

Plant Based Watering System Internet of Things Arduino and Monitoring with Telegram

Rico Amanda^{1)*},

¹⁾Buddhi Dharma University

Jl. Imam Bonjol No.41, RT.002/RW.003, Karawaci, Kec. Karawaci, Tangerang, Indonesia

¹⁾ricoamanda130398@gmail.com

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Abstract

Watering plants is very important if plants are to grow healthy and fertile. Many plant owners do not water their plants because they are busy at work and busy activities outside the home. Watering plants in the form of a system that can work automatically is an integrated design that can help human work. The aim of this research is the application of the Internet of Things and Telegram in watering plants, as well as creating an application for monitoring plant growth and care using the Telegram application. The method used in this research is the internet of things. Internet of Things is a concept where certain objects have the ability to transfer data via a WiFi network, so this process does not require human-to-human or human-to-computer interaction. Everything is run automatically with the program. The Internet of Things is usually called IoT and this technology has developed rapidly starting from wireless technology, micro-electromechanical systems (MEMS) and the internet. The results of this research are that by using an automatic plant watering system based on the internet of things, plants can remain well maintained and the development of the plants can also be monitored via telegram. The results of the questionnaire respondents' answers were on average above 50% in choosing the answer "Strongly Agree". These results show that this application is easy to use and meets user needs.

I. INTRODUCTION

The technological era is developing rapidly along with the need for problems which arise. These various problems that arise can be overcome with technology, both in the fields of education, agriculture, medicine and others, the role cannot be separated technology, the technology that is most needed today is the internet. Indonesia is a tropical country that has abundant natural wealth. Riches These include natural wealth in the form of fertile land. This matter causing many types of plants that are very suitable to grow in Indonesia. Plants have enormous benefits for life, including includes aesthetic functions and, plant food sources, as well as being used for medicine. Ornamental plants are one type of plant that grows abundantly in Indonesia. The increasing interest in ornamental plants creates a problem namely enthusiasts who are still beginners or are new to caring for ornamental plants really understand the care, including the watering process. In the process watering, there are still people interested in ornamental plants in the community Many people water irregularly due to busyness, ignorance or other reasons. This causes ornamental plants they like not getting enough water and wilt easily. On the other hand, currently it is a system with very complex planning It is very necessary to make it easier for humans to carry out an activity. Moreover, if the system created is driven by certain controls integrated, this is what has an impact on humans so they can design and create a form of control that is expected to be used efficiently. This also includes plantations, which include processes sprinkling. Watering plants is very important if the plants are to grow healthy and fertile. Many plant owners do not water their plants due to busyness at work and busy activities outside House. Watering plants in the form of a system that can work automatically is an integrated design that can help the work man. One thing you can do is to use the internet things. Internet of Things is a concept where certain objects have the ability to transfer data over a wifi network, so this process is not requires human-to-human or human-to-computer interaction. All has been run automatically by the program. Internet of Things is commonly called with IoT. And

* Corresponding author

this technology has developed rapidly starting from wireless technology, micro-electromechanical systems (MEMS) and the internet. Based on the problems above, a system is needed to watering plants automatically using the Internet of Things concept by monitoring the Telegram application. Telegram or what is often called TG is a cloud-based multi-platform instant messaging service application. Through Telegram, users can send messages, photos, videos, audio and types other files are encrypted end to end thus, the message sent completely safely from third parties, even from Telegram. Telegram makes it easy for users to access one Telegram account from different devices simultaneously. And can share the number of files unlimited up to 15GB. In this research, data collection will be used by conducting document studies and field research. Based on the background that has been explained, it will be proposed "Automatic Plant Watering System Based on the Internet of Things and Arduino and Monitoring with Telegram".

II. RELATED WORKS/LITERATURE REVIEW

Journal "Design of an Automatic Plant Waterer Based on the Internet of Things Using NodeMCU and Telegram". The aim of this research is to create an automatic plant watering tool based on the Internet of Things using NodeMCU and Telegram. an Internet of Things-based automatic plant watering system using NodeMCU as a link to the Telegram application. Then a test was carried out on the Aglaonema sp plant, the Soil moisture sensor ran well then sent a command to the NodeMCU to send a command to the Mosfet then run the water pump. Soil moisture testing is completed by inserting the sensor that has been associated and modified in the NodeMCU in the pot. When the soil humidity is below 55%, the NodeMCU will act to provide a request to the Mosfet to turn on the pump. By utilizing NodeMCU you can communicate data related to watering time. Then, at that time, in order for notifications to be sent on the Telegram application, the equipment, especially the NodeMCU must be connected to the internet.

Journal "Plant Watering Techniques Using Microcontrollers Based on the Internet of Things". The aim of this design is to hope that this tool can make it easier to care for plants in areas where sensors that detect soil moisture levels have been planted. The results obtained from this research are in the form of a tool that has been designed from several required components and the results of tests that have been carried out as described in this discussion. When the water level increases and the sensor detects water, the connected Telegram application can detect the moisture level of the soil area that has been tested. The pump will water if the soil moisture is $< 65\%$ or below and the pump will turn off if the soil humidity is $> 66\%$ and above. This automatic mode depends on the condition of the soil, if the soil is dry then the pump will water by itself without having to be controlled like manual mode, conversely if the soil is damp or wet then the pump will not water. This plant watering tool using a micro controller based on the internet of things was created to make human work easier in watering plants using a soil moisture sensor which is then processed by nodeMCU and instructed by telegram to display soil moisture values according to dry, damp or wet soil conditions. according to the readings from the soil moisture sensor in the form of values on the telegram. Based on the results of testing 100 times from manual experiments and instructions to Telegram, the test success rate was 100%. Meanwhile, the experimental results of automatic watering of plants obtained a success rate of up to 100% and were appropriate. This tool can be further developed to become a smart garden where it can control temperature, humidity, pn (acidity) and weather, so that plant growth is stable with satisfactory results. This internet of things-based plant watering tool can also be used on a large scale.

III. METHODS

A. Internet of Things

One of the boundaries of mechanical advancement in the ongoing time and furthermore the period what's in store is dominance in the field of parts. Web. of Things is an idea that specific items can move information over a wifi organization, so this cycle doesn't expect human-to-human or human-to-PC connection. Everything is done run consequently by the program. Web of Things is regularly called with a ton. Also, this innovation has grown quickly beginning from innovation remote, miniature electromechanical frameworks (MEMS) and the web.

B. Monitoring

Observing in Indonesian is known as checking. Observing is a movement to guarantee accomplishment all authoritative and the board objectives. On different events, observing likewise characterized as a stage to survey whether an action is carried out as expected, distinguishing issues emerge with the goal that they can be tended to right away, evaluate whether the work design is and the administration utilized is proper to accomplish the targets, knowing the connection among exercises and the point of getting estimations progress. At the end of the day, observing is an inner cycle vital authoritative exercises that can decide its execution whether an association's objectives. The reason for checking is to guarantee that the fundamental undertakings of the association can run appropriately with a foreordained arrangement.

C. Arduino Software

Arduino is an open-source based gadgets stage convenience (simple to utilize) both equipment and programming. All in all, Arduino is an essential framework comprising of equipment and programming that focuses on usability.

D. Telegram

Wire or what is frequently called TG is an application cloud-based multi-stage texting administration. Through Wire, clients can send messages, photographs, recordings, sound and different kinds of documents others are start to finish encoded along these lines, messages that sent totally securely from outsiders, even from Message. Wire makes it simple for clients to get to one Message account from various gadgets all the while. What's more, can share Limitless number of records up to 15GB.

E. Black Box Testing

Black box testing is a sort of testing that treats gadgets programming whose inward presentation is obscure. So the analyzers seeing programming as a "Black Box". It's not vital to see the items, yet realize the testing system outwardly. This sort of testing just ganders at the product from the details and viewpoints needs that have been characterized toward the start of the plan. Concerning model, in the event that there is a piece of programming that is a framework stock data in an organization. So in this kind of white box testing, The product will attempt to destroy the program posting for then tried utilizing the procedures depicted already. In the mean time, in the black box testing type, the product will be executed and afterward attempted to test whether it meets the prerequisites clients are characterized toward the beginning without emptying the posting the program.

IV. RESULTS

The following is the pseudocode Program_automatasi_watering_plants:
{Maintaining soil media in prime condition, namely by maintaining soil moisture by watering it automatically}

Declaration:

```
Pump Relay, Light Relay, Soil Sensor, Water Sensor, LDR = integer
  { declare the pin number used in esp32 }
SSid, Pass, Token = string
  { declare information to connect wifi connection }
Humidity, Water, Dry, Wet = integer
  { declare the wettability percentage target point of the respective function }
ScheduleOn Hours, Morning Hours, Afternoon Hours = integer
  { declare hour description for automation schedule }
  { declare information to connect wifi connection }
```

Description :

1. Read and update time information from the NTP server.
2. Read analog data from soil sensors in the soil and water tank
 - a. Mapping data from each sensor from 0 to 100%.
3. If the current clock is the same as the on-hour schedule and the soil moisture is still below the wet point, then
 - a. Turn on the pump when there is enough water.
 - b. Turn off when the water runs out.
 - c. Or turn it off when the humidity has passed the wet point.
4. If the current clock is between morning and afternoon hours, then
 - a. If the LDR light is dark, then turn on the LED.
 - b. If the LDR light is bright, then turn off the LED.
5. Read messages from Telegram bots
 - a. If the message contains "PUMP ON", then turn on the water pump.
 - b. If the message contains "PUMP OFF", then turn off the water pump.
 - c. If the message contains "LIGHTS ON", then turn on the LED.
 - d. If the message contains "LIGHTS OFF", then turn off the LED.
 - e. If the message content is "SENSOR INFO", then send the sensor data.
 - f. If the content of the incoming message is different from the message above, then send the program list info.
6. When the pump turns on but the water tank runs out, then send the message "WATER IS OUT OF OUT, REFILL IT IMMEDIATELY!" to the saved User ID via the Telegram bot.
7. End

This screen display and menu can be created via the Arduino IDE application. Here's what the program looks like Fig 1:



Fig. 1 Program appearance when starting on Telegram (images obtained from personal documentation)

The following is a display in figure 2 of the interface of the tools in designing an automatic plant watering system based on the internet of things, such as displays of the series of tools used in the design.

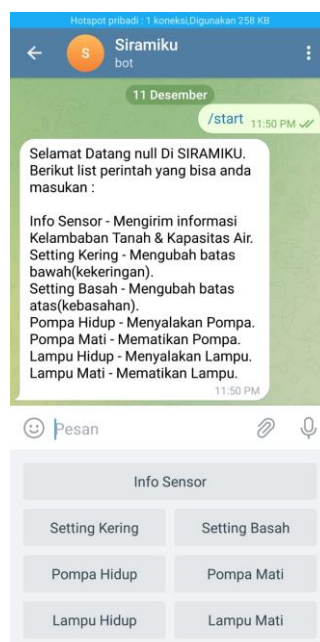


Fig. 2 Program Appearance When Executing Commands in Telegram (images obtained from personal documentation)

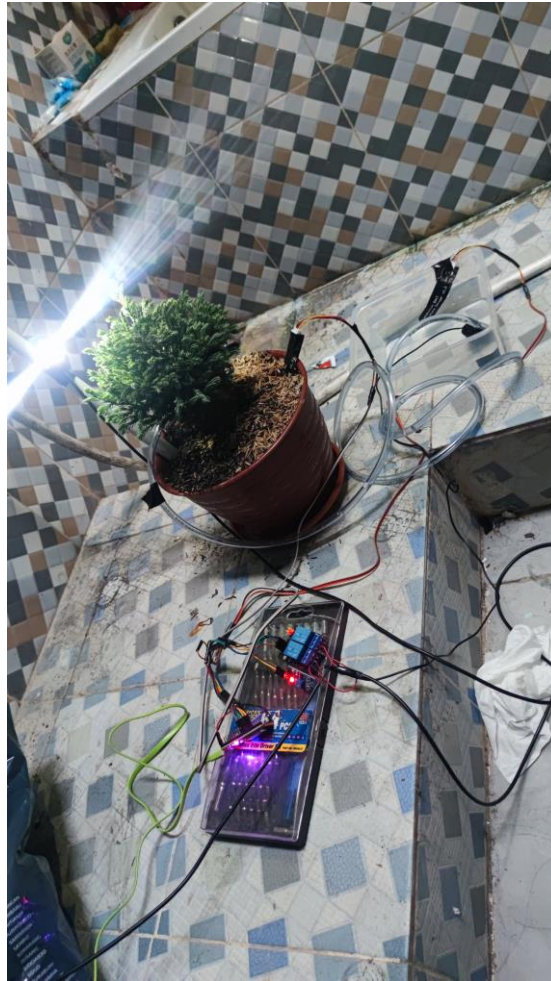


Fig. 3 Display of an Automatic Plant Watering System Tool Based on the Internet of Things (images obtained from personal documentation)

Testing this application uses Black Box Testing. Black Box Testing is carried out to test the success of the series of tools in this design. Following are the test results:

TABLE 1
 BLACK BOX TESTING OF AUTOMATIC PLANT WATERING SYSTEMS BASED ON THE INTERNET OF THINGS (TABLE OBTAINED FROM PERSONAL DOCUMENTATION)

No	Testing	Expected results	Test result	Information
1	Login with correct data	Users can enter the system	In accordance	Valid
2	Login With Incorrect Data	Users cannot log in to the system	It is not in accordance with	Invalid
3	NodeMCU ESP32 Installed Well	The esp32 nodemcu can be connected properly without causing errors	In accordance	Valid
4	NodeMCU ESP32 Not Installed Properly	The esp32 nodemcu cannot connect properly and causes an error	It is not in accordance with	Invalid
5	LDR Sensor Installed Well	The LDR sensor can work well without causing errors	In accordance	Valid
6	LDR Sensor Not Installed Properly	The LDR sensor cannot be connected properly and causes an error	It is not in accordance with	Invalid
7	Relay Installed Well	The relay can be connected properly without causing errors	In accordance	Valid
8	LDR Sensor Not Installed Properly	The relay cannot be connected properly and causes an error	It is not in accordance with	Invalid
9	Capacitive Soil Moisture Sensor Installed Well	The capacitive soil moisture sensor can work well without causing errors	In accordance	Valid
10	Capacitive Soil Moisture Sensor Not Installed Properly	The capacitive soil moisture sensor cannot be connected properly and causes an error	It is not in accordance with	Invalid
11	Lights Installed Well	The lights can work well without causing errors	In accordance	Valid
12	Lights Installed Not Properly	The lights cannot be connected properly and cause an error	It is not in accordance with	Invalid
13	Water Pump Installed Well	The water pump can work well without causing errors	In accordance	Valid
14	Water Pump Not Installed Properly	The water pump cannot be connected properly and causes an error	It is not in accordance with	Invalid
15	Arduino IDE Installed Well	Arduino ide can work well without errors and bugs	In accordance	Valid
16	Arduino IDE Not Installed Properly	The Arduino idea cannot be connected properly and causes an error	It is not in accordance with	Invalid
17	Telegram	Telegram can work well without errors and bugs	In accordance	Valid
18	CTbot Library	Ctbot library can be connected to Arduino Ide and Telegram	In accordance	Valid
19	Dry Setting	The plant watering system can water plants with a dry setting (not wet) with the Telegram application	In accordance	Valid
20	Wet Settings	The plant watering system can water plants with a wet setting (not dry) with the Telegram application	In accordance	Valid
21	Pump On	The plant watering system can turn on the pump with the Telegram application	In accordance	Valid
22	Pump Dead	The plant watering system can turn off the pump with the telegram application	In accordance	Valid
23	Living Lights	The plant watering system can turn on the lights with the Telegram application	In accordance	Valid
24	Lights off	The plant watering system can turn off the lights with the Telegram application	In accordance	Valid

After the respondent answers all the questionnaire questions. So the results were obtained in the form of answers from all respondents. The following is a graph of the results of all respondents' questionnaire answers:

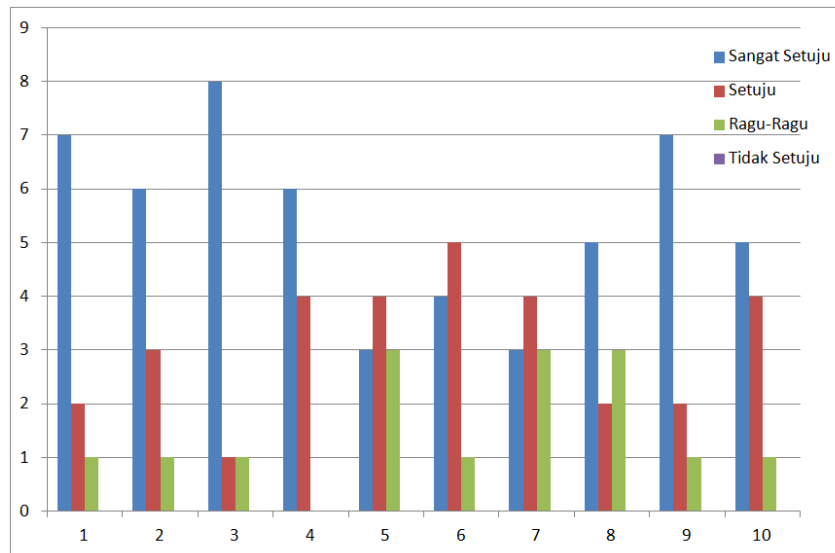


Fig. 4 Graph of Questionnaire Answer Results for All Respondents (images obtained from personal documentation)

TABLE 2
 QUESTIONNAIRE RESULTS FOR ALL RESPONDENTS

Choice	Percentage
Strongly agree	54%
Agree	31%
Doubtful	15%
Don't agree	0%
Total	100%

Based on the picture and table above, it can be concluded that this application is well received. Judging from the results of respondents' answers, the average answer was "Strongly Agree" with a percentage of 54%.

V. DISCUSSION

By using an automatic plant watering system based on the internet of things, plants can be well maintained and plant development can also be monitored via telegram. The results of this research can answer the problems of ornamental plant enthusiasts who are still beginners or are new to keeping ornamental plants and do not really understand their care, including the watering process. In the watering process, it turns out that many ornamental plant enthusiasts in the community still water irregularly due to busyness, ignorance or other reasons. This causes the ornamental plants they love to not get enough water and wilt easily. The comparison of this research with research that has been carried out by other people is that this research uses telegram-based monitoring so that users can control the tool anywhere and at any time. There are also suggestions for better application development, namely creating a system that can be accessed on the website, mobile iOS and desktop PC as well as creating a system that can be downloaded and installed via the Appstore and Playstore.

VI. CONCLUSIONS

Based on the results obtained in writing this thesis, the following conclusions are obtained:

1. Plant Based Watering System Internet of Things Arduino and Monitoring with Telegram which was created to work without any annoying problems or bugs.
2. The results of the questionnaire respondents' answers obtained a percentage of 54% in choosing the answer "Strongly Agree". These results show that this application is easy to use and meets user needs.

REFERENCES

- [1] R. Zhang, "Get Started with ESP32." [Online]. Available: <https://ritazh.com/get-started-with-esp32-785a111476f2/>
- [2] D. E. Nadindra and J. C. Chandra, "Sistem IoT Penyiraman Tanaman Otomatis Berbasis Arduino Dengan Kontrol Telegram," *Sist. Komput. dan Tek. Inform.*, vol. 5, no. 1, pp. 104–114, 2022.
- [3] Y. Bihardu and H. Hutapea, "Rancangan Bangun Sistem Otomatis Tanaman Berbasis Telegram," *Ejournal Kaji. Tek. Elektro*, vol. 5, no. 2, pp. 97–105, 2020.

- [4] D. Risetya, "Apa Itu Power Supply? Pengertian, Cara Kerja, Fungsi, 3 Komponen, dan Jenisnya." [Online]. Available: <https://www.ekrut.com/media/fungsi-power-supply>
- [5] Y. Supardi, *Semua Bisa Menjadi: Programmer Java Basic Programming*. Jakarta: Elex Media Komputindo, 2013.
- [6] Umaritawan and N. Chafid, "Rancang Bangun Alat Penyiraman Tanaman Otomatis Berbasis Arduino Dan Berbasis Web," *Pros. Semin. Nas. Inov. Teknol.*, pp. 208–216, 2021.
- [7] E. Y. Anggraeni and R. Irviani, *Pengantar Sistem Informasi*. Yogyakarta: CV. Andi Offset, 2017.
- [8] I. P. Sari and Z. Indra, *Sistem Monitoring Kebakaran Hutan Berbasis Android*. Ponorogo: Gracias Logis Kreatif, 2021.
- [9] A. Yunan, Safriati, and Hermalinda, "Teknik Penyiraman Tanaman Menggunakan Mikrokontroler Berbasis Internet of Things," *J. Inf. Syst. Res.*, vol. 3, no. 3, p. 331–337, 2022.
- [10] J. Enterprise, *Mengenal Dasar-Dasar Pemrograman Android*. Jakarta: PT Elex Media Komputindo, 2015.
- [11] F. Kevin, "Penyiraman Tanaman Merupakan Hal Penting, Ini Cara Menyiram yang Baik Agar Tanaman Tumbuh Subur." [Online]. Available: <https://kids.grid.id/read/472665588/penyiraman-tanaman-merupakan-hal-penting-ini-cara-menyiram-yang-baik-agar-tanaman-tumbuh-subur?page=all>
- [12] M. Mahardika, A. Sudiarso, and G. S. Prihandana, *Perancangan Dan Manufaktur Pompa Sentrifugal*. Yogyakarta: Gadjah Mada University Press, 2019.
- [13] M. Setiyo, *Listrik & Elektronika Dasar Otomotif (Basic Automotive Electricity & Electronics)*. Magelang: Unimma Press, 2017.
- [14] S. Prasetyo and S. Abdullah, "Rancang Bangun Penyiram Tanaman Otomatis Berbasis Internet of Things Menggunakan NodeMCU dan Telegram Rancang Bangun Penyiram Tanaman Otomatis Berbasis Internet of Things Menggunakan NodeMCU dan Telegram," *J. Restikom Ris. Tek. Inform. dan Komput.*, vol. 3, no. 2, pp. 51–59, 2021.
- [15] M. Nur, *Situs situs pengunduh video Youtube dan Mp3 Terbaik*. Jakarta: MiftaChun, 2019.
- [16] R. S. Wicaksono, *Rekayasa Perangkat Lunak*. Malang: Seribu Bintang, 2017.
- [17] Y. Yudhanto and A. Azis, *Pengantar Teknologi Internet Of Things (IoT)*. Surakarta: UNS Press, 2019.
- [18] J. Hutahaean, *Konsep Sistem Informasi*. Yogyakarta: Deepublish, 2015.
- [19] R. A. Purba et al., *Model Dan Aplikasi Pembelajaran: Inovasi Pembelajaran Di Situasi Tidak Normal Yayasan Kita Menulis*. Medan: Yayasan Kita Menulis, 2022.
- [20] Z. Ahyadi, *Belajar Antarmuka Arduino Secara Cepat Dari Contoh*. Yogyakarta: Deepublish, 2018.
- [21] J. D. Peter, S. L. Fernandes, and A. H. A. Editors, *Disruptive Technologies for Big Data and Cloud Applications*. Singapore: Springer, 2021.
- [22] Rusman, *Belajar & Pembelajaran: Berorientasi Standar Proses Pendidikan*. Jakarta: Prenada Media, 2017.
- [23] S. F. Pane, M. Zamzam, and M. D. Fadillah, *Membangun Aplikasi Peminjaman Jurnal Menggunakan Aplikasi Oracle Apex Online*. Bandung: Kreatif Industri Nusantara, 2020.
- [24] A. A. Sendari, "Fungsi Transformator Step Down, Pahami Cara Kerjanya." [Online]. Available: <https://hot.liputan6.com/read/4207016/fungsi-transformator-step-down-pahami-cara-kerjanya>
- [25] Anhar, *Panduan Bijak Belajar Internet untuk Anak*. Yogyakarta: Adamssein Media, 2016.