JIKO (Jurnal Informatika dan Komputter) Accredited KEMENDIKBUD RISTEK, No.105/E/KPT/2022
Vol. 6, No. 3, December 2023, pp. 221-226 p-ISSN: 2614-8897
DOI: 10.33387/jiko.v6i3.7143 e-ISSN: 2656-1948

APPLICATION OF IOT IN MOBILE-BASED SHALLOT WATERING AND LIGHTING MONITORING SYSTEM

Vera Febriyani[*1], Adityo P Wibowo[2]

[1]Informatika, Universitas Teknologi Yogyakarta
[2]Sistem Informasi, Universitas Teknologi Yogyakarta
[*]Email: [1]verafebriyani32@gmail.com, [2]adityopw@uty.ac.id

(Received: 12 December 2023, Revised: 18 December 2023, Accepted: 21 December 2023)

Abstract

Shallots are one of the short-lived horticultural commodities that have high commercial value and high risk. In the management of shallot cultivation, pest attacks often occur on the leaves, besides that problems also often arise in watering shallots, even though this plant needs sufficient water from the beginning of growth to harvest. The use of IoT as an idea for making tools for automatic plant watering and lighting using the IoT prototype method in this study can help shallot farmers in their work by measuring soil moisture and light entities. This IoT prototype has been adjusted to the level of soil moisture needed by shallot plants, above 100 for dry soil conditions and below 90 for wet soil conditions, the light entity is also adjusted at 18.00 to turn on the lights and at 06.00 to turn off the lights. Measurements from both sensors will be stored in the database, and then displayed on the application in the form of real-time information on humidity and light entities. The test was declared successful because the application can display information obtained from sensor measurements stored in the database. It is hoped that this tool can help ease the work of shallot farmers.

Keywords: *IoT, Monitoring, Lighting, Sprinkling, Sensors*

**Corresponding Author: Vera Febriyani*

1. INTRODUCTION

Shallots are a short-lived horticultural commodity with high commercial value and high risk. This leading agricultural commodity contributes relatively highly to economic development in the region. Therefore, integrated protection against environmentally friendly pests and diseases as well as fertilizer management must be highly considered to be timely and in the right amount. Shallots also have shallow root systems and are sensitive to moisture loss from the soil, so effective watering or supplementary watering should be arranged to maintain moisture.

In onion cultivation, many problems are encountered, including onion caterpillar pests (Spodoptera exigua), this pest attack can result in a decrease in onion production or loss of yield which is not small[1]. In addition, when watering shallots, farmers must understand that shallot plants grow to form bulbs in the soil, excess water can cause the bulbs to rot. On the other hand, these plants require sufficient water from the beginning of growth until just before harvest.

Internet of Things, or often referred to as IoT[2], is the idea that all real-world objects can communicate with each other as part of an integrated system that uses the internet network as a link[3]. Therefore, in this research, an application will be made by implementing the Internet of Things[4] prototype as an automatic irrigation system for shallot plants. The existence of this application can help monitor plants remotely, so it is expected to be able to turn on the lights[5] and water the shallot plants automatically using only the application[6].

Referring to previous research, a system has been made to control water levels and lighting in IoT-based plants, which can be monitored through the user's website[7][8]. However, in previous research the website could not display monitoring of plant lighting[9]. The difference with the research that will be made is how to develop an automatic watering and lighting system based on mobile android[10], where this application will be more easily accessed and used to monitor whether the tool works according to the instructions made in the program, in this study also monitoring plant lighting can be displayed on the application. So that monitoring becomes more efficient and can be done remotely in realtime through applications contained in the user's smartphone.

Based on the explanation above, the author took the initiative to develop a mobile-based automatic watering and lighting system using an IoT prototype[11], to monitor whether the tool works according to the instructions made in the program so that it is expected to help ease the user's work in watering and lighting shallot plants so that monitoring can actually be done remotely through the use of applications.

2. RESEARCH METHOD

This section contains an explanation of the research stages used, which are presented in Figure 1 below.

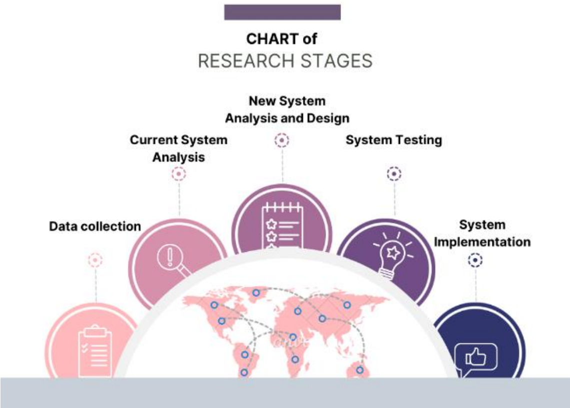


Figure 1. Research Stage

2.1 Data Collection

Data is obtained by direct observation on agricultural land to get a real picture of what data is needed. As well as conducting face-to-face interviews with one of the farmers or landowners to obtain the information and data needed in the system design. Then data is also collected from literature related to various research topics, such as journals, e-books, research reports, and supporting theories of research, tools used, and other supporting data.

So based on the data that has been collected, this application will later be used by farmers, which is expected to be useful for monitoring shallot farmland.

2.2 Current System Analysis

System analysis[12] is a description of a system currently used on shallot farms, which is being studied in the watering and lighting of agricultural land, the system used is still simple, namely by using manual watering tools and turning on the light switch manually as well. The purpose of this system analysis is to create a new computerized system to increase effectiveness and efficiency.

The ongoing system analysis of this system aims to understand more deeply how the system operates and identify the problems faced[13]. The goal is to develop a computerized system[14]. System analysis is carried out based on the sequence of events, and from that sequence, a flowchart is made[15] which can be seen in Figure 2.

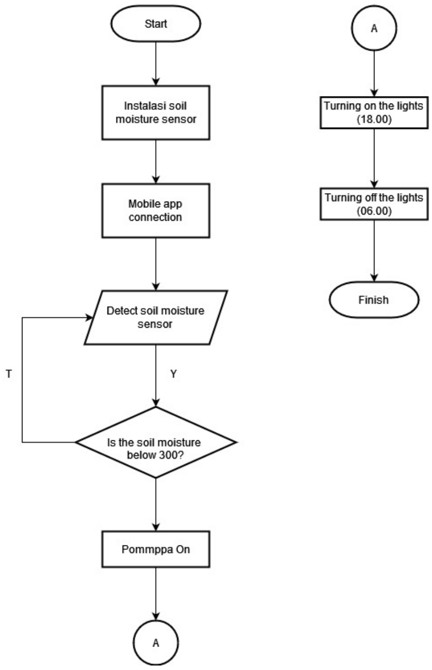


Figure 2. System Flowchart

2.3 New System Analysis and Design

The analysis of the proposed system consists of functional requirements which refer to the processes performed by the system as well as the facilities required, including input requirements, process requirements, and output requirements. There are also non-functional requirements this type of requirement includes action properties that the system must have or elements required by the system to operate, including software requirements and hardware requirements.

The system design is made with a system architecture that can be seen in Figure 3.

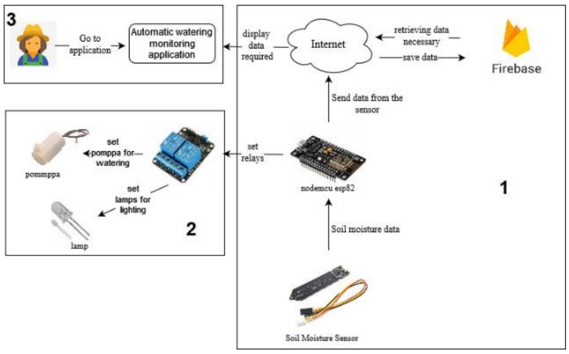


Figure 3. System Architecture

Figure 3 shows the system architecture divided into 3 parts as follows:

1) In the first stage the sensor will identify to provide input data to the nodemcu, such as the soil moisture sensor will detect soil moisture. The output of the sensor will be inputted to the nodemcu esp8266 which will be forwarded to the

internet to be stored in the database, then from the database will be forwarded to the internet again to be displayed on the user application.

2) In the second stage the relay will take sensor data from nodemcu, which will be processed to open the pump if the soil moisture sensor detects a moisture value above 100 (dry) then the pump will open, and if the sensor detects a soil moisture value below 90 then the pump will close. The relay also manages to turn the lights on and off.
3) And in the last or third stage, the output data will be displayed on the user's mobile application, so that they can monitor the plants through the application

2.4 System Testing

This system test is to determine whether the system that has been made is functioning properly or not, making a prototype of automatic watering and lighting to eliminate pests on iot-based leeks, using the Nodemcu ESP8266 microcontroller as a control and data management tool. This prototype of monitoring leek plants is made in acrylic using soil moisture sensors, mini pumps, sprinklers, relays, batteries, LED lights, and applications for monitoring the resulting data.

2.5 System Implementation

The application of the watering and lighting monitoring system for shallot plants was developed using web view assistance (MIT App Inventor), with the Arduino uno IDE and with the Firebase database application stored on a web server. Furthermore, conducting an evaluation process of the system whether it is in accordance with what the user expects evaluating the output or results of the system, and testing the input, management (process), and output of the system.

3. RESULT AND DISCUSSION

3.1 Results

The resulting product is an application of the system analysis and design described in the previous chapter. The product of this research is a monitoring application for shallot plants, by implementing an iot prototype as a monitoring tool in real-time and based on Android. The process of making this application uses web view (MIT App Inventor) for the application and Arduino ide for the program. The application display will be explained starting from the front page, soil moisture monitoring page, and light monitoring page.

3.1.1 Hardware Implementation

The implementation of hardware or IoT can be seen in Figure 4. At this stage there is a series of components that will be used as tools for monitoring, such as soil moisture sensors that will read soil moisture, to be displayed on the mobile page. There is relay 1 to adjust the water pump for automatic watering and relay 2 to turn on and off the lights

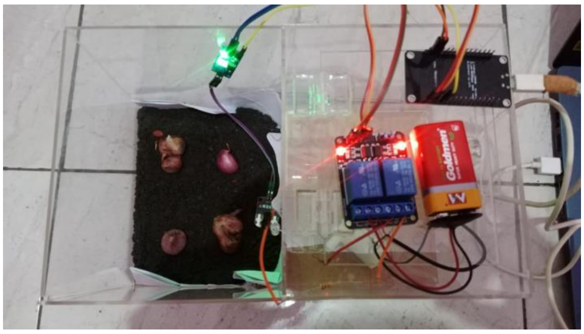


Figure 4. Hardware Implementation

3.1.2 Application Implementation

3.1.2.1 Front Page Implementation

The Front Page implementation can be seen in Figure 5, which was created using Web view (MIT App Inventor). In this front view contains the application logo, the humidity monitoring button to enter the humidity monitoring page, and there is a light button to enter the light monitoring page.

Figure 5. Front Page Implementation

3.1.2.2 Implementation of Humidity Monitoring Page

The implementation of the humidity monitoring page can be seen in Figure 6. Created using a web view, this page contains a display of the humidity value obtained from the humidity sensor. There is also an exit button to exit the application.

Figure 6. Humidity Monitoring Page

3.1.2.3 Implementation of Lamp Monitoring Page

Made using the same web view, this page contains a button that can turn on the lights where the button turns yellow and can also turn off the lights with a button that will turn gray.

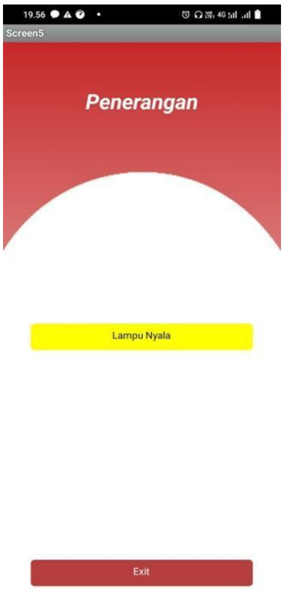
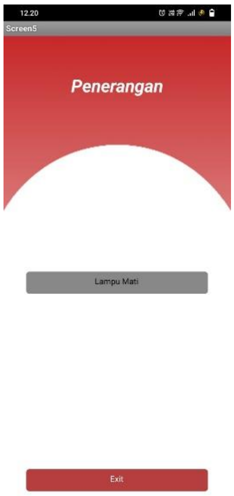


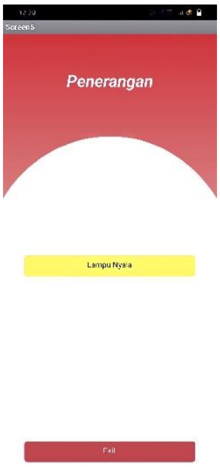
Figure 7. Lamp Monitoring Page

3.1.2.4 Display on Smartphone

The following application display on smartphones can be seen in Table 1.

Table 1. Smartphone Display

No.	***View***	***Description***
1.		Front View
2.		Humidity Monitoring Display
3.		Lamp Monitoring Display (Lights Off)
4.		Lamp Monitoring Display (Lights On)



3.2 Discussion of Results and System Testing

The product of this research is a monitoring application for shallot plants, by implementing an iot prototype as a monitoring tool in real-time and based on Android. The process of making this application uses MIT App Inventor web view for the application and Arduino idea for the program.

After the system design implementation stage, application testing is then carried out. The testing stage is used to find out whether the software is functioning properly, has no errors and whether it is as expected or not.

1) In the test results of the soil moisture sensor for automatic watering show, if the soil moisture value> 100 means the soil condition is dry then, the pump will turn on. Conversely, if the humidity value < 90 means the soil condition is wet, the pump will turn off. This means that the soil moisture sensor can work well.
2) Relay Testing Results to regulate pumps and lights, relays can make pumps turn on or off automatically, and turn on or off lights manually.

Testing is also done with the black box testing method, in the form of testing the application button whether the functionality is as expected or not. Black box testing can be seen in Table 2.

Table 2. Testing Result

No.	***Testing activity***	***Expected realization***	***Testing Results***	***Conclusion***
1.	Humidity Monitoring Button	Can display the Humidity Monitoring page	Display the Humidity Monitoring page	[x] Accepted [ ] Rejected
2.	Light Monitoring Button	Can display the Lamp Monitoring page	Display the Lamp Monitoring page	[x] Accepted [ ] Rejected
3.	Light Button	Can turn lights off and on	Displays on/off light indication	[x] Accepted [ ] Rejected
4.	Exit button	Can return to the main page	Display the main page	[x] Accepted [ ] Rejected
5.	*Soil Moisture Sensor*	Can detect soil moisture	Displays the humidity condition of the soil	[x] Accepted [ ] Rejected
6.	*Relay*	Can manage pumps and lights	Turning pumps and lights off or on	[x] Accepted [ ] Rejected

4. CONCLUSION

Based on the discussion described above, conclusions can be drawn regarding the results of testing and in research on the application of iot in a mobile-based shallot watering and lighting monitoring system, namely soil moisture conditions can be displayed through a mobile application. The ESP8266 Module must be placed in an area or location that gets a wifi network so that it can send sensor data properly. Users can also turn off and turn on the lights via a smartphone. Therefore, this application allows users to monitor plants through smartphones, and of course monitoring can be done more effectively and efficiently.

This research still has weaknesses due to the limitations of the author. These weaknesses can be described by the author including, on lights that are still turned on and off manually. Then there are still not many features, such as features for monitoring water levels.

5. REFERENCE

[1] A. F. Rahmawati, S. Ikawati, and T. Himawan, “Evaluasi Berbagai Insektisida Terhadap Hama Ulat Bawang (Spodoptera exigua Hubner) (Lepidoptera: Noctuidae) Pada Tanaman Bawang Merah,” *J. HPT*, vol. 4, no. 2, pp. 54–60, 2016.

[2] A. Selay *et al.*, “Karimah Tauhid, Volume 1 Nomor 6 (2022), e-ISSN 2963-590X,” *Karimah Tauhid*, vol. 1, no. 2963–590X, pp. 861–862, 2022.

[3] Y. Efendi, “Internet Of Things (Iot) Sistem Pengendalian Lampu Menggunakan Raspberry Pi Berbasis Mobile,” *J. Ilm. Ilmu Komput.*, vol. 4, no. 1, pp. 19–26, 2018, doi: 10.35329/jiik.v4i1.48.

[4] F. Susanto, N. K. Prasiani, and P. Darmawan, “Implementasi Internet of Things Dalam Kehidupan Sehari-Hari,” *J. Imagine*, vol. 2, no. 1, pp. 35–40, 2022, doi: 10.35886/imagine.v2i1.329.

[5] A. Z. Purwalaksana, “Sistem Monitoring Ketinggian Air dan Otomasi Penghidupan Lampu pada Budidaya Hidroponik Berbasis IoT,” *J. Ilm. Maksitek*, vol. 5, no. 2, pp. 169–176, 2020.

[6] Nur Azis, Muhammad Syarif Hartawan, and SyifaNur Amelia, “Rancang Bangun Otomatisasi Penyiraman dan Monitoring Tanaman Kangkung

Berbasis Android," *J. IKRA-ITH Inform.*, vol. 4, no. 3, pp. 95–102, 2020.

[7] Zakaria, "Sistem Kontrol Ketinggian Air Pada Sawah Bawang Merah Berbasis Iot," *Front. Neurosci.*, vol. 14, no. 1, pp. 1–13, 2021.

[8] D. Ramdani, F. Mukti Wibowo, and Y. Adi Setyoko, "Journal of Informatics, Information System, Software Engineering and Applications Rancang Bangun Sistem Otomatisasi Suhu Dan Monitoring pH Air Aquascape Berbasis IoT (Internet Of Thing) Menggunakan Nodemcu Esp8266 Pada Aplikasi Telegram," *J. Informatics, Inf. Syst. Softw. Eng. Appl.*, vol. 3, no. 1, pp. 59–068, 2020, doi: 10.20895/INISTA.V2I2.

[9] Shofiyun, "Sistem Irigasi Otomatis Pada Sawah Bawang Merah Berbasis Iot (Internet Of Things) Tugas," no. March, pp. 1–19, 2021.

[10] M. A. J. Hidayat and A. Z. Amrullah, "Sistem Kontrol Dan Monitoring Tanaman Hidroponik Berbasis Internet Of Things (Iot) Menggunakan Nodemcu ESP32," *J. SAINTEKOM*, vol. 12, no. 1, pp. 23–32, 2022, doi: 10.33020/saintekom.v12i1.223.

[11] D. Daryanti, "Prototype Sistem Monitoring Pengairan Pertanian Bawang Merah Dan Pencahayaan Otomatis Dari Hama Daun Bawang Berbasis Internet Of Things," *Front. Neurosci.*, vol. 14, no. 1, pp. 1–13, 2021.

[12] F. J. Kaunang, "Analisis dan Perancangan Sistem Informasi Fasilitas Sekolah," *e-Jurnal JUSITI (Jurnal Sist. Inf. dan Teknol. Informasi)*, vol. 7–2, no. 2, pp. 124–130, 2018, doi: 10.36774/jusiti.v7i2.247.

[13] Malabay, "Pemanfaatan Flowchart Untuk Kebutuhan Deskripsi Proses Bisnis," *J. Ilmu Komput.*, vol. 12, no. 1, pp. 21–26, 2016.

[14] A. I. Basri, W. P. Sumiyar, and V. A. Tisya, "Pemanfaatan Flowchart Untuk Memudahkan Dalam Proses Bisnis Kerjasama Daerah Pemerintah Kota Yogyakarta," *ABDIMAS Nusant. J. Pengabdi. Kpd. Masy.*, vol. 3, no. September, pp. 34–37, 2022.

[15] P. Zhang, W. Dou, and H. Liu, "Hierarchical data structures for flowchart," *Sci. Rep.*, vol. 13, no. 1, pp. 1–14, 2023, doi: 10.1038/s41598-023-31968-z.