İSTANBUL SAĞLIK VE TEKNOLOJİ ÜNİVERSİTESİ

FACULTY OF ENGINEERING AND NATURAL SCIENCES
THESIS MONITORING REPORT 1

IOT-AGROS: IOT-BASED REMOTE CONTROLLED AGRICULTURAL CLIMATE SYSTEM

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MÜHENDİSLİK FAKÜLTESİ

IOT-AGROS: IOT-BASED REMOTE CONTROLLED AGRICULTURAL CLIMATE SYSTEM

Mekatronik Mühendisliği (İngilizce) Bölümü öğrencisi Yağmur Sıla Bakış tarafından hazırlanan 1. tez izleme raporu ...../...../..... tarihinde toplanan tez izleme komitesi tarafından değerlendirilmiş olup kabul ……

İSTÜN İSTANBUL SAĞLIK VE TEKNOLOJİ ÜNİVERSİTESİ		**Tarih**	
İzleme Komitesi	**Ünvanı**	**Adı-Soyadı**	**İmzası**
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Üye		Yağmur Sıla Bakış	

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ABBREVIATIONS

ESP32: Espressif Systems Wi-Fi and Bluetooth Enabled Microcontroller

IoT: Internet of Things

IoT-AGROS: IoT-Based Remote Controlled Agricultural Climate System

LCD: Liquid Crystal Display

MQ-135: Metal Oxide Semiconductor (MOS) type air quality gas sensor

Wi-Fi: Wireless Fidelity

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ABSTRACT

IOT-AGROS: IOT-BASED REMOTE CONTROLLED AGRICULTURAL CLIMATE SYSTEM

Yağmur Sıla Bakış

Mechatronics Engineering Department
Thesis Monitoring Report

Project Mentor: Dr. Arif Solmaz

This project aims to monitor and control critical environmental parameters such as temperature, relative humidity, and soil moisture in real time using sensors within a closed prototype greenhouse cabinet. Designed to eliminate the difficulties and inefficiencies of manual monitoring in traditional agriculture, the system is built on a Wi-Fi-enabled ESP32 microcontroller-based infrastructure. Excess heat and humidity accumulating inside the cabinet are discharged via an exhaust fan located at the top, following a cross-ventilation principle; when soil moisture falls below a threshold, automatic irrigation is performed using a mini water pump. All this environmental data is displayed on the local interface and can also be monitored and managed remotely by the user via the Blynk cloud platform. This first report addresses the academic literature background, conceptual preliminary design, and future business plan of the system.

Keywords: Climate Control, IoT, Microcontroller, Remote Control, Smart Greenhouse.

1. CURRENT SITUATION

At this stage of the project, the concept, theoretical framework, and scope studies of the graduation project titled IoT-AGROS (IoT-Based Remote Controlled Agricultural Climate System) have been successfully completed. The main objective of the project is to monitor critical environmental parameters such as temperature, relative humidity, and soil moisture in real-time using microcontroller-based sensors within a closed prototype greenhouse cabinet and to manage them remotely via cloud platforms. In this context, the current status of the project has been discussed in detail under the following headings:

- During this period, the conceptual design of the project was finalized. The Wi-Fi-enabled ESP32 microcontroller was selected as the main processing unit of the system; the basic hardware components to be used in the data collection and automation phases were determined. In addition, the scientific foundations of the project were established by conducting a review of international academic literature on smart agriculture and IoT integration.

- The most fundamental challenge encountered during the project process was the existence of numerous sensor alternatives with different sensitivities and technical specifications on the market, and the need for in-depth examination of the data communication protocol compatibility of these sensors with the ESP32. Due to the time constraints in the current reporting period, and the emphasis on theoretical and literature background, it was not possible to conduct laboratory tests of all sensor models. Therefore, the finalization of the most suitable sensor architecture was left to the next stage.

- To prevent potential disruptions in sensor compatibility and supply processes from hindering the overall flow of the project, it was decided to prefer modules with widespread documentation and community support and to design a modular software architecture. Until the next report, it is planned to finalize the sensor selections, prepare the material list, and work on the mechanical insulation details of the physical prototype.

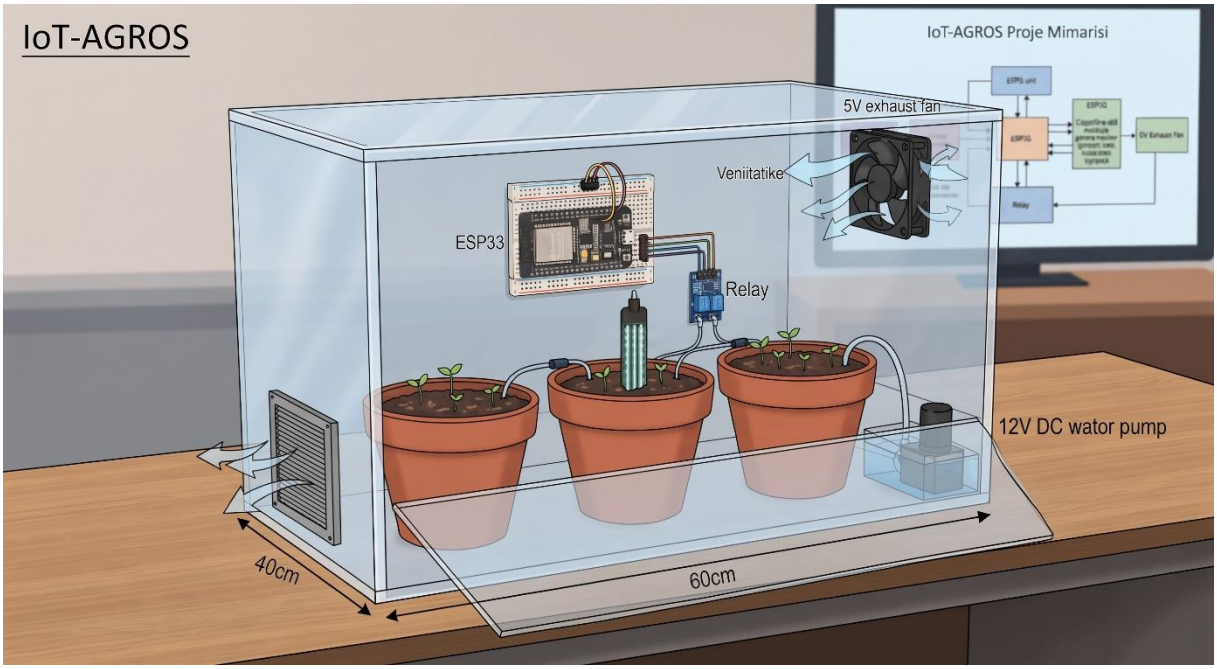


Figure 1: Animated view of the project (AI-powered tools were used for visual design.)

2. ACTIONS TAKEN

During this period, a comprehensive literature review was conducted to establish the academic foundation of the project. Current international studies in the fields of agricultural automation and IoT were examined; in particular, the roles of the ESP32 microcontroller, sensor networks, and cloud-based remote monitoring systems in greenhouse climate control were analyzed. Based on the findings, the project's system architecture and control strategies were shaped according to the literature. The research findings were noted for use in the graduation thesis and are also shared in this report.

The increasing global population, shrinking agricultural land, and climate change necessitate a shift from traditional farming approaches to smart and sustainable systems. This project aims to monitor and control critical environmental parameters such as temperature, humidity, soil moisture, and air quality in real-time using IoT-based sensors in enclosed prototype greenhouses. Eliminating the challenges of manual monitoring in traditional agriculture, this system is of great importance for small and medium-sized agricultural enterprises in terms of optimizing resources, reducing water consumption, and increasing crop yields by minimizing human intervention.

In advanced smart greenhouse applications, real-time monitoring of environmental parameters and cloud-based remote management play a critical role. Farooq et al. (2022) highlighted that IoT-based greenhouse systems optimize agricultural resource management and

reduce human intervention through sensor networks, communication protocols, and cloud platforms. Saravanakumar et al. (2026) experimentally demonstrated that variables such as soil moisture, air quality (MQ-135), and light intensity can be monitored and automated in real-time using prototype systems based on the ESP32 microcontroller and the Blynk cloud platform. This project aims to create a small-scale, low-cost, and reliable greenhouse automation prototype by adopting a similar microcontroller and cloud-based architecture.

3. THINGS THAT CANNOT BE DONE

During this period, the prototype cabinet, ESP32 microcontroller, test pots, and soil structure, which are the core hardware components of the project, were finalized and planned. However, the exact model and technical specifications of the environmental and climate sensors to be used in the system have not yet been finalized.

The primary reason for this is the need for a thorough examination of the sensitivity rates, response times, resistance to environmental factors (humidity, dust, etc.), and data communication protocol compatibility with ESP32 of various sensor alternatives available on the market (e.g., temperature, humidity, gas, and light sensors). Due to time constraints during the current reporting period, which prioritized literature review and conceptual design, there was insufficient time to complete the detailed research comparing which sensor characteristics would be most efficient for the project's operating environment. Therefore, the selection of the most suitable sensor architecture and its hardware integration have been postponed to the next report.

4. PLANNING

This section presents a phased timeline of activities to be carried out until the next monitoring report; it also addresses cost analysis and potential risk management strategies, which are crucial for the sustainability of the project. The work to be carried out until the next report and its timeline are as follows:

Activity 1: Sensor Research and Decision Making

The sensitivity rates, response times, and hardware/software compatibility of the environmental sensors to be used in the system will be examined in depth, and the final sensor model will be decided upon.

Activity 2: Expanding the Literature Research

The literature base will be enriched by reviewing current international articles on communication protocols and cloud integration used in smart greenhouses.

Activity 3: Cost Calculation

A budget analysis of the project will be conducted by determining the current market costs of all components such as ESP32, sensors, relay board, water pump, prototype cabinet materials, and adapter.

Risk Management and Strategies

The potential risks, their impacts, and the measures to be taken against them, which are foreseen in order to complete the project within the targeted time and budget, are tabulated and explained below:

Potential Risk	**Risk Type**	**Impact Degree**	**Strategy to be Taken**
Sensor Compatibility and Latency Issues	Technical / Hardware	Medium	Choosing sensors with widely available documentation and community support will enable a faster transition to alternative models.
Budget/Cost Overrun	Economic	Low	A detailed price/performance analysis will be conducted before project components are procured, focusing on low-cost open-source modules.

Table 1: Risk management and strategies to be implemented.

5. CONCLUSION

In conclusion, this first reporting period successfully covered the concept design, literature review, and system requirements of the IoT-AGROS project. The disadvantages of traditional agricultural practices were examined, and the importance of IoT-based automation systems in resource efficiency was demonstrated.

In the current phase of the project, the targeted literature review has been completed; the ESP32 microcontroller has been determined as the main processing unit of the system, and the

basic architecture for cloud integration has been determined. Preliminary studies have been conducted for the optimization of physical hardware and sensor models, and a detailed business plan and risk management strategy have been created for future phases. In the next stage, it is anticipated that the project will fully reach its targeted phases with the finalization of sensor selections, the establishment of a hardware prototype, and software integration.

REFERENCES

[1] P. Saravanakumar, A. Abinaya, D. Naveena, M. Megila, and Dr. Somu, "Smart Greenhouse System using IoT for Climate Control and Remote Monitoring," Proceedings of the 7th International Conference on Smart Electronics and Communication (ICOSEC), pp. 1562-1567, 2026.

[2] M. S. Farooq, R. Javid, S. Riaz, and Z. Atal, "IoT Based Smart Greenhouse Framework and Control Strategies for Sustainable Agriculture," IEEE Access, vol. 10, pp. 99394-99421, 2022.