5. Graphs from all readings

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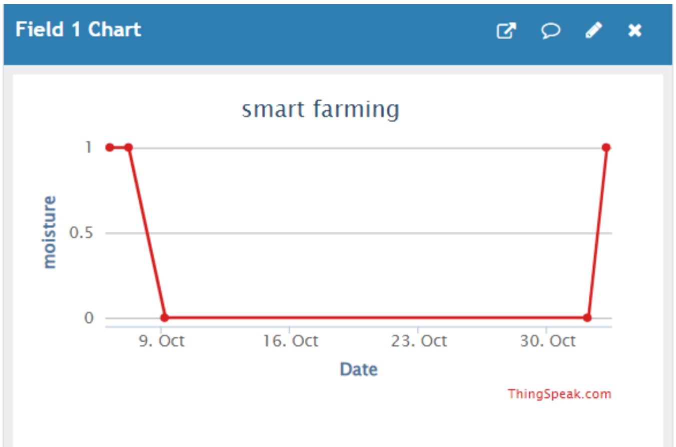
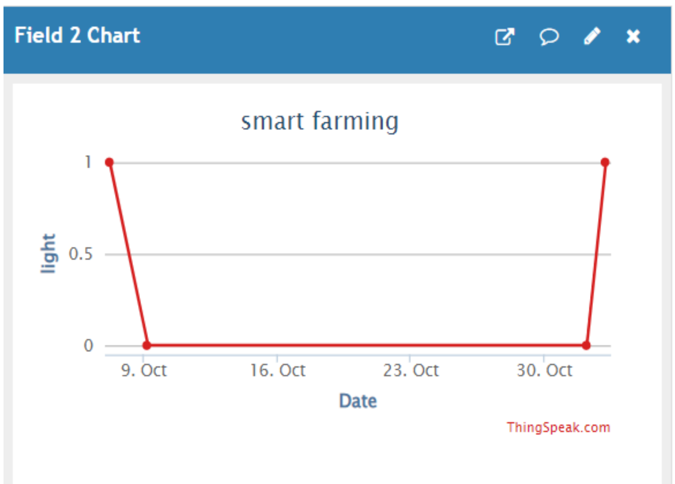
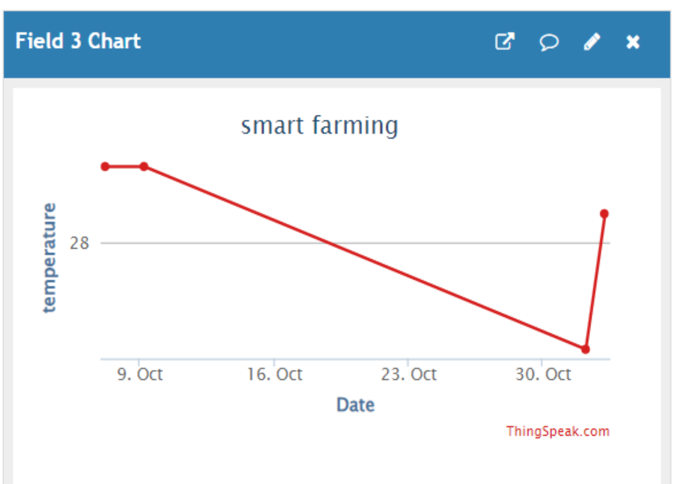
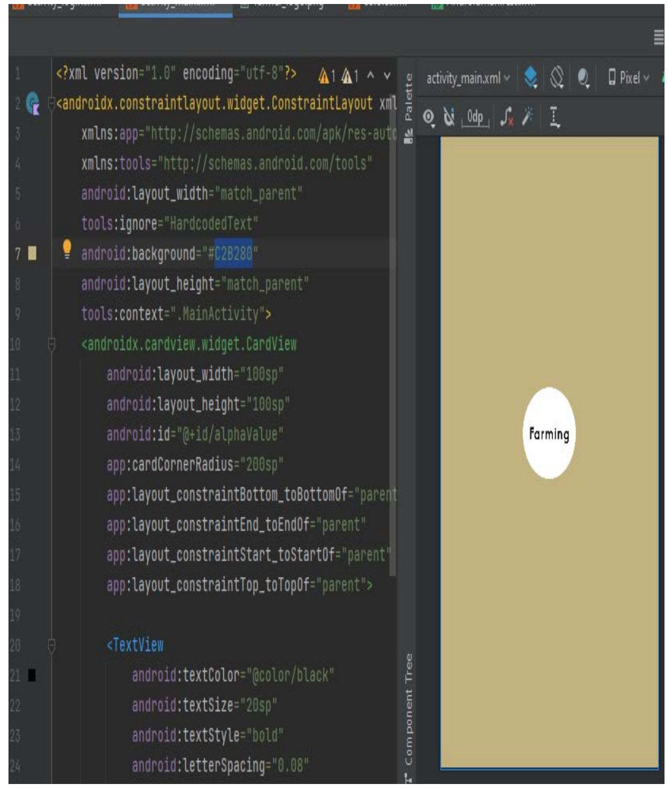




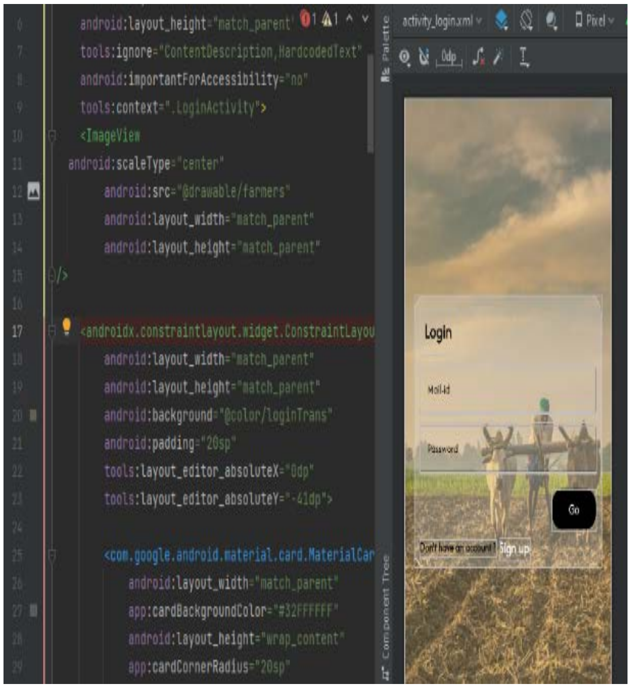


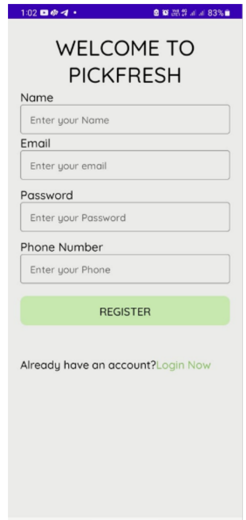
6. Codes and results

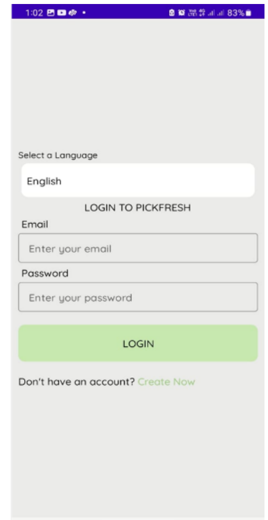
6.1 Homepage



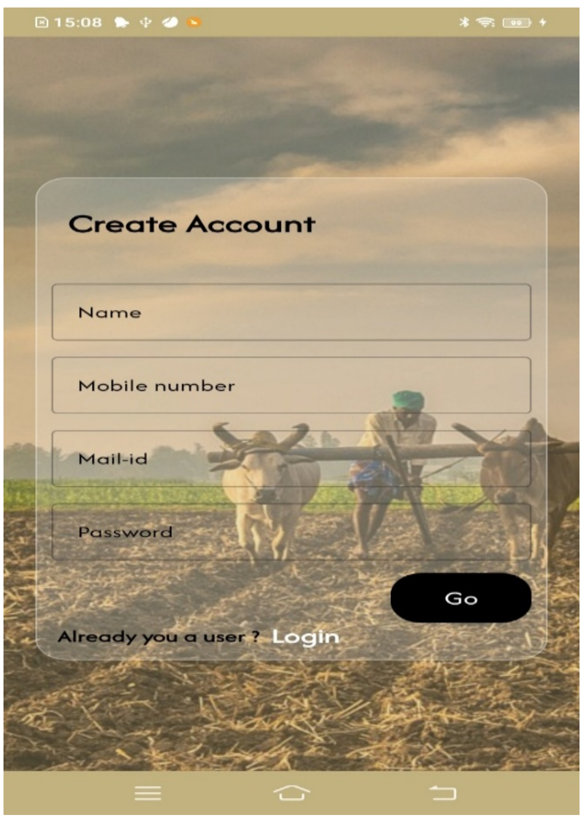
6.2 Signup page

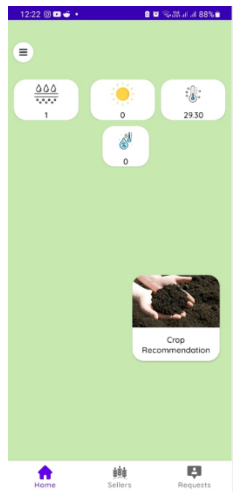


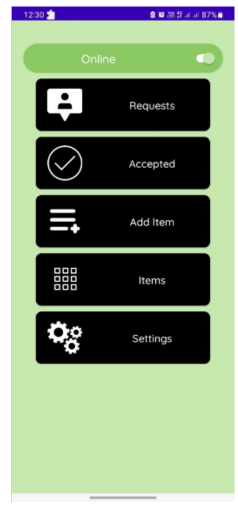




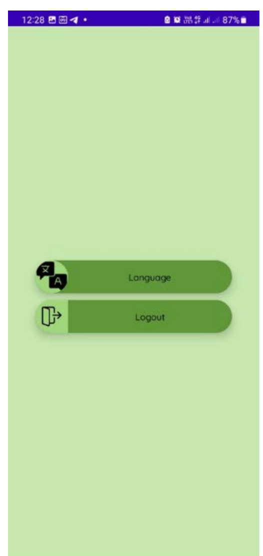
LOGIN/SIGNUP PAGE

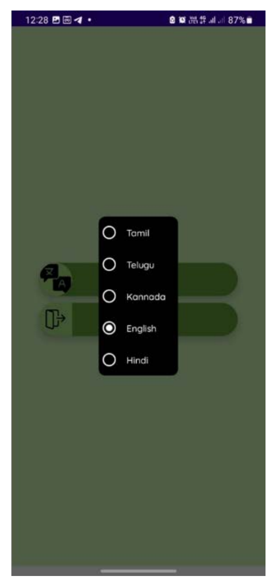




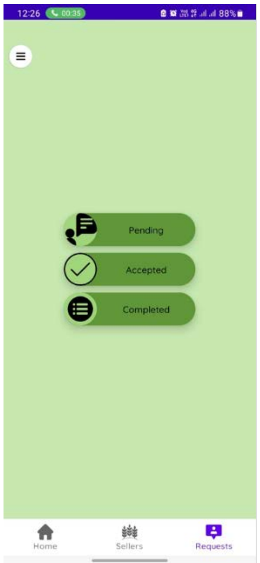


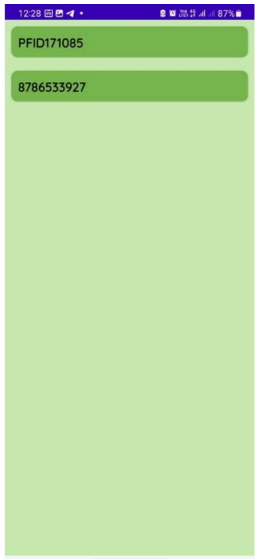
FARMER/SHOPKEEPER PROFILE



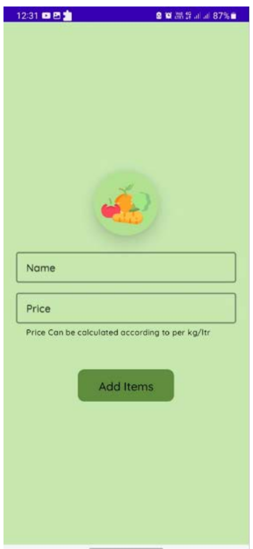


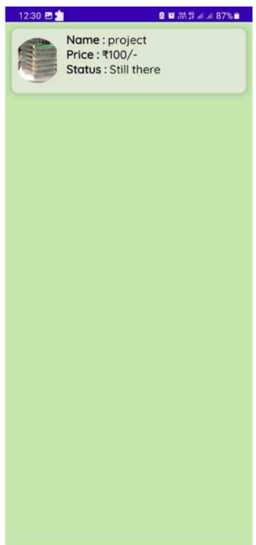
SETTINGS/CHANGE LANGUAGE





ORDER STATUS/ORDER ID





ADD ITEMS/INVENTORY STATUS

LOCALITY SHOPKEEPERS / PRECISE LOCATION

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