Research Inventy: International Journal of Engineering And Science
Vol.12, Issue 1 (January 2022), PP 43-47
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

Implementation of Plant Monitoring System in Greenhouse Based on IoT

1st Alfie Syahri, 2nd Novrina, 3rd SwelandiahEndahPratiwi
*[*1]Dept.of Computer Science and Information Technology, University of Gunadarma, West Java, Indonesia*
[23]Dept. of Computer Science and Information Technology, University of Gunadarma, West Java, Indonesia

Abstract
One of the Internet of Things applications that can be made is the monitoring and control of plant cultivation systems. By utilizing the Internet of Things, monitoring and control of the cultivation system can be carried out remotely without direct interaction. In the IoT-based plant monitoring system at the Greenhouse, there is a system that is integrated with Cloud services via the internet. Through this monitoring and automation system, it can later be developed more widely for farmers/Farmers Groups so that they can monitor plant growth, regulate treatment in cultivation, especially watering plants, and control the development of plant production whenever and wherever they are. This technology will assist farmers in carrying out some of the main cultivation activities so as to reduce the amount of labor needed and save time for these activities.

Keywords: *Drip Irrigation, IoT Project Based Learning, Plant Aeration.*

Date of Submission: 14-01-2022 Date of Acceptance: 28-01-2022

I. INTRODUCTION

Plant maintenance sometimes requires a knowledge of the characteristics of the plant, for example there are plants that should not be exposed to direct sunlight but there are also those that need a lot of sunlight, there are plants that need moist air with cold temperatures to grow optimally, Because each plant has different characteristics, with the help of a greenhouse, artificial environmental conditioning can be realized, for example, if we want a humid environment, then by adding artificial mist, we can obtain a humid environment in the greenhouse [1]. Greenhouses, also known as greenhouses, are used in the cultivation of horticultural crops such as vegetables and ornamental plants [10].The use of greenhouses allows modification of the environment that is not suitable for plant growth to be closer to the optimum conditions for plant growth [7].Greenhouse farming is considered as a viable alternative and sustainable solution, which can combat future food crises by controlling the local environment and growing crops all year round, even in harsh outdoor conditions [6]. In the IoT-based plant monitoring system in the greenhouse, using an IoT-based system that is applied to plants. Internet of Things is a concept where internet connection is extended to physical devices used in daily life [5]. Through this monitoring and automation system, it can later be developed more widely for farmers/Farmers Groups so that they can monitor plant growth, regulate treatments in cultivation, especially watering plants, and control the development of crop production whenever and wherever it is located.

II. RESEARCH METHODS

The monitoring system of sensor data, pump control, lights and fans in the greenhouse is only carried out on the software subsystem (software). The software subsystem (software) discusses how to create a program so that all elements of the system can communicate. The following is a block diagram design of the monitoring application for sensor data, cameras, pump controls, lights and fans in the greenhouse.

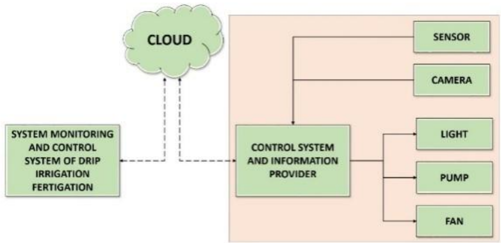

Figure 1: Design of Monitoring System and Control Systemmonitoring and control

On the block diagram of a crop irrigationsystem using the Internet of Things. In the diagram, it consists of 3 main blocks, namely the monitoring and control system of irrigation on the web, Cloud service (LoRaWAN) and the Control System and Information Provider using the Arduino and Raspberry Pi. The system on the web serves to read and send data to the cloud service. Cloud service serves to receive and store data as well as being a liaison between monitoring and controlling applications for hydroponic systems with control systems and information providers. The control system and information provider function to send sensor and camera data and read data on Cloud service for commands on pump, lights and fan.

III. IMPLEMENTATION OF IoT-BASED PLANT MONITORING SYSTEM AT GREENHOUSE

3.1. Monitoring System Implementation at Greenhouse

Figure 2: Installation in Greenhouse

Figure 2 is a physical form of a monitoring system prototype in a greenhouse consisting of Arduino Mega as a sensor data processor, Raspberry Pi 4 as a web camera control, DHT22 as a temperature and humidity sensor, soil moisture as a growing media humidity sensor, LDR as a light sensor, pump as drip irrigation for plants, fan as room temperature regulator, lamp as room light regulator, relay as a control to turn on the pump if the soil on the plant is dry, fan if the temperature is more than the maximum limit that has been determined and lights if the light intensity in the room decreases.

3.1.1. Monitoring System Implementation at Greenhouse

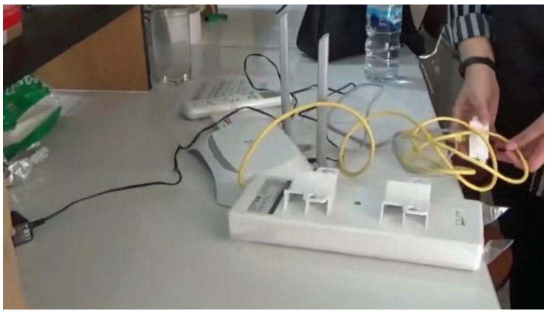

Figure 3: Installation on Operation Center System

The components used in the Operation Center System are components for data transmission. The Operation Center System can do remote monitoring without having to monitor plants in the greenhouse directly. The data that can be seen include sensor data for planting media humidity, air humidity, air temperature and light intensity.

3.2. TRIAL

The sensor used to get the value of air temperature and humidity using the DHT22 sensor, the humidity of the growing media with the Soil Moisture sensor and the light intensity using the LDR sensor. The value obtained on the sensor is shown through a serial monitor which will be sent to the web for display. It shown in Figure 4.

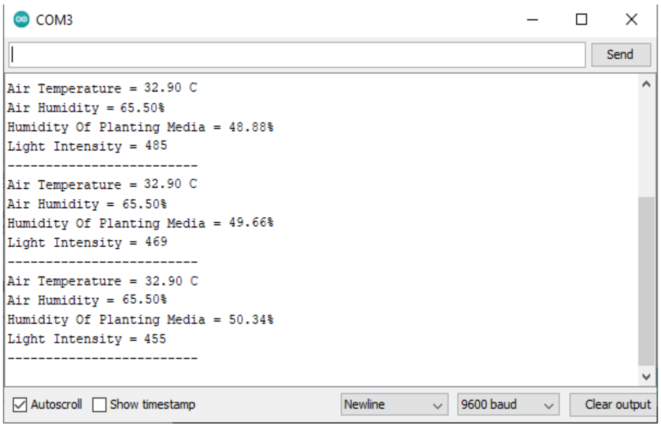

Figure 4: Serial Monitor Display

Showing the camera system, the camera view is clearly visible and can broadcast live conditions in the Greenhouse on a web. It shown in Figure 5.

Figure 5: Camera View

IV. RESULTS AND DISCUSSION

Based on the results of the research that has been done, the Design of IOT-Based Plant Monitoring System in the Greenhouse has been implemented and is ready to be developed. The results that have been obtained are data on the value of light intensity, room temperature, temperature and humidity of planting media and live camera broadcasts at the Greenhouse.

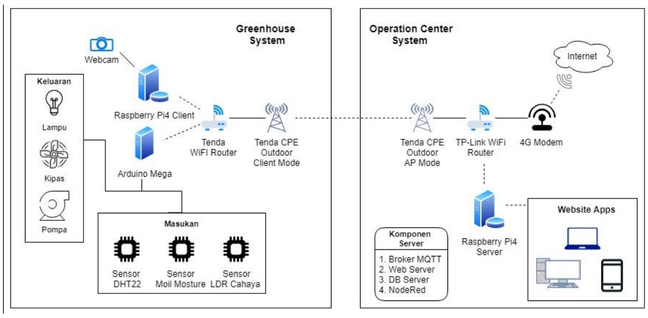

Figure 6: Greenhouse System and Operation Center System

Based on Figure 6, the design has two places to monitor the Operation Center System and collect data from the sensors used in the Greenhouse System. The greenhouse system has several sensors to get the value of light intensity, room temperature, and humidity of the planting media and a camera which later will affect the output of the actuator which will be sent to the Operation Center System.The design we made uses 2 routers and 2 CPEs for data communication, using a Raspberry Pi 4 microcontroller and Arduino Mega and the sensors used are DHT 22, planting media humidity, LDR and Web camera.

The DHT22 is a digital relative humidity and temperature sensor. The DHT22 sensor uses a capacitor and thermistor to measure the air around it and outputs a signal to the data pin. DHT22 is claimed to have good reading quality, judging by the fast response of the data acquisition process and its minimalist size, as well as its relatively low price when compared to a thermohygrometer [6]. The outputs of our design are lights, fan and pump.

Table 1: Sensor Data

Number of Trial	Air Temp. (˚C)	Air Humidity(%)	Humidity Of PlantingMedia(%)	Light Intensity
1	32,30	66,00	42,13	479
2	32,30	66,90	42,62	478
3	32,30	66,60	42,52	478
4	32,80	63,80	42,13	445
5	32,70	63,60	42,03	450
6	32,80	63,60	42,03	450
7	33,00	62,90	14,66	434
8	32,90	63,00	14,37	431
9	32,90	36,20	14,47	437
10	33,10	60,90	14,27	405

Based on table 1, testing using these sensors can take an output according to the desired needs. In carrying out 10 experiments, experiments 1 to 6 obtained a stable value, while experiments 7 to 10 obtained a lower percentage of growing media humidity. The value obtained by the sensor will later affect the automation system for lights, fans and pumps to be turned off or on later.

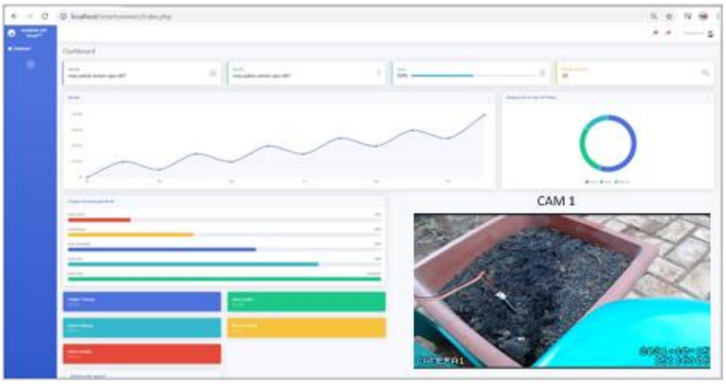

Figure 5: Website Design

The website can display the value data obtained through graphs and live camera broadcasts to see the conditions that occur in the Greenhouse in real time.

V. CONCLUSIONS AND FURTHER RESEARCH

The design of an IoT-based plant monitoring system at the Greenhouse will get results in the form of light intensity, room temperature, temperature and humidity of the growing media and live camera broadcasts at the Greenhouse using various sensors such as DHT22 sensors and humidity sensors. This design has a place to monitor the Operation Center System which later when implemented, plants can be monitored without having to come to the Greenhouse but only through the Operation Center System.

For further research, it will be realized at the Greenhouse by running an automation system on lights, fans and pumps and displaying the conditions that occur in the Greenhouse through the website to display graphic data obtained by each sensor and camera view.

VI. SUGGESTION

Based on the system we created, our system can only be controlled automatically and cannot be controlled manually from the website. If the sensor cannot work properly, the output can be controlled accordingly. So we recommend adding a control system manually. On the website, we still use the local network by accessing the IP that has been created. It would be better if the website uses an official/paid domain to make it easier for users to access the website to monitor the system in the greenhouse.

REFERENCES

[1]. A. Emmalia, D. Joseph, "ImplementasiIot Pada Remote Monitoring Dan Controlling Greenhouse", MNEMONIC, Vol. 1, No. 1, Februari 2018.

[2]. A. Sumarudin, W. Putra, E. Ismantohadi, S. Supardi, and M. Qomarrudin, "Sistem Monitoring TanamanHortikulturaPertanian Di KabupatenIndramayuBerbasis Internet Of Things", JATI, vol. 9, no. 1, pp. 45-54, Mar. 2019.

[3]. A Wahyu, P. Muttaqin A. and Syauqy D, "Sistem Monitoring Suhu, Kelembaban, dan PengendaliPenyiramanTanamanHidroponikmenggunakan Blynk Android", PTIIK, Vol. 1, No. 4, April2017, hlm. 292-297.

[4]. A. Yogha, Ad. A. Wahyu K, "Implementasi Wireless Sensor Network untukOtomatisasiSuhu Ruang dan KelembabanTanah pada Greenhouse Berbasis Web Server", JOIN, Volume 3 No. 1 | Juni2018 : 14-21.

[5]. Admin. 2020. Mengenal IoT (Internet of Things). https://el.iti.ac.id/mengenal-iot-internet-of-things/. Access: November 21th 2021.

[6]. G. Anuradha, G. Aman, K. Harish, M. Karan, "Monitoring of Smart Greenhouse", IRJET, Volume: 03 Issue: 11 | Nov -2016.

[7]. H. Suhardiyanto, "TeknologiRumahTanamanuntukIklimTropikaBasah", Bogor: IPB Press, 2009.

[8]. L. Abdulrazzak, I.A. Bierk, H. Aday, "Humidity and temperature monitoring", Int. J. Eng. Technol., vol. 7, no. 4, pp. 5174- 5177, 2018.

[9]. Syafruddin, "ImplementasiMetodeDiskusiTerhadapPeningkatan Hasil BelajarSiswa", Ilmiah Pendidikan Teknik Elektro, Vol.1, No.1, Februari 2017, hal. 63-73.

[10]. T. Edi, "Review :PemanfaatanTeknologi Greenhouse DanHidroponikSebagai Solusi MenghadapiPerubahanIklimDalamBudidayaTanamanHortikultura", BuanaSainsVol 19 No 1: 91 - 102, 2019.

Alfie Syahri. "Implementation of Plant Monitoring System in Greenhouse Based on IoT." *International Journal of Engineering and Science*, vol. 12, no. 1, 2022, pp. 43-47.