PROJECT PHASE -1

GreenSense: The Complete IoT Solution for Plant Growth and Care Using Machine Vision and AI-Powered Disease Detection.

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CONTENTS

INTRODUCTION

- In modern homes, plants play a vital role in enhancing aesthetic appeal and creating a calming, natural environment. However, caring for indoor plants can be challenging, especially with busy lifestyles, inconsistent watering schedules, and changing environmental conditions. Additionally, as water resources become scarce due to pollution and climate change, efficient use of water in plant care has become increasingly important.

- Dry soil, insufficient watering, and unpredictable indoor conditions are some of the common issues that hinder the growth of decorative plants, often leading to their premature decline. These challenges highlight the need for a smarter, more sustainable approach to home plant care.

- The self-sustaining smart plant system is designed to transform plant care for home decor enthusiasts. Using IoT technology, the system continuously monitors soil moisture, nutrient levels, and environmental factors, automating the watering process when needed and sending alerts when critical conditions require attention. This ensures your plants stay healthy and vibrant with minimal effort, while optimizing water usage and promoting sustainability. Perfect for busy households, this innovative solution combines technology and nature to make plant care both effortless and eco-friendly.

MOTIVATION

- Busy Lifestyles: People often forget or are unable to maintain consistent watering and care for indoor plants.
- Water Scarcity: Increasing water pollution and scarcity require smarter irrigation methods to avoid waste.
- Dry Soil Issues: Overwatering or underwatering leads to unhealthy plants, which negatively impacts home aesthetics.
- Inconsistent Indoor Conditions: Variability in temperature, humidity, and sunlight inside homes affects plant growth.
- Growing Interest in Home Decor: As more people invest in indoor plants for aesthetic and environmental reasons, there is a growing need for simplified yet effective plant care systems.

EXISTING SYSTEM

Challenges in Traditional Methods:

1. Inefficient Water Usage: Manual watering often results in either overwatering or underwatering, which can harm plant health. Overwatering can lead to root rot and fungal diseases, while underwatering can cause dehydration and stunted growth.

2. Lack of Real-time Monitoring: Traditional methods do not provide continuous monitoring of environmental parameters, making it difficult to respond promptly to changes in temperature, humidity, or soil moisture.

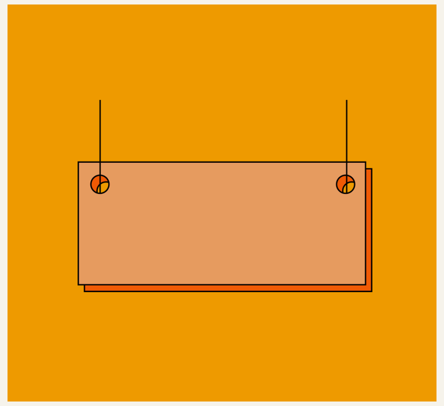
3. Delayed Disease Detection: Visual inspection may not identify early signs of diseases, leading to delayed intervention and potential spread of diseases that can devastate the plants.

4. Labor-intensive: Regular manual checks and interventions are time-consuming and require consistent effort from the gardener.

5. Inconsistent Care: Variability in the gardener's attention and knowledge can lead to inconsistent care, affecting plant health and yield.

Project Phase 1

LITERARY REVIEW



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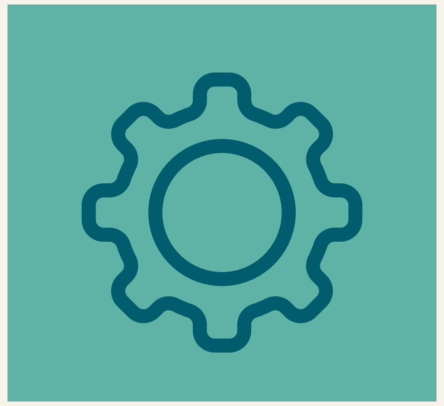


Problems Addressed

Techniques Used

Results

A REVIEW ON SMART PLANT MONITORING SYSTEM

Authors:Ashwini Patil, Ashwini Mali

Problem Addressed	**The system addresses the challenge of automating plant care and efficient irrigation by utilizing IoT technologies, sensors, and microcontrollers. It monitors soil moisture, temperature, and humidity, and automates watering based on real-time data. The solution aims to reduce water wastage, minimize manual intervention, and ensure sustainable plant health through smart, remote monitoring.**
Approach	The smart plant monitoring system uses wireless sensors for soil moisture, temperature, and humidity, controlled by an Arduino Uno. It automates watering with a pump, provides light with a red LED, and alerts users via a buzzer, Bluetooth, or GSM. Bluetooth gives status updates without internet, while GSM notifies users when connected.
Results	In plant monitoring, temperature, humidity, and soil moisture are crucial for crop growth. Improper levels can affect growth, waste water, and energy. The paper reviews systems that monitor these parameters and take automatic actions, with graphical representations of the data for better visualization.

A SMART SYSTEM FOR GARDEN WATERING USING WIRELESS SENSOR NETWORKS

Authors:Constantinos Marios Angelopoulos, Sotiris Nikoletseas, Georgios Constantinos

Problem Addressed	**Current irrigation systems are inefficient, wasting water and increasing costs. Wireless Sensor Networks (WSNs) enable real-time monitoring and remote management, offering a more efficient solution for water usage in agriculture, industry, and home gardening.**
Approach	The system includes sensor motes, soil humidity sensors, and electro-valves to control watering for different plants with varying needs (e.g., geranium, lavender, and mint). Each pot is monitored independently, with sensors triggering watering when soil moisture is low and stopping it when moisture levels normalize. Data on soil humidity and temperature is collected by the motes, forwarded to a PC via a gateway mote, and stored in a MySQL database for analysis.
Results	The study compares traditional irrigation and a smart irrigation system using wireless sensor networks (WSN) for three plants with varying water needs. The system efficiently maintains soil humidity by adjusting watering according to environmental conditions, unlike the traditional system, which causes excessive water use and soil moisture fluctuations. The smart system ensures optimal watering, conserving water and adapting to temperature or sunlight changes.

A STUDY ON IOT BASED REAL-TIME PLANTS GROWTH MONITORING FOR SMART GARDEN

Author:Mi-Hwa Song

Problem Addressed	**The agricultural industry faces issues like unpredictable weather, labor shortages, and unmonitored environmental factors. This research proposes an IoT-based platform to automate monitoring and irrigation, enhancing crop quality and productivity.**
Approach	The proposed system utilizes open-source hardware, including NodeMCU (ESP8266 WiFi module), to automate plant monitoring and irrigation. Sensors like DHT11 (humidity/temperature), soil moisture, and MQ135 (gas detection) collect environmental data, which is processed by NodeMCU. The system triggers actions such as watering (via a water pump), cooling (fan), or lighting (LED) based on sensor readings. Data is transmitted to cloud-based Google Firebase and a physical server (Raspberry Pi), allowing real-time updates and automation control via Wi-Fi.
Results	The system successfully monitors real-time data and automates decisions based on sensor inputs. Future improvements include adding a pH sensor to assess soil suitability, implementing a fertilizer pump, adopting green computing techniques for energy efficiency, and ensuring interoperability between IoT devices for better system communication.

A NOVEL APPROACH TO IOT BASED PLANT HEALTH MONITORING SYSTEM

Author:Srinidhi Siddagangaiah

Problem Addressed	**The problem addressed in this paper is the challenge of monitoring plant health by tracking environmental parameters such as temperature, humidity, light intensity, and soil moisture. Traditional methods of plant health management are often insufficient, and the integration of IoT technologies can improve plant care by providing real-time data and alerts to users when conditions deviate from optimal levels.**
Approach	The IoT-based plant health monitoring system uses sensors (DHT11 for temperature and humidity, YL-38 for soil moisture, and TEMT6000 for light intensity) connected to an Arduino Uno. The data is sent to the Ubidots IoT cloud platform, which stores the data and triggers alerts if conditions deviate from optimal levels, enabling remote monitoring and control.
Results	The IoT-based plant health monitoring system successfully collects environmental data (temperature, humidity, soil moisture, and light intensity) using sensors (DHT11, YL-38+YL-69, and TEMT6000) connected to an Arduino Uno. The data is sent to the Ubidots cloud platform via HTTP using Arduino's Rest API. Once stored in the cloud, the data is accessible remotely, allowing users to monitor and visualize plant health through a customizable dashboard.

AN IOT CONTROLLED SYSTEM FOR PLANT GROWTH

Authors:Boonsit Yimwadsana , Pichamon Chanthapeth, Chanyanuch Lertthanyaphan , Antika Pornvechamnuay

Problem Addressed	**This project addresses the lack of scientific methods in traditional farming, which can lead to poor plant growth and production. The IoT-based system enables farmers to monitor and control key factors like temperature, humidity, light, and soil moisture, improving farming efficiency and productivity.**
Approach	The system monitors environmental factors (temperature, humidity, light, soil moisture) to optimize plant growth. It collects data, compares it with an ideal model, and adjusts conditions using actuators. The system offers real-time monitoring and control via a dashboard, with both manual and automated adjustments.
Results	This paper demonstrates that IoT technology, using sensors and actuators, can significantly improve farming by enabling remote monitoring and control of environmental conditions. This leads to increased production and quality by providing precise care for plants, while also reducing operational costs through automation. The system is designed to be user-friendly, making it accessible to both farmers and hobbyists. However, a key limitation is the need for sensor calibration to ensure accurate measurements and recommendations, especially when using different hardware. For optimal performance, a complete system with high-quality sensors is recommended.

AUTOMATIC IOT BASED PLANT MONITORING AND WATERING SYSTEM USING RASPBERRY PI

Authors:Anusha k , Dr. U B Mahadevaswamy

Problem Addressed	**Improvement in the agriculture field needs lot of caring and use of digital concepts. Countries like India though the main source for citizens is agriculture they use an old traditional method which makes them earn less money, not able to solve family financial problems. Some of the instruments they can't fix due to huge amount so, in order to overcome these problems this system is developed and should be economical to the users.**
Approach	The approach for the proposed IoT-based plant monitoring and watering system involves both hardware and software components. Hardware includes a Raspberry Pi, various sensors (temperature, humidity, moisture, light, IR), a relay, motor, and a server with a web-based application. The Raspberry Pi acts as the central processor, interfacing with the sensors to collect environmental data. The data is processed using Python and displayed on a web application for remote monitoring. The system automatically controls irrigation based on soil moisture levels and triggers an intruder alert with the IR sensor.
Results	The proposed IoT-based plant monitoring and watering system successfully integrates Raspberry Pi, multiple sensors (temperature, humidity, moisture, light, and IR), and a web-based application for remote monitoring. The system collects real-time environmental data, triggers automatic irrigation based on soil moisture, and detects intruders using the IR sensor. The results are displayed on a monitor and accessible via a web app. Comparisons show that the proposed system offers better security, more accessible control, and improved functionality compared to existing systems. Future improvements include further agricultural applications and rainwater harvesting integration.

DEEP LEARNING BASED COMPUTER VISION APPROACHES FOR SMART AGRICULTURAL APPLICATIONS

Authors:V.G. Dhanya,A. Subeesh,N.L. Kushwaha,Dinesh Kumar Vishwakarma,T. Nagesh Kumar,G. Ritika,A.N. Singh

Problem Addressed	**The agriculture industry is rapidly adopting digital technologies, with computer vision powered by deep learning playing a key role in automating tasks with precision. This review highlights the applications of computer vision in agriculture, such as seed quality analysis, soil analysis, plant health monitoring, and yield estimation. Despite advancements, challenges remain in deploying these solutions in real-time on farms, particularly in building quality datasets and ensuring the effectiveness of deep learning models in practical settings.**
Approach	The approach uses deep learning-based computer vision, mainly CNNs, to automate agricultural tasks like seed quality analysis and plant health monitoring. It enables accurate classification and sorting of seeds, improving efficiency and decision-making in agriculture.
Results	Deep learning-based computer vision has significant automation potential in agriculture, enhancing tasks such as plant health monitoring, weed detection, irrigation management, and yield estimation. The integration with UAVs and spectral data further improves solution accuracy. Despite challenges like data quality and computational requirements, the adoption of these technologies is increasing, promising further advancements in agricultural automation.

ENHANCEMENT OF PLANT MONITORING USING IOT

Authors:A. Pravin, T. Prem Jacob and P. Asha

Problem Addressed	**The agriculture sector faces significant challenges, particularly water scarcity, inefficient irrigation, and crop diseases. IoT-based solutions using devices like Raspberry Pi and Arduino can help monitor and manage critical factors such as soil humidity, temperature, light, and crop health. However, there is a need for affordable, effective systems to assist farmers in real-time decision-making for irrigation and disease management, ensuring better crop yield and productivity.**
Approach	The proposed system aims to monitor and manage crop growth through IoT-based sensors for temperature, soil moisture, and light intensity. The system collects data from the sensors and processes it using an Arduino. Based on the data, the system takes actions such as controlling irrigation through a water pump and relay mechanism. The system also provides real-time updates to farmers via GSM, allowing them to remotely monitor the conditions of their crops. This approach ensures optimal water usage, maintains soil moisture, and promotes better crop growth and productivity.
Results	The proposed approach effectively addresses water usage in agriculture by using sensors to monitor soil moisture, temperature, and light conditions. Based on real-time data, the system adjusts irrigation and provides immediate alerts to farmers through GSM. This enables timely intervention, ensuring optimal crop growth while conserving water and maintaining favorable growing conditions.

IOT BASED SMART GREENHOUSE AUTOMATION USING ARDUINO

Authors:Prof. D.O.Shirsath, Punam Kamble, Rohini Mane, Ashwini Kolap, Prof.R.S.More

Problem Addressed	**This paper addresses the challenges in greenhouse management by utilizing an IoT-based automation system to monitor critical environmental factors such as temperature, humidity, soil moisture, light intensity, and CO_2 levels. The system employs multiple sensors to gather data and process it using an Arduino platform. This data is then used to make real-time decisions, such as controlling the irrigation system or adjusting environmental conditions, ultimately optimizing plant growth and improving productivity. The integration of IoT ensures remote monitoring and control, providing farmers with real-time insights to manage greenhouse environments efficiently.**
Approach	The proposed Greenhouse Automation System utilizes Arduino-based controllers and various sensors to monitor and control the environmental factors inside a greenhouse. It incorporates sensors like soil moisture, temperature, humidity, and light to gather data that is crucial for optimal plant growth. This data is processed by the Arduino, and the system can automatically control devices such as fans, heaters, and irrigation systems based on the sensor inputs. Additionally, the system integrates IoT technology to send real-time data to a web portal, allowing for remote monitoring and control. This approach enhances resource efficiency, reduces labor costs, and ensures consistent environmental conditions for plant growth.
Results	The system uses sensors (LDR, LM35, DHT11) to monitor environmental factors like light, temperature, and humidity. When these values exceed set thresholds, relays trigger actions like turning on a fan or heater. The sensor data is displayed on the Arduino IDE’s serial monitor for real-time analysis and control. This ensures optimal greenhouse conditions for plant growth.

IOT SMART PLANT MONITORING SYSTEM

Authors:Mrs. Y. Durga Bhargavi, Mukka Manvitha, Y. Umashankar, K. Vijaya Varma, N. Nikhil Reddy

Problem Addressed	**Traditional plant monitoring methods are labor-intensive, inefficient, and prone to delays in detecting issues like pests, diseases, and environmental stress. These methods lack real-time insights, hindering proactive care and resource optimization. A need exists for an automated, scalable solution that provides continuous monitoring, early detection, and data-driven decision-making. The proposed Smart Plant Monitoring System, using IoT cameras and advanced image processing, addresses these challenges by offering real-time, accurate analysis of plant health, enhancing crop yield, and optimizing resource use.**
Approach	This paper discusses various techniques for identifying plant diseases, with a focus on leveraging advanced technologies such as machine learning, deep learning, and image processing. These methods aim to improve the accuracy and efficiency of plant disease detection, helping farmers prevent yield loss. The proposed systems utilize different approaches, including K-Nearest Neighbors (K-NN), deep learning models, and convolutional neural networks (CNN) to analyze plant leaves and detect diseases like gray spot, leaf spot, rust, and pests. By integrating IoT and AI, these solutions enable real-time monitoring, early detection, and decision-making, leading to better resource management and optimized crop yields.
Results	In conclusion, the smart plant monitoring system using cameras provides an efficient way to detect plant health issues early, allowing for timely intervention. Its user-friendly interface supports decision-making for farmers and researchers, promoting sustainable agriculture by integrating technology with nature. This system paves the way for smarter, more responsive plant care.

IOT- POWERED REAL TIME SMART PLANT SURVEILLANCE SYSTEM FOR DIGITAL GARDENING AND AGRICULTURE

Authors:K Subhashini, R D Kalaimathy, K Shreya Shree, R Deepika, R Lakshmi Devi, A Abirami, Dr. J Thamil Selvi.

Problem Addressed	**The problem addressed by this paper is the inefficient management of water resources in agriculture, particularly in areas prone to drought. Existing irrigation systems often waste water or fail to provide timely irrigation. This paper proposes an IoT-enabled plant monitoring and automated watering system to optimize water usage, conserve resources, and ensure optimal plant growth by automating the watering process based on real-time soil moisture data.**
Approach	The approach used in this project involves developing an IoT-enabled plant monitoring and automated watering system. The system integrates various components such as soil moisture sensors, a DC water pump, a NodeMCU microcontroller, and a Blynk mobile app to automate plant care. The soil moisture sensor measures the moisture level, and the data is transmitted to the Blynk app, which sends notifications to the user for irrigation control. When the moisture level falls below a threshold, the automated watering system is activated. This system is designed to conserve water, reduce labor costs, and improve productivity in agriculture by providing remote monitoring and control via a mobile app.
Results	The experiment demonstrated the successful implementation of the IoT-based plant monitoring and automated watering system. The system effectively monitored soil moisture, temperature, and humidity levels, with data displayed through the Blynk app. When soil moisture fell below a threshold, the user received a notification, enabling them to activate the water pump. The system reduced water wastage and labor costs while ensuring optimal plant care. The recorded data showed that as temperature increased, humidity decreased, and watering occurred when soil moisture dropped below 35%. This approach enhances resource efficiency and provides a reliable solution for automated irrigation.

IOT-BASED SMART PLANT MONITORING SYSTEM USING NODEMCU

Authors:Kishan Gautam Barnwal, Shubh Vishnu Giram, Ramesh Premnath Gupta, Vinit Hasmukh Damani

Problem Addressed	**The problem approach focuses on addressing the challenges faced in agriculture, such as inefficient irrigation, soil monitoring, and pest detection. Traditional methods are often labor-intensive and ineffective in optimizing resources. By implementing an IoT-based solution with the ESP8266 microcontroller, the system aims to automate irrigation based on real-time soil moisture, temperature, and electrical conductivity data. Additionally, the system will include pest detection to ensure overall crop health.**
Approach	The project utilizes a capacitive soil moisture sensor to monitor the soil's moisture content, a DHT11 sensor to measure air temperature and humidity, and a 5V relay module to control a DC water pump. The system is controlled by a NodeMCU-ESP8266 board, which connects to the internet via Wi-Fi, enabling remote monitoring through the Blynk app. The system automatically activates the water pump when the soil moisture falls below a threshold and turns it off when moisture levels are sufficient. This setup ensures efficient irrigation and reduces water wastage. Users can monitor and control the system remotely via the Blynk app, where real-time data on soil moisture, temperature, and humidity are displayed. The system integrates IoT technology to automate irrigation, improving plant growth and optimizing water usage.
Results	This project introduces an automated irrigation system controlled via an online app, reducing labor and optimizing water usage. It improves crop yield and supports efficient plant care. The system's future potential includes large-scale agricultural use, adapting to extreme conditions, and providing continuous adjustments for optimal plant health.

MACHINE LEARNING IMPLEMENTATION IN IOT BASED INTELLIGENT SYSTEM FOR AGRICULTURE

Authors:Bhanu K N, Jasmine H J, Mahadevaswamy H S.

Problem Addressed	**The problem addressed in this paper is the lack of accurate soil condition data in agriculture, which affects crop yield and resource management. The need for a "Smart" agriculture system is highlighted, where machine learning and Internet of Things (IoT) technologies are integrated to monitor and manage environmental factors, optimize irrigation, and improve crop productivity. This system aims to provide farmers with real-time data to make informed decisions, reduce labor, and enhance sustainability in farming practices.**
Approach	The approach used in this paper involves an IoT-based smart agriculture system that utilizes sensors to monitor soil parameters and environmental conditions. The collected data is transmitted to a cloud platform, such as ThingSpeak, where machine learning techniques are applied to analyze and classify the data. If the data falls beyond a predefined threshold, it is flagged, and notifications are sent to users via email or SMS. This system enables real-time monitoring and decision-making to optimize agricultural practices.
Results	The results of the proposed IoT-based smart agriculture system show the successful transmission of real-time data, such as atmospheric temperature, humidity, soil moisture, and soil temperature, from sensors to the ThingSpeak cloud platform. The Naive Bayes classification algorithm achieved an accuracy of 76.47%. The system enables smart irrigation decisions by notifying users via email when data exceeds threshold values. The integration of IoT with machine learning enhances decision-making, improving agricultural productivity and efficiency. Future work could explore incorporating additional parameters like fertility for broader agricultural optimization.

NOVEL IOT-BASED PLANT MONITORING SYSTEM

Authors:Muhammad Haashir Absar, Ghulam Fiza Mirza, Warisha Zakai, Youail John, Noman Mansoor

Problem Addressed	**The problem addressed in this paper is the lack of efficient, remote monitoring and management of plant health parameters in conventional greenhouses. This issue leads to challenges such as resource wastage, increased labor costs, and reduced crop productivity. Traditional methods fail to provide timely insights and control over environmental factors like temperature, humidity, and soil moisture, affecting plant growth. The proposed system aims to tackle these problems by integrating IoT technologies for remote monitoring and automated water sprinkling to maintain optimal plant health conditions.**
Approach	The approach used in this system involves the integration of IoT technologies to remotely monitor and control the environmental conditions for plant health. Sensors (DHT11 for temperature and humidity, soil moisture sensors) collect data on plant conditions. This data is processed by an Arduino microcontroller and transmitted via the ESP8266 Wi-Fi module to the Blynk app. The user can monitor real-time data and manage plant care remotely, including controlling water sprinkling through a solenoid valve. The system aims to reduce labor, optimize plant growth, and conserve water by enabling remote administration.
Results	The IoT-based Smart Plant Monitoring System allows remote monitoring and control of plant health parameters, such as temperature, humidity, and soil moisture. Through the Blynk app, farmers can view normal conditions and take corrective actions, such as watering plants, when conditions become critical. The system helps optimize plant growth, reduces labor, and conserves water. Results showed satisfactory real-time testing on an aloe vera plant. The system is cost-effective and can be expanded with additional sensors for broader applications like greenhouse and crop monitoring. Future work includes integrating more sensors for enhanced plant management.

SMART IRRIGATION AND MONITORING SYSTEM FOR POT PLANT

Authors:Gan Yaw Kiat, Mohammad Faiz Liewabdullah

Problem Addressed	**The Smart Irrigation and Monitoring System addresses the challenge of maintaining plant health amidst busy schedules. It automates irrigation based on soil humidity and monitors pH levels, ensuring optimal conditions for plant growth. Through the Blynk app, users receive notifications for pH deviations and can remotely manage plant care. This system simplifies gardening tasks and enhances convenience for plant owners.**
Approach	The approach in this study integrates key components like the Arduino Uno, soil humidity sensor, ultrasonic sensor, pH value sensor, water pump, and ESP8266 Wi-Fi module. The system automates irrigation, monitors soil pH and moisture levels, and sends alerts via the Blynk app. It uses an ultrasonic sensor to measure water levels, triggering refills as needed. The system simplifies plant care through automation and remote monitoring.
Results	The prototype of the Smart Irrigation and Monitoring System was successfully built using an Arduino Uno. The system includes sensors for pH, water level, and soil humidity, and is integrated with the Blynk application for remote monitoring. The user interface on Blynk allows users to monitor plant health and receive notifications for abnormal pH values or low water levels. The system also provides a virtual switch for fertilization when needed. The data is transmitted securely via a Blynk authentication token, allowing users to make informed decisions based on real-time data and past trends.

OBJECTIVES

- Sustainable Urban Gardening:
  - Enable urban and terrace gardeners to monitor and care for plants with minimal manual intervention, promoting water conservation and resource efficiency.
- AI and Machine Vision for Plant Health:
  - Use machine learning and machine vision to detect plant diseases early and provide actionable care recommendations, ensuring healthier plants and optimized fertilizer use.
- Scalable Agricultural Solutions:
  - Develop a modular system that can be scaled for larger agricultural use, empowering small-scale farmers to improve crop yield and productivity through data-driven insights.

OBJECTIVES

Project Phase 1

- **Economic Empowerment and Innovation:**
  - **Provide an affordable, technology-driven solution to enhance agricultural practices, contributing to Karnataka's vision of fostering smart agriculture and technological adoption in farming.**

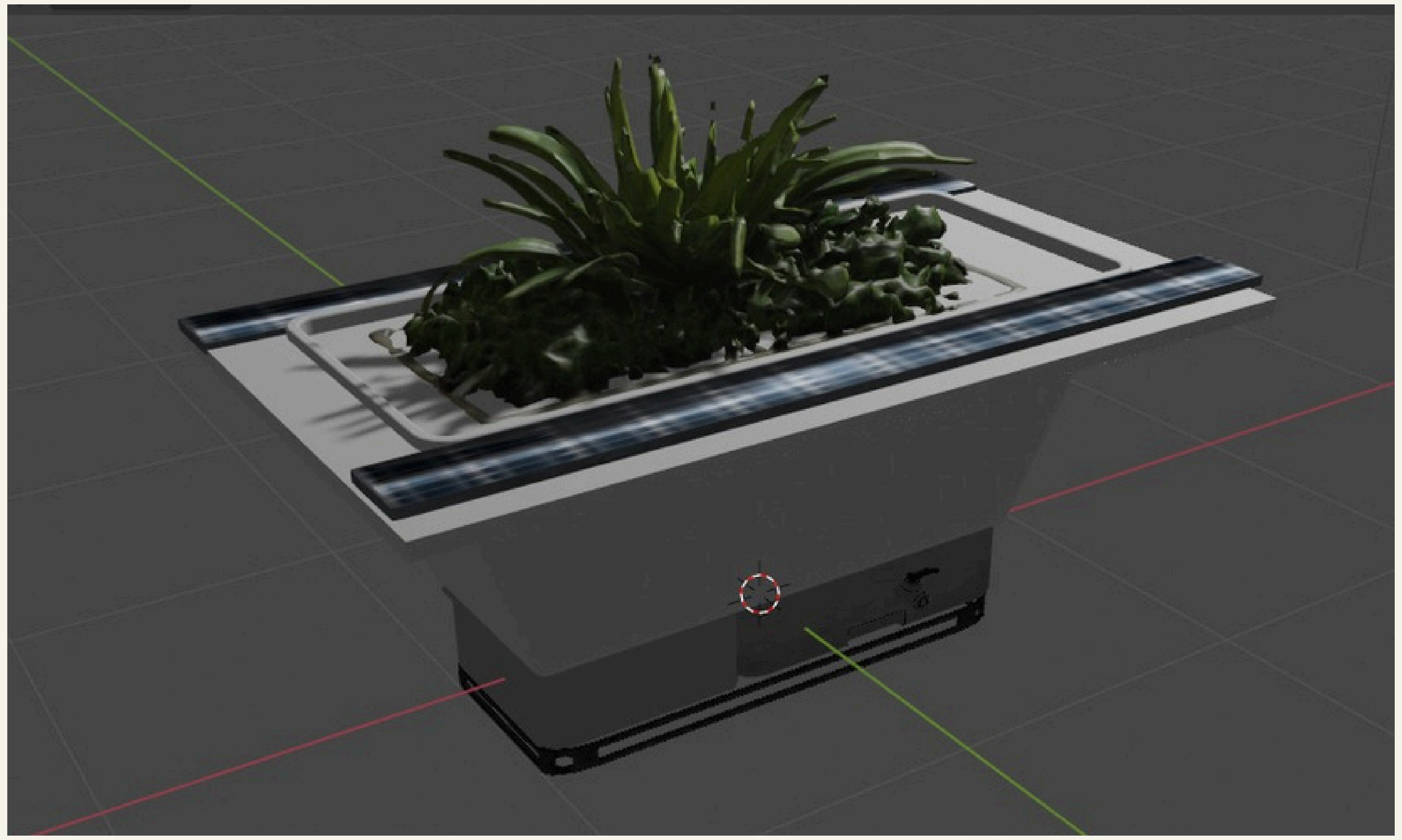
- **Self-Sustainability and Environmental Impact:**
  - **Integrate solar power and rechargeable batteries to ensure the system operates sustainably, reducing dependence on external power sources and supporting eco-friendly practices**

PROPOSED SYSTEM

Project Phase 1

- The GreenSense system is an IoT-enabled smart pot designed for real-time plant monitoring and automation.
- It uses sensors to track soil moisture, temperature, light levels, and air quality, while a camera module with machine learning detects plant diseases.
- The system automates irrigation, provides fertilizer suggestions, and sends notifications via the Blynk app.
- Powered by solar energy, it is affordable, modular, and scalable, making it ideal for urban gardeners and small-scale farmers, with potential applications in large agricultural lands.

3D Render:



FUNCTIONAL REQUIREMENTS

- REAL-TIME MONITORING OF ENVIRONMENTAL FACTORS LIKE HUMIDITY, TEMPERATURE, LIGHT, AND SOIL MOISTURE.
- AUTOMATED WATERING SYSTEM BASED ON SOIL MOISTURE AND TEMPERATURE LEVELS.
- DISEASE DETECTION USING IMAGE PROCESSING AND CNNS TO IDENTIFY PLANT DISEASES.
- YIELD PREDICTION FOR DOMESTIC PLANTS USING HISTORICAL AND REAL-TIME DATA.
- CLOUD INTEGRATION FOR DATA STORAGE, ANALYTICS, AND SMARTPHONE NOTIFICATIONS FOR CRITICAL UPDATES.
- INTUITIVE USER INTERFACE TO MONITOR PLANT HEALTH AND SYSTEM TRENDS.
- COMMUNICATION BETWEEN MULTIPLE ARDUINO UNITS FOR SCALABILITY.

NON-FUNCTIONAL REQUIREMENTS

- THE SYSTEM MUST OPERATE SUSTAINABLY USING A RECHARGEABLE BATTERY AND SOLAR PANEL
- HIGH AVAILABILITY AND RELIABILITY OF THE SYSTEM, EVEN IN OFF-GRID CONDITIONS.
- MINIMAL LATENCY IN REAL-TIME DATA PROCESSING AND SMARTPHONE NOTIFICATIONS.
- SCALABLE DESIGN TO SUPPORT MULTIPLE PLANTS OR LARGER SETUPS.
- USER-FRIENDLY INTERFACE WITH A CLEAN AND RESPONSIVE DESIGN.
- SECURE DATA TRANSMISSION TO THE CLOUD AND MOBILE DEVICES.
- ENERGY-EFFICIENT HARDWARE AND ALGORITHMS TO MAXIMIZE BATTERY LIFE.

HARDWARE REQUIREMENTS

- ARDUINO MICROCONTROLLER (ESP32).
- SENSORS FOR HUMIDITY, TEMPERATURE, LIGHT, AND SOIL MOISTURE.
- PUMP AND RELAY MODULE FOR THE WATERING SYSTEM.
- CAMERA MODULE FOR CAPTURING PLANT IMAGES FOR DISEASE DETECTION.
- SOLAR PANEL AND RECHARGEABLE BATTERY FOR POWER SUPPLY.
- WI-FI OR BLUETOOTH MODULE FOR CONNECTIVITY.
- ADDITIONAL ARDUINO UNITS FOR SCALABILITY .

SOFTWARE REQUIREMENTS

- Arduino IDE for programming the microcontroller.
- Image processing framework (e.g., OpenCV) and CNN model for disease detection.
- Cloud platform (e.g., AWS, Firebase) for data storage and analytics.
- Mobile app or web-based dashboard for user interface (Blynk app).
- Programming languages: Python for AI/ML, C++ for Arduino, and JavaScript/TypeScript for the interface.
- Docker for containerization of cloud services and model deployment.
- API integration for sending alerts to smartphones (e.g., Firebase Cloud Messaging).

SYSTEM DESIGN

System Architecture

- Sensors Module:
  - Collects real-time data for humidity, temperature, light, and soil moisture.
  - Sends data to the Arduino for processing.
- ESP32 Microcontroller:
  - Acts as the central control unit.
  - Receives data from sensors, processes it, and controls actuators like the pump.
  - Communicates with the cloud via Wi-Fi.
- Disease Detection Module:
  - Captures images using the camera module.
  - Processes images locally or sends them to the cloud for CNN-based analysis.

SYSTEM DESIGN

System Architecture

- Cloud Services:
  - Stores and analyzes collected sensor data and images.
  - Hosts machine learning models for disease detection and yield prediction.
  - Generates insights and sends notifications to the user.

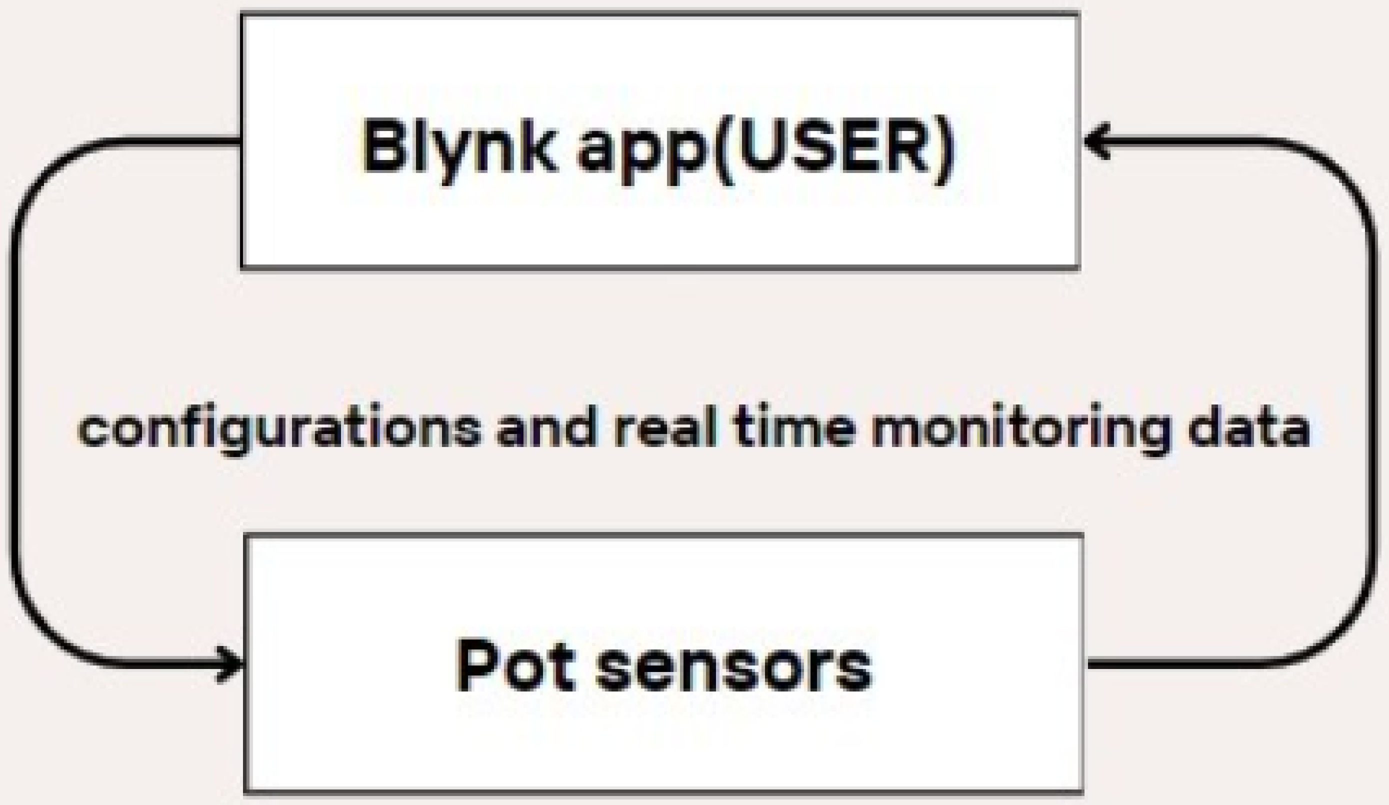
- User Interface:
  - Provides a mobile or web application for users to view real-time data, trends, and alerts.

- Power Module:
  - Includes a solar panel and rechargeable battery to power the system.

- Communication Module:
  - Enables multiple ESP32 units to communicate and share data in larger setups.

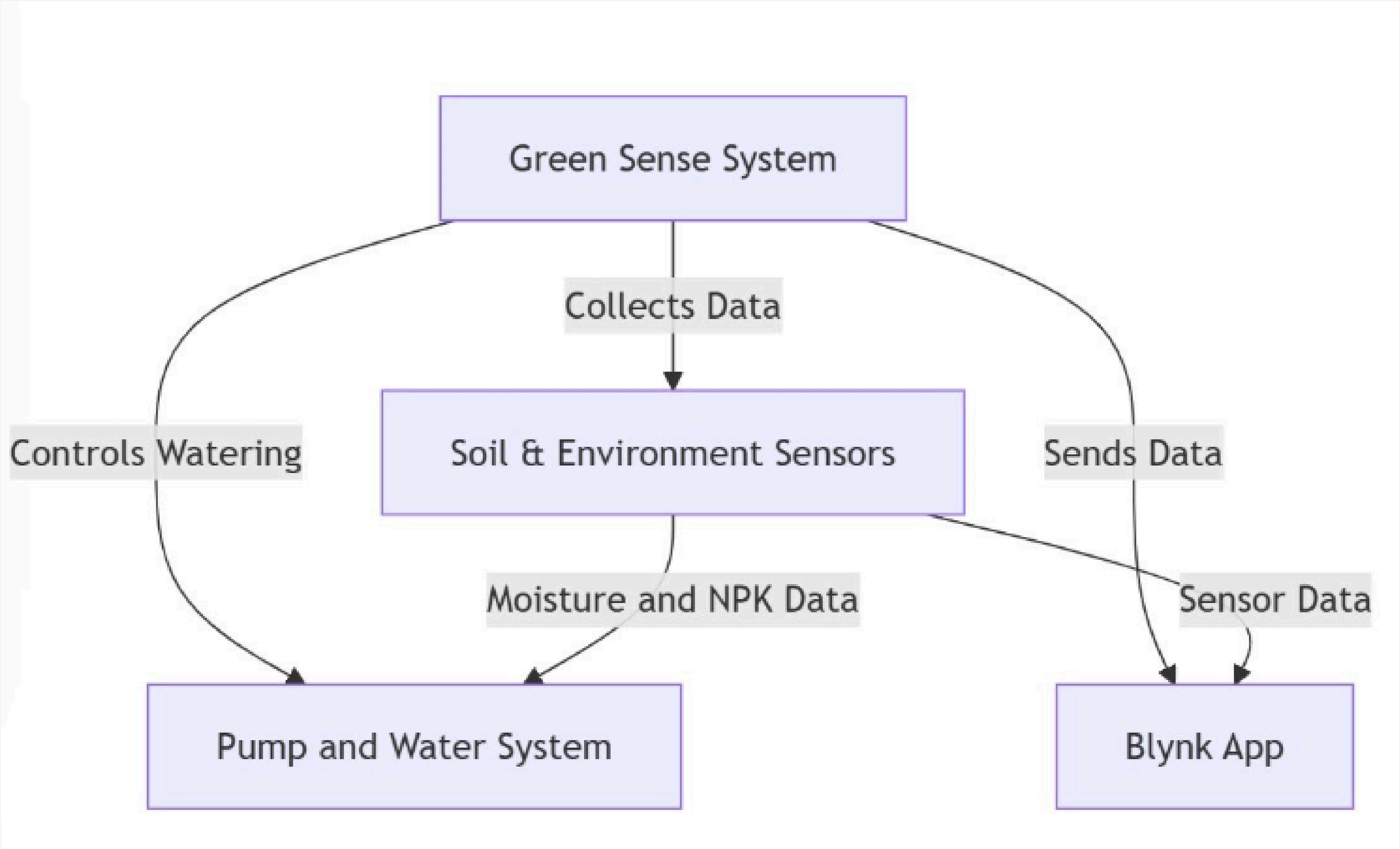
DATA FLOW DIAGRAM

Level 0



DATA FLOW DIAGRAM

Level 1

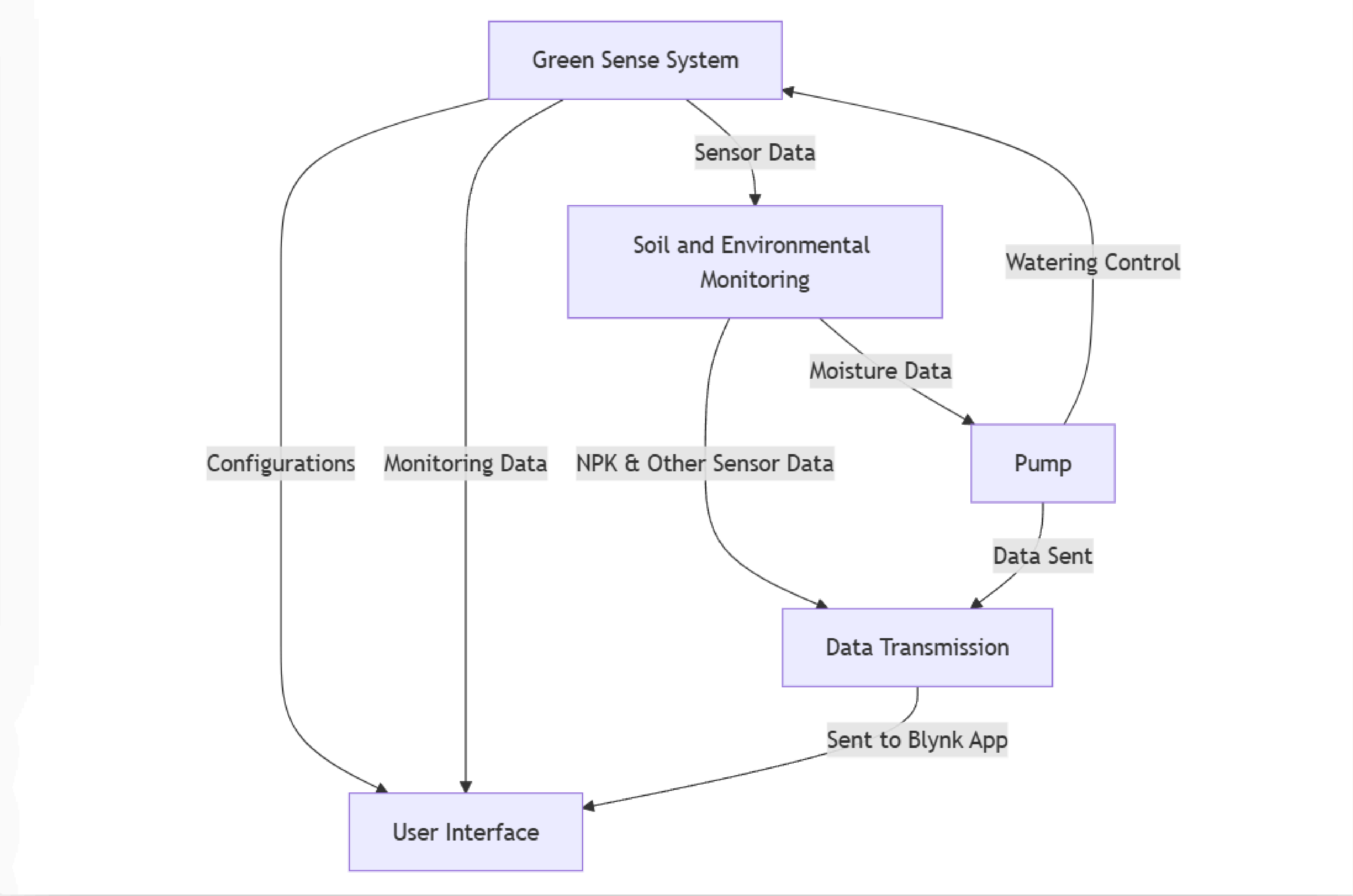


Project Phase 1

DATA FLOW DIAGRAM

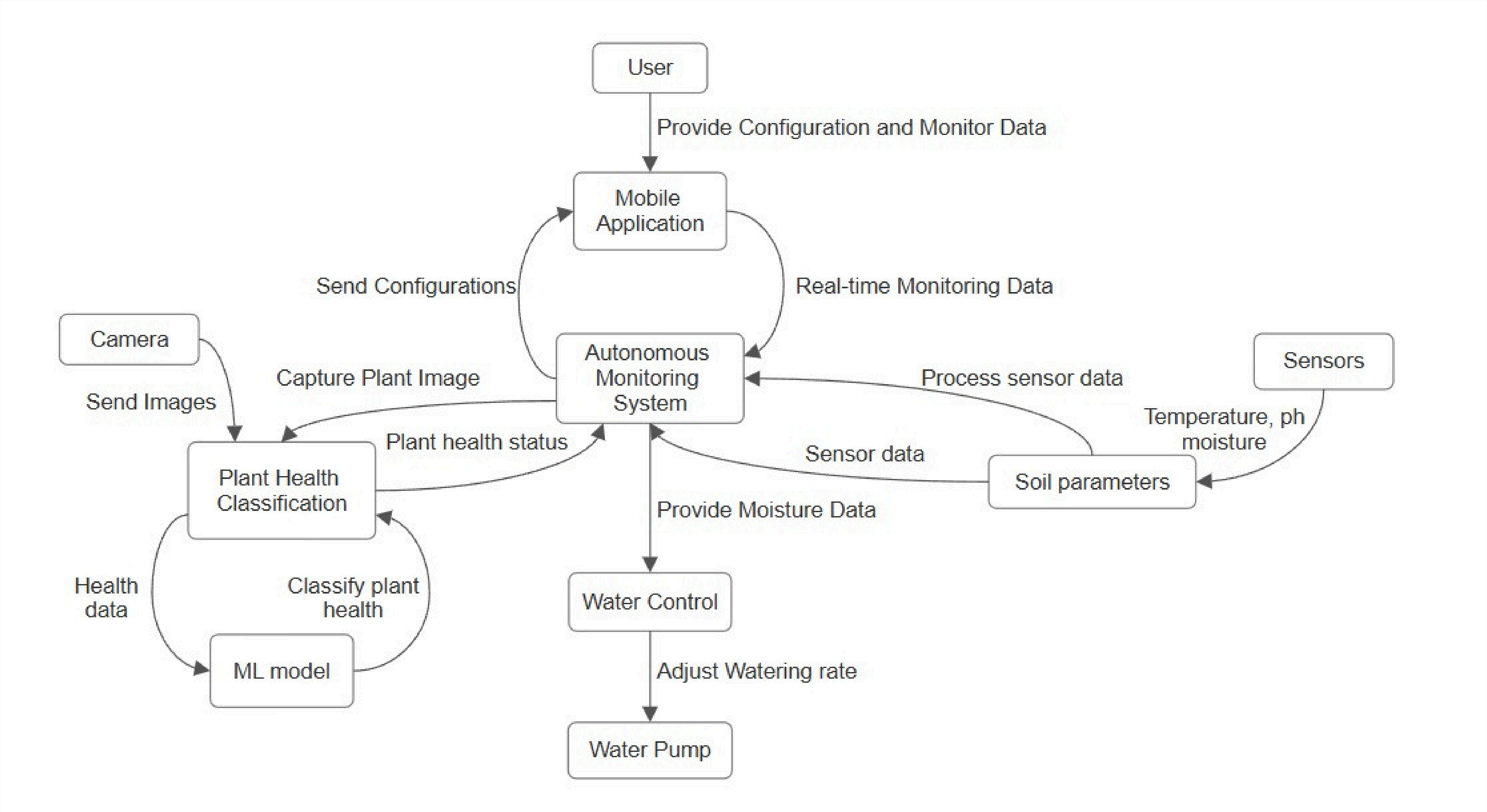
Project Phase 1

Level 2

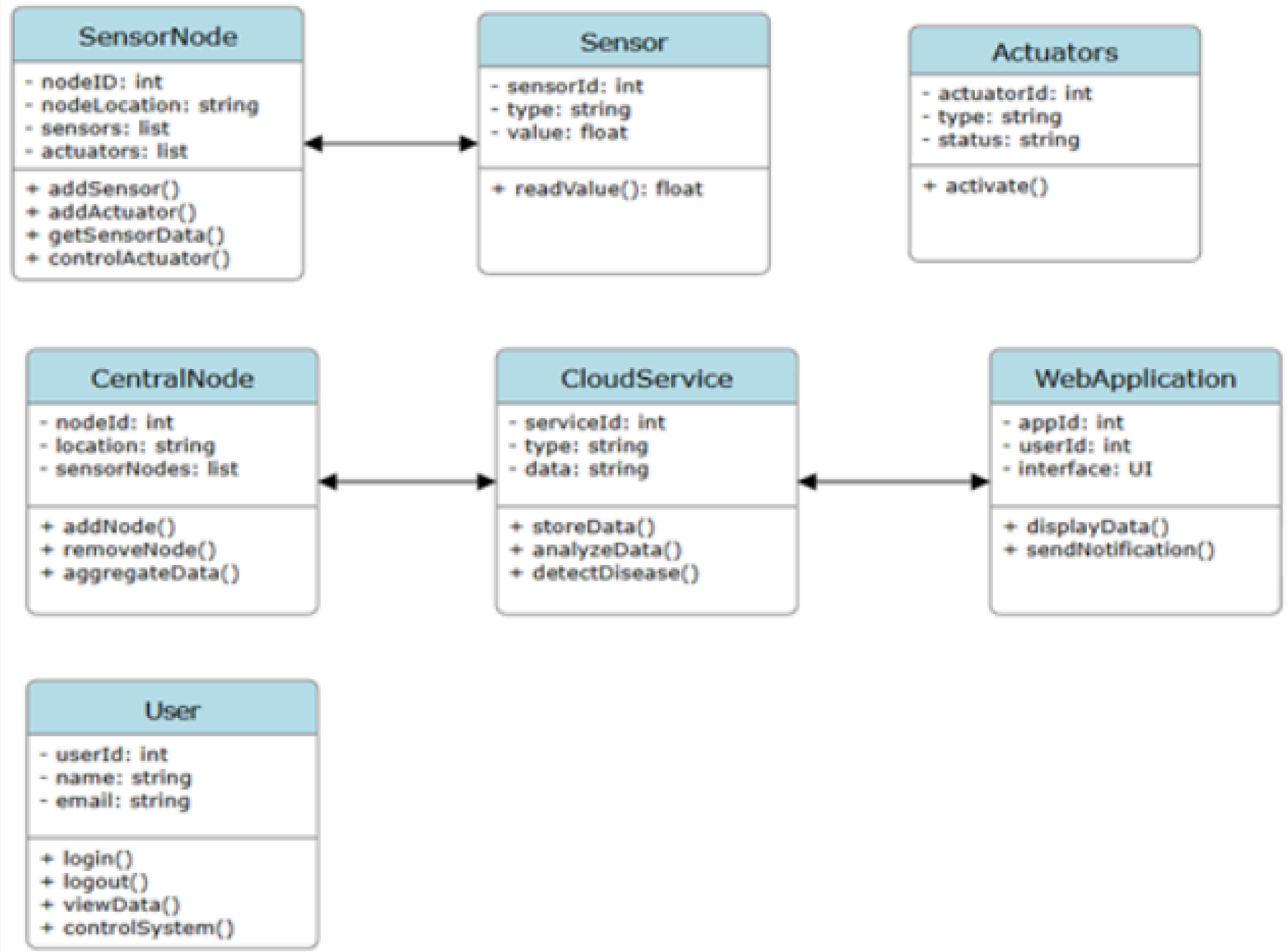


DATA FLOW DIAGRAM

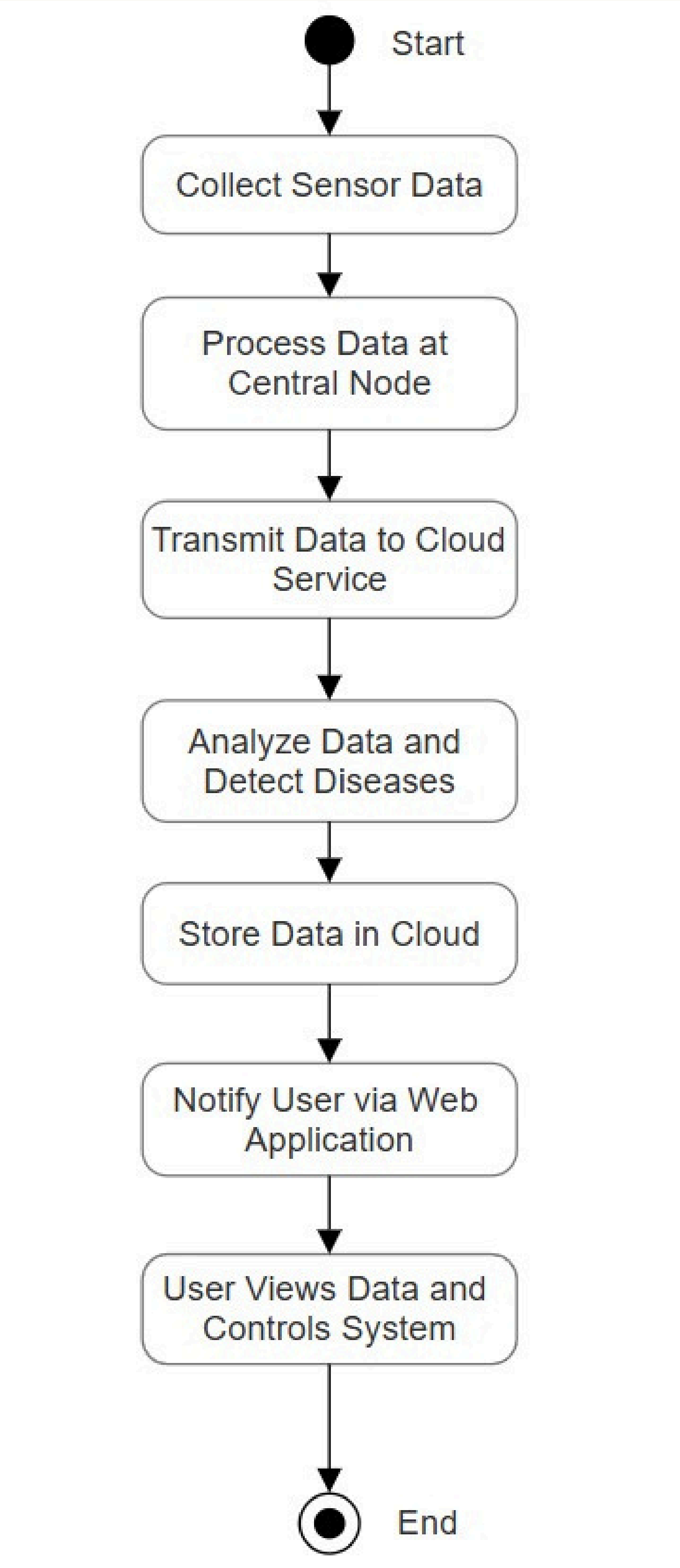
Level 3



CLASS DIAGRAM

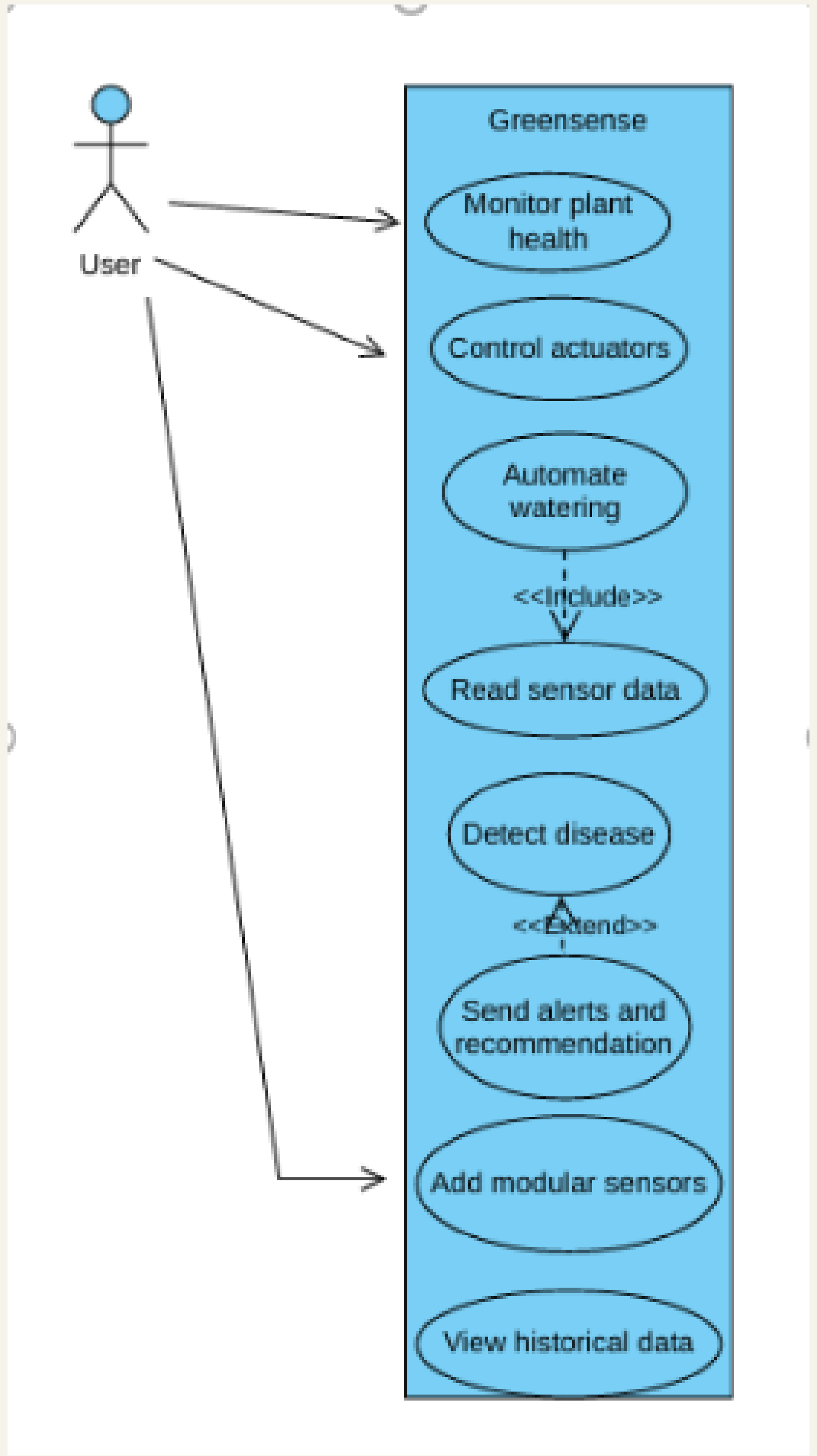


ACTIVITY DIAGRAM



Project Phase 1

USE CASE DIAGRAM



Project Phase 1

CONCLUSION

- GreenSense is a smart plant monitoring system using IoT, cloud computing, and AI to optimize plant health in home gardening, agriculture, and urban farming. It tracks temperature, humidity, soil moisture, pH, and light intensity, ensuring ideal growing conditions.

- Automated irrigation adjusts water distribution in real time, preventing waste and promoting sustainability. Machine learning enables early disease detection, reducing crop loss and chemical use. A web app allows remote monitoring, alerts, and system control.

- Scalable for various environments, GreenSense supports sustainable agriculture with energy-efficient components and solar power. Future upgrades include improved AI, expanded sensors, and smart system integration, driving efficiency and sustainability in plant care.

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Project Phase 1

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THANK YOU