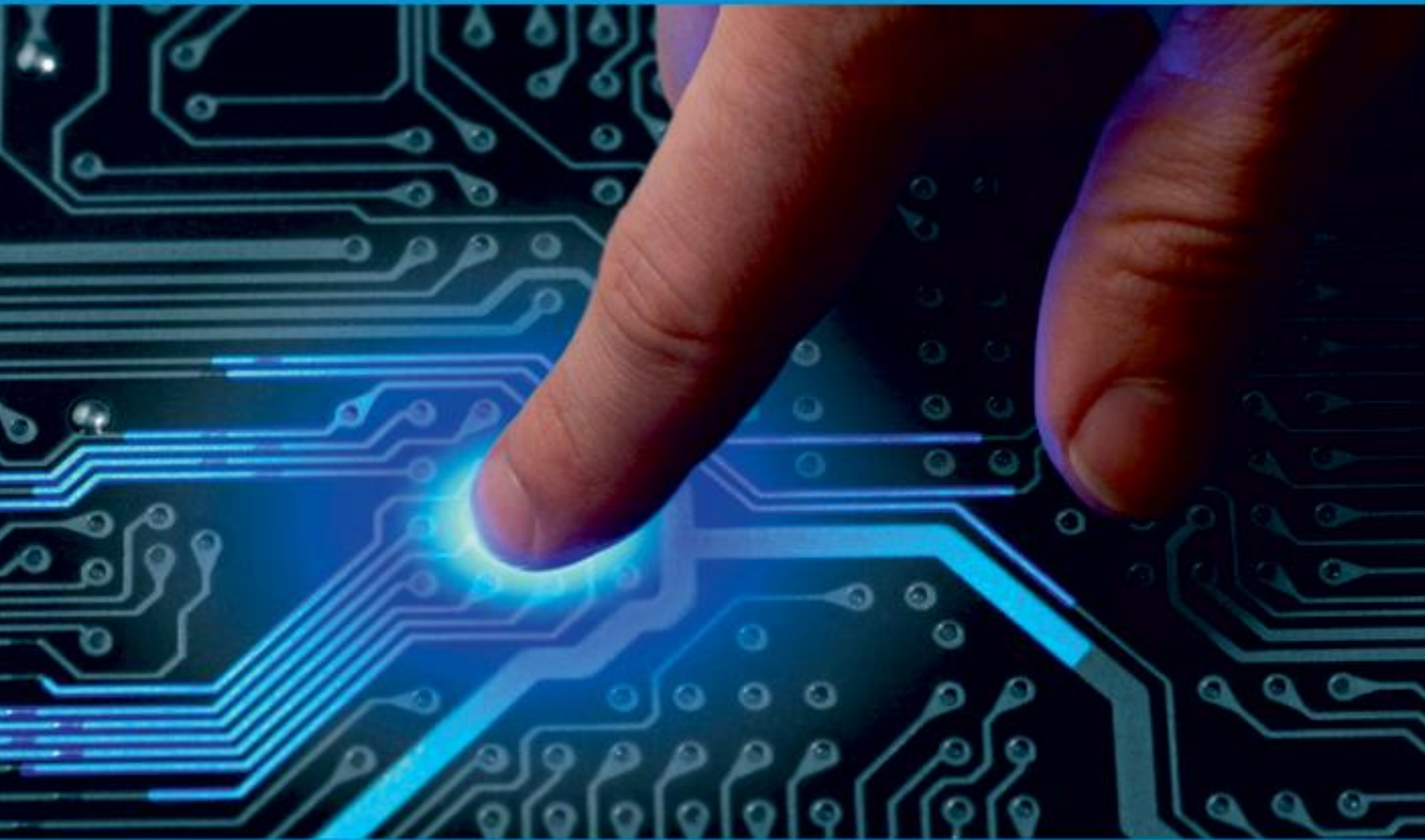
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 5, May 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

| DOI: 10.15680/IJIRCCE.2024.1205021 |

Implementation towards IOT based Smart Gardening System

Dwartale Kiran[1], Kharat Mayuri[2], Pansare Akshay[3], Prof. Anupama Ghadge[4]

UG Student, Dept. of E & TC Engg., HSBPVT'S GOI Faculty of Engineering Kashti Maharashtra India[1-3]

Assistant Professor, Dept. of E & TC Engg., HSBPVT'S GOI Faculty of Engineering Kashti Maharashtra India[4]

ABSTRACT: The smart gardening system presented in the system utilizes IoT technology, specifically employing the ESP8266 microcontroller and the Blynk IoT cloud platform. The system incorporates various sensors and actuators to automate and optimize the management of a garden or farmland. Key components include a soil moisture sensor for monitoring soil moisture levels, a water pump for automated irrigation based on moisture levels, an LDR (Light Dependent Resistor) for measuring ambient light intensity and adjusting light conditions accordingly, and an IR sensor for detecting perimeter intrusion to enhance security. By leveraging these components and IoT connectivity, the system enables remote monitoring and control of essential parameters for plant growth and security. Users can access real-time data and receive notifications through the Blynk mobile application, allowing them to make informed decisions and take timely actions to maintain optimal growing conditions and prevent unauthorized access to the farmland perimeter. This smart gardening system offers convenience, efficiency, and enhanced security, contributing to more sustainable and productive agricultural practices.

KEYWORDS: Agriculture, smart farming, greenhouse, IoT, sensors

I. INTRODUCTION

The world population is continuously increasing, leading to a higher demand for food production. However, traditional farming methods face challenges such as water scarcity, climate change, and labor shortages. To address these issues, there is a growing interest in smart agriculture, which involves the use of IoT technology to improve the efficiency and productivity of farming practices. One key aspect of smart agriculture is smart gardening, which focuses on small-scale farming, home gardening, and urban agriculture. Smart gardening systems leverage IoT devices and sensors to monitor and manage various parameters such as soil moisture, light intensity, and security.

In this project, we propose a smart gardening system that utilizes the ESP8266 microcontroller and the Blynk IoT cloud platform. The system integrates sensors such as a soil moisture sensor, an LDR for light intensity measurement, and an IR sensor for perimeter intrusion detection. It also includes a water pump for automated irrigation.By implementing this system, users can remotely monitor and control their garden, ensuring optimal growing conditions for plants while conserving water and energy. The system also enhances security by detecting and alerting users to unauthorized access to the garden perimeter. Overall, this project aims to demonstrate the feasibility and benefits of using IoT technology in smart gardening, contributing to more sustainable and efficient food production practices.

Different kind of problems faced by the farmers motivated us for the recommended that are: the Indian farming is on the hitch because of the limited technical system know of the best and efficient agricultural practices and moreover they are still dependent on conventional methods of gardening that leads to lesser productivity of crops.

So, by using upcoming technology the productivity of crops can be maximized at minimal cost. This also reduces burden of taking up of heavy loans on farmers which they have incurred on themselves in order to sustain their livings or to get good yields of their crops. Apart from these issues scarcity of resources also adds up in their problem causing hindrance or stopping framers from cultivating and hence Indian economy is also additionally getting influenced to large extent as most of the fruitful lands of the nation are being destroyed that forms the vital part of GDP.

So, through this framework we are presenting solution for this issue by introducing an automated and systematic farming strategies that enable farmers to cultivate in a productive way also with limited resources and greater yield which is assured and efficient. By the use of efficiency level would be further expanded as far as utilization of water, soil, fertilizers, pesticides etc.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1205021 |

II. RELATED WORK

Following literature survey is conducted with different technologies used for the system. The study shows the problems which could be faced by system and the solution is given for every problem.

1) Effect of Greenhouse Design Parameters on the Heating and Cooling Requirement of Greenhouses in Moroccan Climatic Conditions IEEE 2021

The model considers the presence of the plants inside the greenhouse by adding the heat and humidity gain into the heat and water balance of the greenhouse using an evapotranspiration sub-model. The effect of evapotranspiration on the greenhouse thermal behavior was also examined in this study. The relative error of the annually heating demand obtained by this model is 1.66\%, and the evapotranspiration model used in this study shows relative deviation less than 6.5%.

2)Arduino based Low-Cost Greenhouse Monitoring System for Small Scale Farmers 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks 2021

The paper presents minimal effort nursery house checking framework. In green house development, plants are under acceptable climatic conditions, for instance, temperature, dampness, etc. The present work intended to screen and control the indoor and openair sogginess, temperature, and climatic conditions impacting the plants by using Arduino Uno. I Arduino has an option to assume the responsibility for the cooling fan and focus light dependent on the changing characteristics of the sensor associated with it. The parameters are checked and the information is recorded and sends the message to the mail or message.

3)IoT Based Smart Plant Irrigation System with Enhanced learning 2020 IEEE 2020 Authors propose a smart plant irrigation

IoT system that autonomously adapts itself to a defined irrigation habit. The automated plant irrigation systems generally make decisions based on static models derived from the plant's characteristics. The learning mechanism of the model reveals the mathematical connections of the environmental variables used in the determination of the irrigation habit and progressively enhances its learning procedure as the irrigation data accumulates in the model.

Authors evaluated the success of our irrigation model with four different supervised machine learning algorithms and adapted the Gradient Boosting Regression Trees(GBRT) method in our IoT solution. We established a test bed for the sensor edge, mobile client, and the decision service on the cloud to analyze the overall system performance.

4)Automated Irrigation System and Detection of Nutrient Content in the Soil 2020 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS), 2020

The automatic irrigation system based on sensor-based systems has been designed and implemented as one of the most widely used and advantageous automatic systems. The sensors used are moisture sensors it is used to detect the moisture level of the soil and the water is pumped to the soil or field automatically. It makes the work easier for farmers, and time consumption is also less. Along with this irrigation process, the soil's nutrient content is also monitored. If the soil's nutrient content is below the required amount the app will send a notification to the farmer through the app and the farmer can feed the crops with essential nutrients.

5)Green house based on IoT and AI for societal benefit 2020 IEEE

The microcontroller (LPC2138), environment monitoring sensors, communication module (ESP8266), along with a server design which takes into account the real time weather forecast, and data analysis on the data gathered by sensors for irrigation decision is focused on achieving automation, IoT deployment level -3, wrong weather forecast counter-action in real time with automation and intelligent control for water utilisation. The data has been tested for algorithms such as Naïve Bayes, C4.5 and SMO (svm). A web page has been created which can be used for monitoring the data of green house.

By conducting a comprehensive literature survey, you can gain valuable insights into the state- of-the-art technologies, best practices, and research gaps in IoT-based agriculture and smart gardening, informing the design and implementation of your project.

Optimize Water Usage: Traditional irrigation methods may lead to over-watering or under- watering of plants, resulting in water wastage or plant stress. The smart gardening system incorporates a soil moisture sensor and a

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |
|| Volume 12, Issue 5, May 2024 ||
| DOI: 10.15680/IJIRCCE.2024.1205021 |

water pump to automate irrigation based on real-time moisture levels, ensuring plants receive the right amount of water.

Monitor Environmental Conditions: Monitoring environmental factors such as light intensity is crucial for plant growth. The system integrates an LDR to measure light intensity and adjust artificial lighting accordingly, providing optimal growing conditions for plants.

Enhance Security: Unauthorized access to farmland or garden areas can lead to theft, vandalism, or damage to crops. The smart gardening system includes an IR sensor forperimeter intrusion detection, alerting users to any unauthorized access attempts andenhancing overall security.

Remote Monitoring and Control: Traditional gardening methods often require physical presence for monitoring and management. The smart gardening system allows users to remotely monitor environmental conditions, irrigation status, and security alerts through the Blynk IoT cloud platform, providing convenience and enabling timely intervention when necessary.

By addressing these challenges and providing solutions through IoT-based automation and monitoring, the smart gardening system aims to improve the efficiency, productivity, and security of gardening and farming practices, ultimately contributing to sustainable food production and resource conservation.

III. PROPOSED METHODOLOGY

A. *System Architecture:*

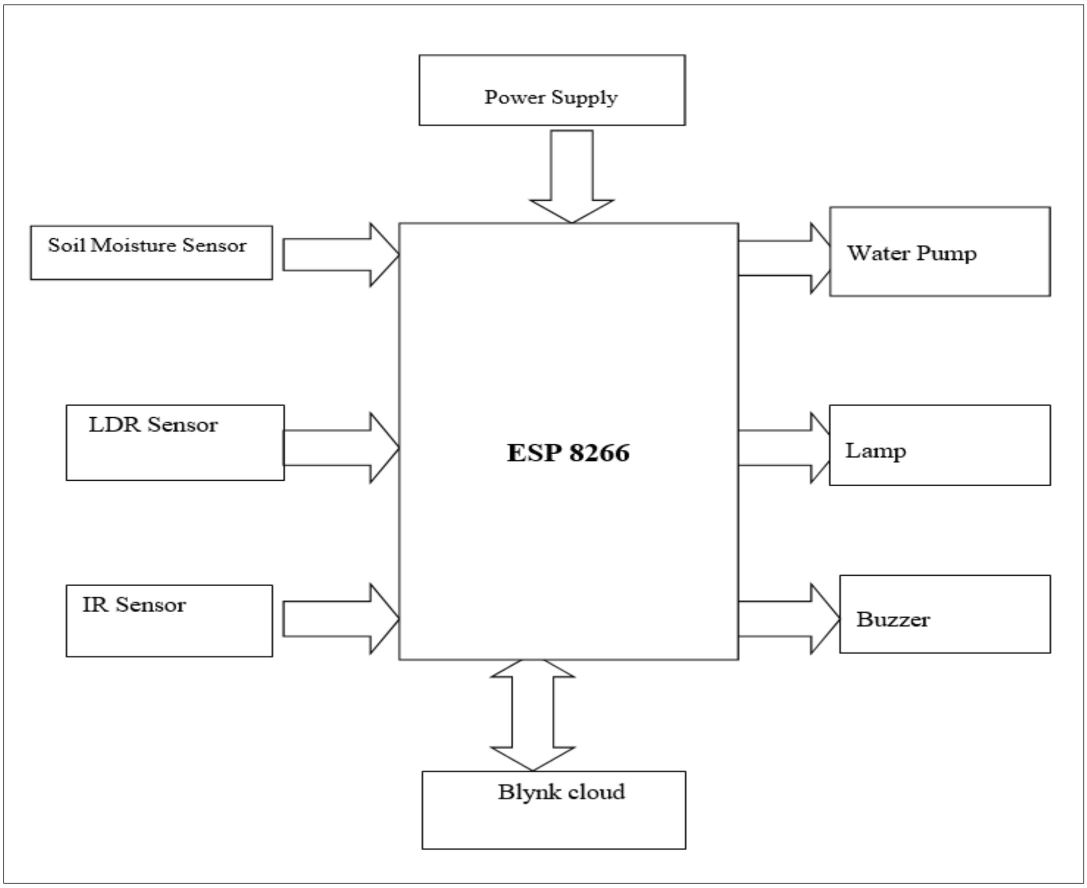


Fig 1 : System Architecture

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1205021 |

B. *Circuit Design:*

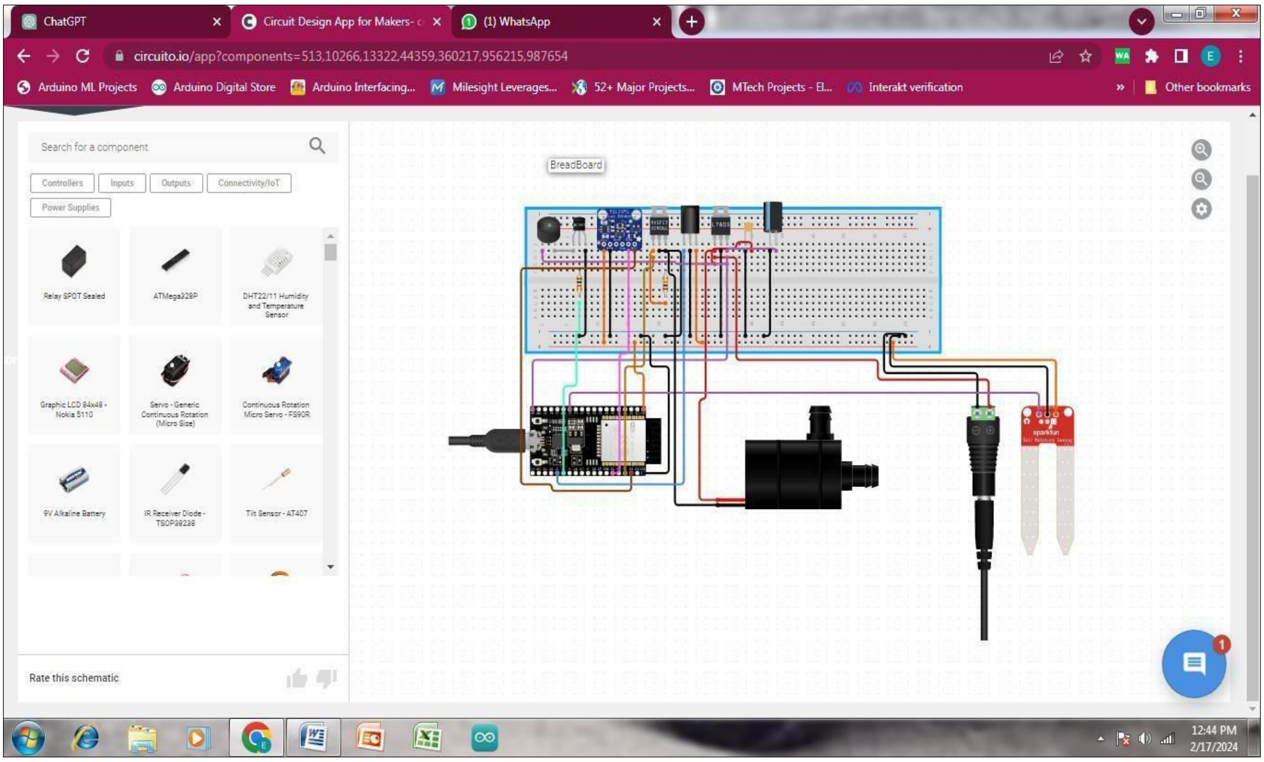


Fig 2 : Circuit Design

C. *Working:*

- **Initialization**: Upon startup, the microcontroller initializes its connections and sets up communication with the Blynk IoT cloud platform. It also configures the pins for sensor inputs and actuator outputs.
- **Data Acquisition**: The microcontroller continuously reads data from the connected sensors, including the soil moisture sensor, light sensor (LDR), and infrared (IR) sensor for perimeter detection. These sensors provide real-time information about soil moisture levels, light intensity, and perimeter status.
- **Sensor Data Processing**: The microcontroller processes the sensor data to determine the current environmental conditions in the garden or farmland. For example, it may compare the soil moisture readings to a predefined threshold to determine if irrigation is needed.
- **Control Actions**: Based on the sensor data and predefined thresholds, the microcontroller executes control actions to manage the smart gardening system. For instance, if the soil moisture level is below a certain threshold, indicating the need for irrigation, the microcontroller activates the water pump to provide water to the plants.
- **Communication with Blynk**: The microcontroller communicates with the Blynk IoT cloud platform to send sensor data and receive control commands from the user via the Blynk mobile app. This allows users to remotely monitor the status of their garden, adjust settings, and receive notifications.
- **Feedback and Monitoring**: The microcontroller provides feedback to the user through the Blynk app, updating them on the current environmental conditions, irrigation status, and any security alerts. Users can monitor the system in real-time and take appropriate actions as needed.
- **Continuous Operation**: The microcontroller operates in a continuous loop, repeating the process of data acquisition, processing, control actions, and communication with Blynk to ensure the smart gardening system functions effectively and efficiently.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1205021 |

Overall, the controller (ESP8266 microcontroller) plays a central role in monitoring, controlling, and managing the various components of your smart gardening system, enabling automation, remote access, and optimization of gardening tasks.

IV. ALGORITHM

1) Initialization:

Initialize the microcontroller (ESP8266) and connect it to the Blynk IoT cloud platform. Initialize and configure all sensors (soil moisture sensor, LDR, IR sensor) and actuators (waterpump).

2) Setup Blynk Integration:

Set up communication between the microcontroller and the Blynk server. Define virtual pins for sensor readings and actuator controls in the Blynk app.

3) Data Acquisition:

Continuously read sensor data (soil moisture, light intensity, perimeter status) at regularintervals.

4) Soil Moisture Monitoring and Irrigation Control: Read soil moisture level from the soil moisture sensor.If moisture level is below a defined threshold:

Activate the water pump to irrigate the plants.

Update the Blynk app with the current soil moisture reading.

5) Light Intensity Monitoring and Control: Read light intensity from the LDR.

If light intensity is below a defined threshold:

Activate artificial lighting (if available).

Update the Blynk app with the current light intensity reading.

6) Security Monitoring:

Read perimeter status from the IR sensor.If perimeter intrusion is detected:

Trigger a security alert.

Update the Blynk app with the current security status.

7) Remote Monitoring and Control:

Send sensor data (soil moisture, light intensity, perimeter status) to the Blynk app.

Receive control commands (e.g., manual irrigation) from the Blynk app and act accordingly.

8) Repeat:

Repeat the data acquisition and control steps continuously in a loop.

This algorithm provides a basic framework for the operation of the smart gardening system. Depending on the specific requirements and features of your project, you may need to further refine and expand upon this algorithm. Additionally, consider incorporating error handling andfault tolerance mechanismsto ensure robust performance in real-world conditions.

V. SIMULATION RESULTS

A. Application Results

- Automation: The system automatically adjusts irrigation schedules based on soil moisture
- Remote levels and controls other parameters such as light intensity and security.
- Monitoring: Users can remotely monitor the status of their garden and receive notificationsor alerts via a mobile app, providing convenience and peace of mind.

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1205021 |

- Optimized Plant Growth: The system facilitates optimal growing conditions for plants,leading to healthier growth, increased yields, and improved overall garden productivity.
- Resource Efficiency: By optimizing resource usage, such as water and energy, the system promotes sustainability and reduces environmental impact.
- User Experience: The system offers a user-friendly interface and intuitive controls, enhancing the gardening experience for users of all skill levels.
-
- Data Insights: Users can gain insights into their garden's health and performance throughdata collected by the system, enabling informed decision-making and continuous improvement.

B. Experimental Setup:

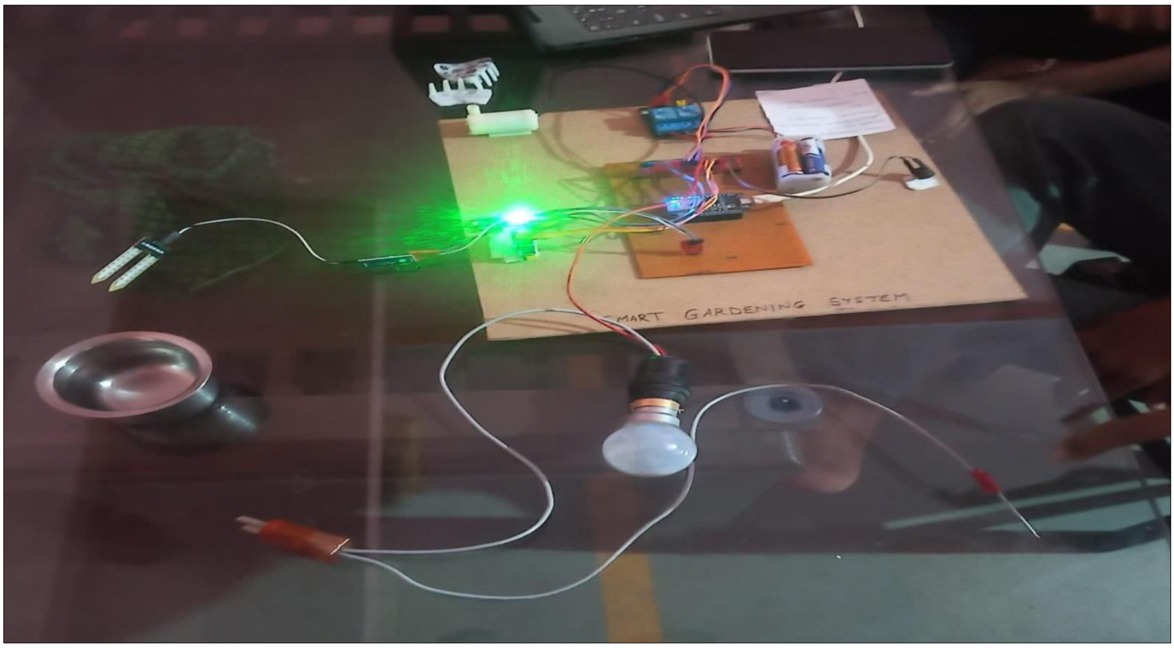


Fig 3 : Experimental Setup

C. Screenshot of Application:

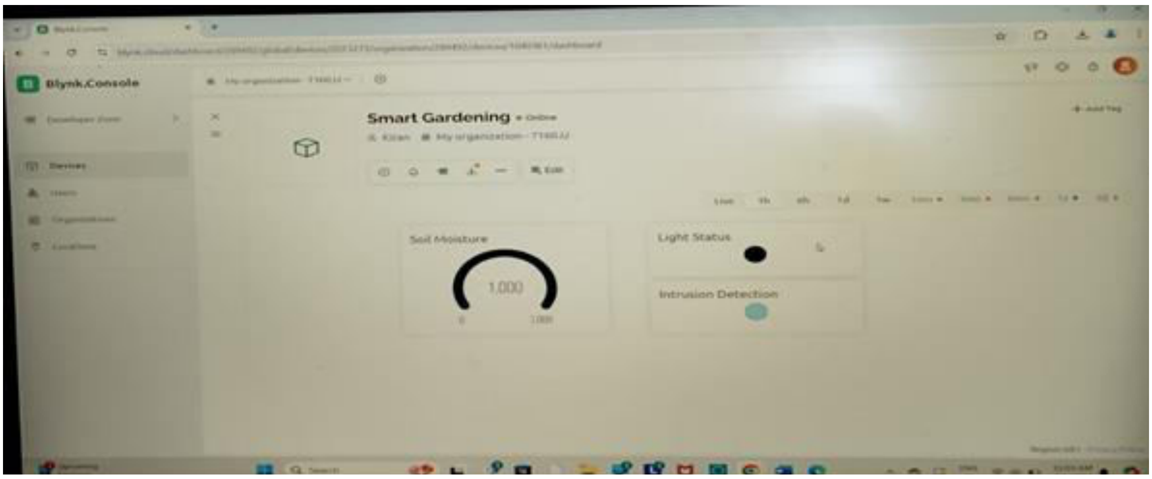


Fig 4: Application Screenshot

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1205021 |

A soil moisture sensor for monitoring soil moisture levels, a water pump for automated irrigation based on moisture levels, an LDR (Light Dependent Resistor) for measuring ambient light intensity and adjusting light conditions accordingly, and an IR sensor for detecting unauthorized person for security. Smartphone Application showing monitored parameters and controlling functions

VI. CONCLUSION AND FUTURE WORK

In conclusion, smart gardening systems represent a modern and innovative approach to gardening that leverages IoT technology to optimize plant growth, conserve resources, and enhance user experience. These systems offer numerous advantages, including efficient resource management, optimized plant growth, convenience, security, and environmental sustainability. Through automation, remote monitoring, and data-driven decision-making, smart gardening systems empower users to maintain healthy and productive gardens with minimal effort and environmental impact. They have diverse applications across various contexts, including home gardens, urban agriculture, community development, education, research, and commercial farming.

While smart gardening systems offer significant benefits, it's essential to consider potential challenges such as initial cost, technical complexity, reliability, and data privacy. Addressing these challenges through proper planning, training, and support can ensure a successful and sustainable gardening experience for users. Overall, smart gardening systems represent an exciting opportunity to revolutionize the way we grow plants, fostering a deeper connection to nature, promoting sustainability, and empowering individuals and communities to cultivate thriving gardens in harmony with the environment. With ongoing innovation and adoption, smart gardening has the potential to play akey role in shaping the future of gardening and agriculture for years to come.

REFERENCES

1. N. Choab, A. Allouhi, A. E. Maakoul, T. Kousksou, S. Saadeddine and A. Jamil, "Effect of Greenhouse Design Parameters on the Heating and Cooling Requirement of Greenhouses in Moroccan Climatic Conditions," in IEEE Access, vol. 9, pp. 2986-3003, 2021, doi: 10.1109/ACCESS.2020.3047851.
2. M. Anisha et al., "Arduino based Low-Cost Greenhouse Monitoring System for Small Scale Farmers," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, pp. 1120-1127, doi: 10.1109/ICICV50876.2021.9388402.
3. K. Cagri Serdaroglu, C. Onel and S. Baydere, "IoT Based Smart Plant Irrigation System with Enhanced learning," 2020 IEEE Computing, Communications and IoT Applications (ComComAp), 2020, pp. 1-6, doi: 10.1109/ComComAp51192.2020.9398892.
4. A. P. G. V, R. S. Sree, S. Meera and R. A. Kalpana, "Automated Irrigation System and Detection of Nutrient Content in the Soil," 2020 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS), 2020, pp. 1-3, doi: 10.1109/ICPECTS49113.2020.9336990.
5. M. Nargotra and M. J. Khurjekar, "Green house based on IoT and AI for societal benefit," 2020 International Conference on Emerging Smart Computing and Informatics (ESCI), 2020, pp. 109-112, doi: 10.1109/ESCI48226.2020.9167637.