Smart Gardening System Using IOT

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Abstract. This study presents a new innovation for urban agriculture using Internet of Things (IoT) technology. The system addresses sustainability and limited resources in traditional agriculture by integrating a network of sensors, actuators and advanced analytics. Real-time data collection, automatic precision irrigation, optimized nutrient distribution and energy-saving studies are the main research areas. The solution provides farmers with insights to make better decisions through remote monitoring and predictive modelling. It promotes the energy sector using export technology. This article presents the most comprehensive solutions for healthy and smart city management and contributes to the debate on smart agriculture by analyzing the design process, use and impact.

1. Introduction

In response to global population growth and urbanization challenges, urban agriculture requires new methods to improve resource use, enhance sustainability, and ensure food security. Against this background, the integration of Internet of Things (IoT) technology into agriculture has emerged as revolutionary. This article takes an in-depth look at the development and implementation of smart building technologies, revealing their potential to transform urban culture.

Agriculture often faces constraints such as limited space, water scarcity and the need for resource management. In the urban environment, these challenges are exacerbated by limited space and increasing demand for local, sustainable products. The emergence of IoT technology has led to a revolutionary change that allows instant monitoring and smart control of various environmental factors critical to crop health.

Our research focuses on the design and implementation of network- integrated smart garden systems incorporating sensors, actuators and advanced analytics. The main goals of the system include real-time data collection, water efficiency, food efficiency and energy efficiency. Together, these products contribute to sustainable urban agriculture by reducing resource waste and maximizing crop yields.

Using sensors to monitor humidity, temperature, humidity, light intensity and nutrient availability and form the basis for decision making. Smart gardening systems solve important problems related to environmental impact and resource use by optimizing the use of water and fertilizer through the combination of automatic precision irrigation and nutrient distribution systems.

Remote monitoring and control continues to increase energy efficiency, allowing farmers to control and monitor their products from anywhere. The integration of a user-friendly interface ensures easy access, making the technology inclusive for farmers with different levels of expertise.

Energy is another focus using real- time intelligent algorithms to improve the performance of the Internet network. Smart home construction not only reduces operating costs by reducing energy consumption, but also meets today's safety goals.

This article contributes to the smart agriculture debate by examining in detail the design, implementation and impact of smart agriculture. Addressing key issues in urban agriculture, this research is designed to lay a foundation for further research and implementation of IoT- based solutions for healthy and smart consumption. The next section will discuss the architecture, methodology, results, and conclusions to provide a better understanding of the evolution of IoT in urban agriculture.

1.1. Objective

The primary objective of smart agriculture is to integrate technologies such as artificial intelligence, sensor networks, and the Internet of Things to enhance the performance of conventional agriculture. Thanks to this system, users should be able to benefit from technology and user experience that increase efficiency and sustainability in agriculture, as well as an understanding of environmental issues and protection.

- Developing cost-effective solutions that can be utilized by many users, promoting integration and freedom as a smart building, are some of the main goals.

- Collecting and analyzing data from multiple sensors to provide analysis and recommendations to improve plant health, growth, andyield.

2. Literature Survey

Nikhil Sukhdev. [1] (2018) paper focuses on the implementation of IoT technology to automate gardening systems. With water scarcity on the rise, the paper emphasizes the importance of using water efficiently. It also discusses the monitoring of soil temperature and humidity, and the implementation of corresponding measures.

Mitul Sheth and Pinal Rupani. [2] (2019) aim to enhance the conventional water supply system for home gardening and farm fields by developing a Smart Automated System. This system utilizes soil wetness, temperature, and humidity detectors positioned at the plant root area. The detected values are transmitted to the base station with the objective of collecting and syncing the data with the internet via Wifi. Users are notified when the water level falls below the designated point. The study demonstrates the feasibility of using NodeMCU for wireless monitoring of circuit diagrams, and the results are displayed through the Blynk App.

Sachin Sharma,Abhinav Sharma. [3] (2020)- This paper presents a design which is able to gather real-time data with various parameters used in gardening system.This paper presents the design, implementation and validation process of new innovative technologies which can gather data related to home gardening like humidity, temperature, fertilizers compositions, and many more, push gathered data into VANET cloud for analysis, generate alerts and notify it to user for appropriate actions.In this paper,we present Cloud-based IoT technologies in VANET implementation for smart home gardening management system.

Mokh. Sholihul Hadi, Pradipta Adi Nugraha. [4] (2020) Through the use of remote water pump control and garden soil moisture monitoring, this research integrates the Internet of Things into the garden irrigation system. The water pump attached to the garden's water supply is designed to automatically change the moisture parameter to its ideal value when the soil moisture sensor detects low moisture levels.Additionally, the garden's owner can use a smartphone app to keep an eye on the moisture level of the soil.

Samuel Olawepo and Ayodele Adebiyi. [5] (2020), discusses the potential advantages of Smart Garden Automation for effective food production and food security. This study demonstrates the components needed for Smart Garden Automation with the current systems, including sensors and microcontrollers that are connected to the internet and cloud data storage. Live feeds of event statistics are displayed through emails or front-end applications.

S. Uma Maheswari; P. T. V. Bhuvaneswari. [6] (2021) Plant maintenance and watering have become necessities for our everyday lives. One resource that shouldn't be wasted is water, but plant life should also be taken into consideration. Plant rotting could result from excessive watering. Therefore, to protect the health of plants, a balance between both should be maintained. An intelligent irrigation system has been developed to assist in the automatic hydration of plants in response to ambient circumstances.Plant watering can be done automatically with the use of a Raspberry Pi interfaced with a web API and a soil moisture sensor.

Sartika Triwahyu Fauziah; Edi Mulyana; A Ibrahim Nur; Saepul Uyun; Teddy Yusuf; Rina Mardiati.
[7] (2022) This study suggests using LoRa technology to construct a smart garden system. The fundamentals of the control system used in this study make use of an Android application-accessible smart garden system that can transmit data inputs in the form of inputs to monitor soil temperature, air temperature, air humidity, and automatically water ground kale plants. The device utilized for communication is the LoRa EBYTE E32. The MQTT protocol serves as a data communication gateway, and the LoRa EBYTE E32 module acts as a module for data transmission between the sensor node and the LoRa gateway. We present a novel plant-based Internet of Things (IoT) monitoring system that can be accessed via an Android application.

Soraya Norma Mustika; Muladi; Anik Nur Handayani; Muhammad Afnan Habibi. [8] (2022) Watering is without a doubt a crucial part of taking care of plants. Two times a day, in the morning and the evening, give the Monstera adansonii plant ample watering. This Smart Garden system includes a soil moisture sensor, a DHT11 sensor for temperature and humidity monitoring, a DC mini pump for watering control, and a NodeMCU ESP8266 microprocessor. The values of these sensors will be displayed in real-time in the Blynk application while simultaneously employing features to water the plants. If all a user has is a smartphone and internet access, caring for Monstera Adansonii plants will be simpler.

Niloy Chakraborty,Adrika Mukherjee,Mayuri Bhadra. [9] (2022) This project's main objective is to use less water when gardening and to keep up the garden from a distance. In this gardening system, critical plant data, including as temperature, relative humidity, and soil moisture, are continuously maintained in a relational database. The end users of the garden can regulate the ideal growing environment for their plants by keeping an eye on the status of the real-time sensors. In this system, a deep learning technique based on Convolutional Neural Networks (CNNs) [3] has been linked with a plant health identification model to create a plant recognition model.

Gauri R Choudhari. [10] (2023) This project resulted in the creation of an Internet of Things (IoT)-based smart garden system that enables the user to monitor several plant-related metrics, such as moisture level, temperature, humidity, and light condition. The irrigation system, which can be set to run automatically or under user control, can help control the moisture content of the soil. In addition to the manual mode, an automatic watering system is available to maintain soil moisture without requiring human participation. A dispenser for fertilizer has been integrated into the system. This guarantees that the plant will receive all of the nutrients it needs. The system is backed by a web dashboard and a smartphone application, and it operates over Wi- Fi. As a result, the functions of regulating and monitoring are simple and convenient.

3. Existing System

Manual effort and human observation played a major role in conventional gardening practices prior to the development of smart gardening technologies. Gardeners employed traditional irrigation techniques like hoses and watering cans, and they manually judged when to water plants based on visual indications like soil dryness. Plants exposure to sunlight was determined by their natural processes; little could be done to regulate temperature or to maximize light levels. When data on temperature, moisture content of the soil, and other environmental parameters were gathered, they were done so manually and were not methodically documented for examination. There was no way for gardeners to monitor and care for their plants remotely or in real time—they had to be physically present. Decisions about how to care for plants were made more on common sense and experience than on exact, data- driven insights. Water and other resources were possibly abused, and resource inefficiencies were widespread. Because there was no automation, manual intervention was necessary for things like modifying watering schedules and reacting to changing conditions. These constraints have been addressed by the move to smart gardening systems, which offer automation, data-driven decision-making, and remote monitoring for better plant health and more effective use of resources.

- Affected crops is identified by Human.
- Medicine is also given manually.
- In existing method, using CISC mechanism is used.
- High maintaince.

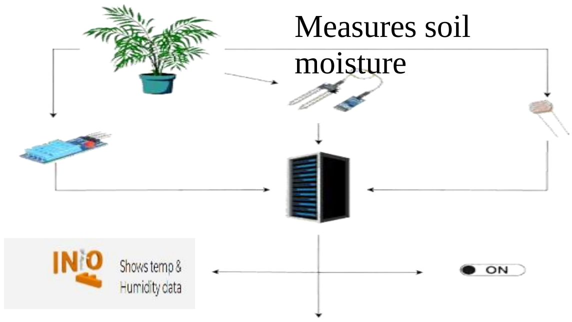
- Only using sensor is used in existing methods.

4. Proposed System

A smart gardening system optimizes and automates multiple technologies to improve plant care. This system uses a network of sensors, such as light, temperature, humidity, and soil moisture sensors, to continuously monitor the surrounding environment. Actuators react to sensor data to provide plants with the right amount of light and water. Examples of these actuators are automatic watering systems and shade/light controls. Acting as the brains of the system, the control unit—typically a microcontroller or Raspberry Pi—collects sensor data and sends actuator orders. Wi-Fi and Bluetooth connectivity options provide communication with a central hub or user interface, which is usually accessed via a mobile application or web site. The retention of past data through cloud storage makes it easier to follow plant growth and analyze system performance. In order to improve notifications. To complete a complete smart gardening system that maximizes plant health and resource use while giving users remote monitoring and control, energy-efficient design elements also help to extend battery life or reduce electricity consumption.

- Control from remote places
- Maintain the humidity
- Maintain the Temperature

4.1 System Architecture



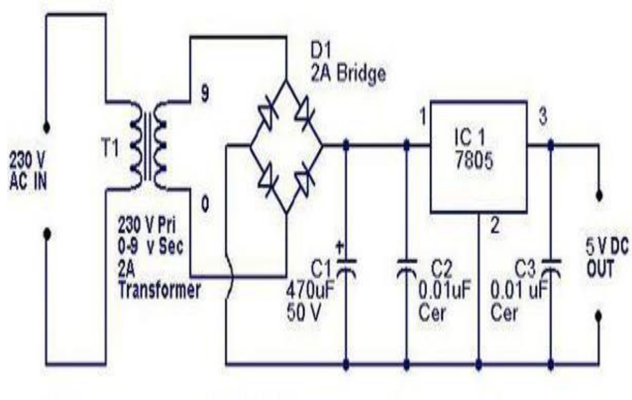
Measures

Temp & Humidity

Adafruit Server

Data visuals can be generated

4.2 Power Supply CircuitDiagram

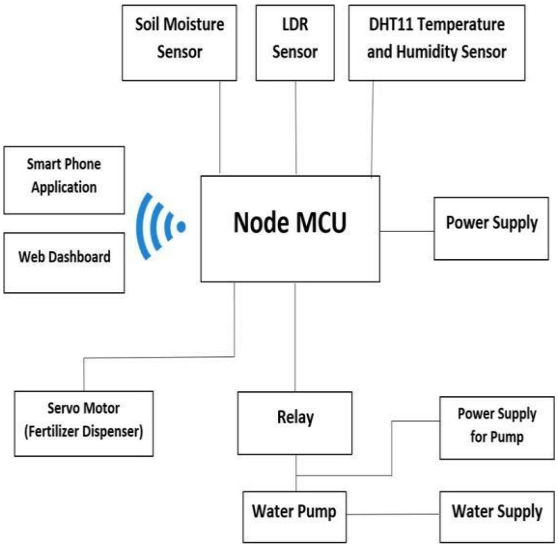


Detects light

Digital manual regulation

plant care techniques. Plant advanced features can include machine learning and decision-making algorithms. Access restrictions and encryption are two examples of security methods that guarantee user privacy and data integrity. Users are kept informed about important occurrences through alerts and notifications that are sent via push

4.3 Architecture Design



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0FC0FXCD	84	2397855	2023-07-28 13:55:40 UTC		
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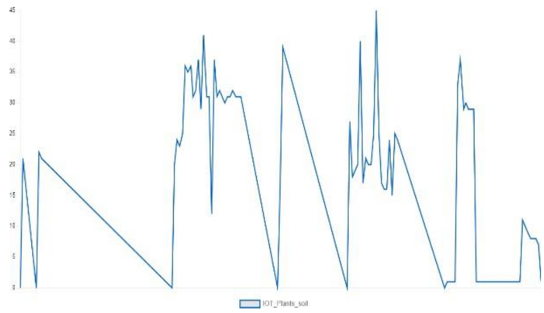
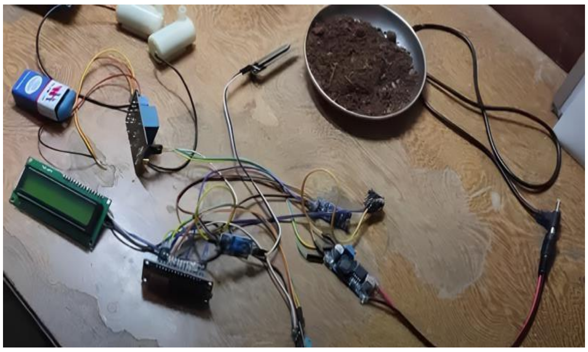
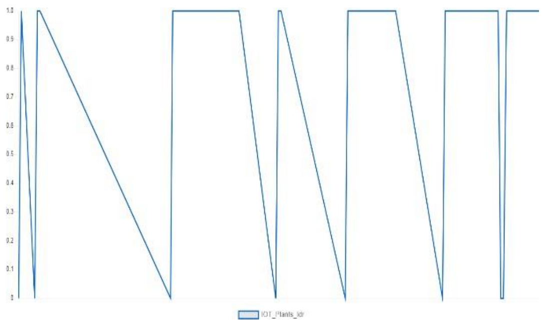
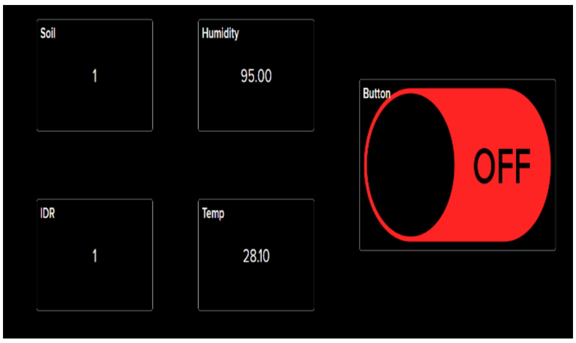
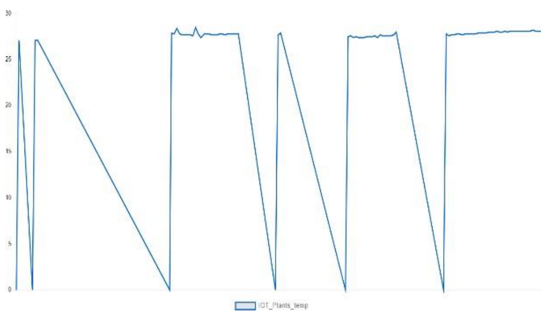


5. Deployment of the model









6. Conclusion

To sum up, the creation and application of our intelligent gardening system mark a noteworthy progression in the precision agricultural domain. Our initiative sought to address the issues with conventional gardening procedures by integrating cutting-edge technology, such as automation, data analytics, and Internet of Things sensors. Important environmental characteristics including soil moisture, temperature, humidity, and light levels may be monitored in real time thanks to our technology. Users were able to make well-informed decisions for the best possible care for their plants thanks to the actionable insights provided by the data these sensors collected. By ensuring that water resources were used wisely, the automation features—such as automated watering based on soil moisture levels—contributed to resource efficiency. By using less water, this not only helps the environment but also encourages sustainable farming techniques.The creation of an intuitive user interface that is available on mobile and online platforms has enabled individuals with diverse technical backgrounds to utilize the smart gardening system. The interface gave customers ease and flexibility by enabling remote monitoring and control. Future research could concentrate on improving the energy efficiency of sensor nodes, possibly looking into alternate energy sources and energy-harvesting technologies, as energy consumption is still a crucial component of Internet of Things applications. To sum up, our intelligent gardening system is a development toward more effective and ecological farming methods. The integration of data-driven decision assistance, real-time monitoring, and intuitive interfaces presents novel opportunities for gardeners, regardless of experience level. Our initiative lays the groundwork for future developments in the horticultural and technological nexus as we investigate breakthroughs in smart agriculture.

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