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# Designing Automatic Sprinklers and Web-Based Plant Monitoring Using a Microcontroller

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ABSTRACT

Utilization of industrial development 4.0 and IoT in the agricultural sector is still very minimal even though with the use of IoT technology and industrial development 4.0. in the agricultural sector can increase agricultural productivity. Efficiency in terms of watering plants manually is still lacking. The solution to this problem is to take advantage of technological developments, namely presenting a new innovation in watering plants by designing plant watering tools and monitoring using a web-based arduino Mega 2560 Rev3 microcontroller. The sensors to be used are: YL-69, DHT11 and HY-SRF-05 as the water tank volume sensor from the device, and using the ESP-01 as a WiFi module. If one of the earthen boxes is dry, the tool will water the dry soil box. This tool will also display the sensor data to the LCD screen, then send the sensor data to the database and the monitoring results will be presented in web form. The tool that has been designed can be used as a tool for watering plants for farmers and the general public as well as for up-to-date monitoring of plants.



## 1. Introduction

Microcontroller is an electronic device in the form of an IC (Integrated Circuit) which has the ability to manipulate data (information) based on a sequence of instructions (programs) that have been made. Arduino is a microcontroller that is popularly used today. Microcontroller is the brain of the automation system.

PeThe use of industrial development 4.0 and IoT in the agricultural sector in Indonesia, especially in the city of Pematangsiantar, is still very minimal due to the lack of public knowledge, especially farmers about the industrial revolution 4.0 and IoT. Utilizing IoT technology, the agricultural sector in Indonesia can experiment with new business models and innovations such as precision agriculture, vertical agriculture, smart farming, sensors and drones, analytical tools, agricultural internet and agricultural automation. Utilizing these innovations can improve the performance and productivity of agriculture in Indonesia.[1][2][3]

Plants are something that cannot be separated from agriculture, plants really need water intake for their continued development. Fertile soil is one of the factors that influence plants to grow well. The level of soil fertility can be affected by the moisture it contains.

PaThe farmers in Pematangsiantar city are still having difficulty meeting the water intake needed by the plants so that the development and growth of the plants are stunted, slow and even the plants wither and eventually die. This occurs due to several things such as access to water for difficult crops, farmers' lack of knowledge of soil moisture, extreme seasons and so on.

SSolution for the watering constraints mentioned above is to present a new innovation in watering plants. This innovation is through the provision of a tool that can replace the task of farmers in meeting water intake needs for plants. This tool can water plants automatically, and can monitor soil moisture quickly and accurately.

## 2. Method

### 2.1 Internet of Things (IoT)

*Internet Of Things* (IoT) is defined as the ability to combine smart objects that can interact with various intelligent computing devices accessed via the internet. In implementing the Internet of Things, several technologies are involved, such as: Radio Frequency Identification (RFID), Wireless Sensor Networks,



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Cloud Computing, and Web Technology. Internet Of Things has penetrated into various sectors, from households, transportation, health, agriculture, and others.[3][4][5]

**2.2 Soil**

Soil is one of the factors that influence vegetation growth which consists of mineral assemblages, organic matter and relatively loose sediments located above bedrock. Soil types consist of many mixtures, or more than one kind of particle size, just as clay soil does not only consist of clay particles, but consists of many mixtures with silt grains and sand.[1][6]

**2.3 Microcontroller**

The microcontroller is a basic part of a computer system where all or most of its elements are packaged in one IC (Integrated Circuit) chip which is smaller than personal computers and mainframe computers. Microcontroller is also a computer system that has one or more specific tasks. In simple terms, the computer will produce specific output based on the input received and the program being carried out.[3][4][7]

**2.4 Sensor**

In general, sensors are defined as devices capable of capturing physical or chemical phenomena and then converting them into electric signals, either electric currents or voltages. In this study, several sensors were used, namely: DHT11 humidity and air temperature sensor, soil moisture sensor Soil Moisture YL-69, ultrasonic sensor HY-SR-05.[3][8][9][10][11]

**2.5 The web**

*World Wide Web* or often known as the web, is a service that provides information in the form of data, voice, figs, numbers, and videos using the concept of hyperlinks (links), which makes it easier for surfers (the term computer users call for browsing or browsing information via the internet). [4][12]

**2.6 Research Flowchart**

To complete this research, several steps were taken to carry out the research, as shown in Fig. 1.

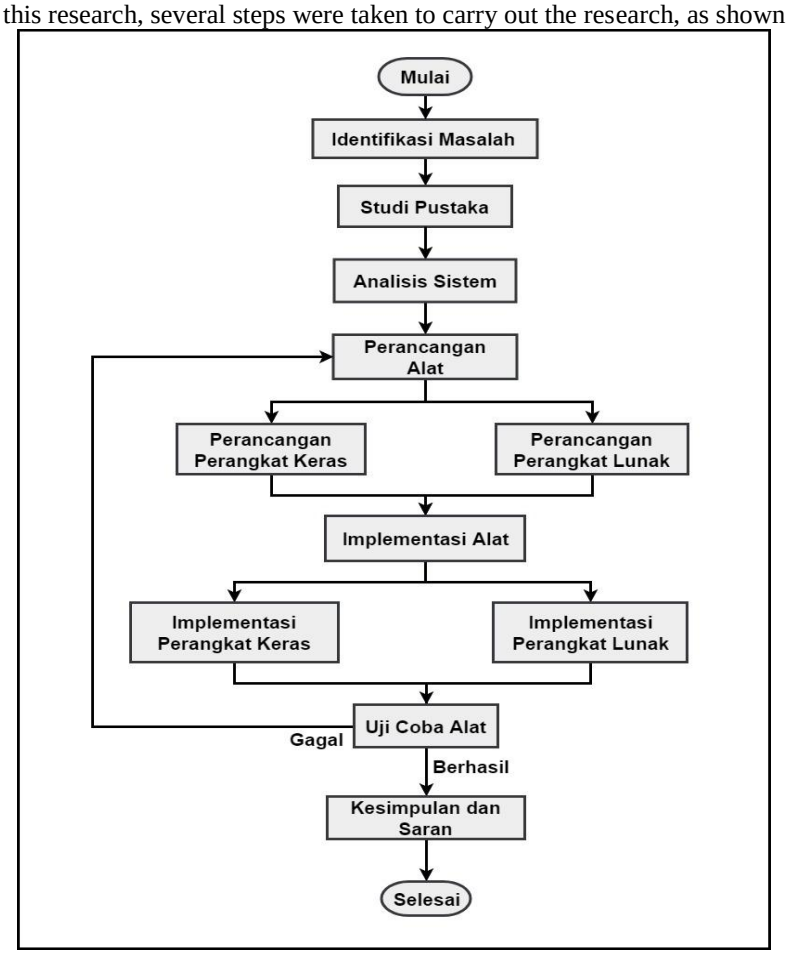


**Fig 1.**Research Flowchart



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## 3 Results and Discussion

### 3.1 Plant Box Design

The plant box consists of 3 parts, in each part there will be a Soil Moisture YL-69 sensor to determine soil moisture in plants. The results of its implementation can be seen in Fig. 2.

**Fig 2.**Plant Box

### 3.2 Design Tool

The design of the tool is the design of the overall tool components used in order to function properly. The complete design of the tool can be seen in Figure 3.

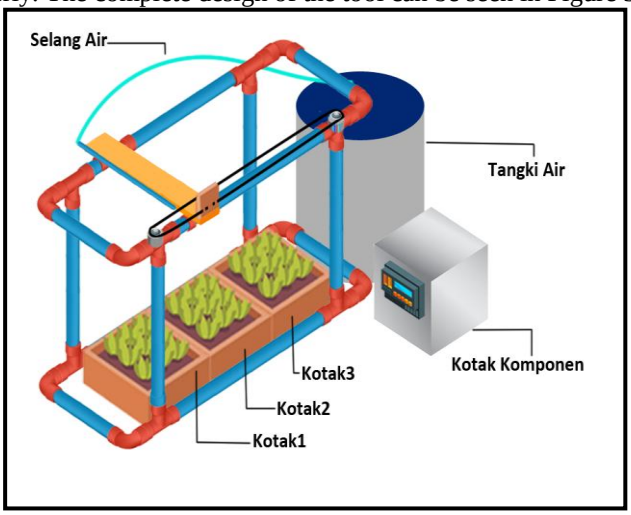


**Fig 3.**Overall Tool Design

### 3.3 Design Software

The design of the software uses a Use Case Diagram. Programming tools will use the Arduino IDE which will then be designed for a web that functions as a plant monitoring medium. In the use case diagram that is designed, the user will first log into the system, after the user has successfully logged in, the user can see the ground sensor, air sensor, water reservoir sensor, and can see the sensor as a whole. The design of the Use Case Diagram can be seen in Figure 4.



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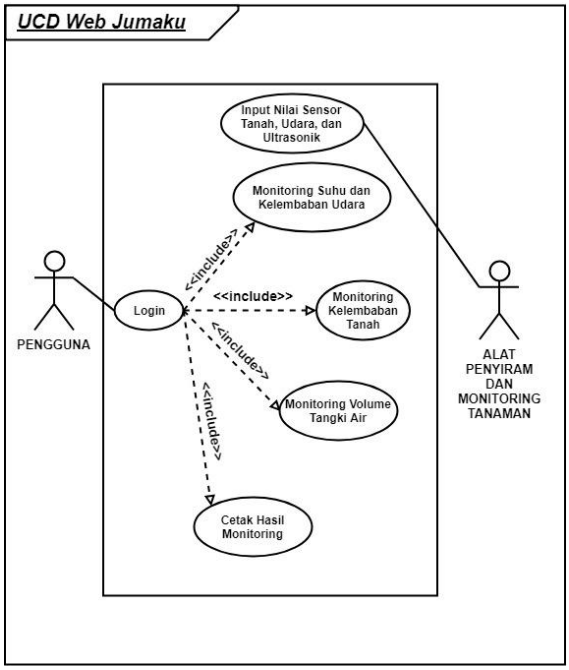


**Fig 4.**Jumaku Web Use Case Diagram

### 3.4 Soil Monitoring, Air Monitoring, Water Tank Monitoring

The soil monitoring page consists of three line charts that display the soil moisture value that has been stored in the database. Data from the line chart will be updated automatically every 1 second. The air monitoring page displays air sensor data that has been saved into a database, which consists of humidity and air temperature data. Likewise, the water tank monitoring page displays water level data that has been sent by the tool into the database. The unit of water level used is centimeter (Cm). Fig. 5 shows the monitoring display of land, air, and water tank.


**Fig 5.**Soil, Air, and Water Tank Monitoring

### 3.5 Discussion

From the results of the implementation and testing of the system being designed, it certainly has advantages and disadvantages, as well as the sprinklers and monitoring tools that are designed. Here are the advantages of automatic sprinklers and plant monitoring:

a. With this series of systems, it can simplify the process of watering plants.
b. The division of three boxes and three sensors on the soil makes the watering process more targeted, because only boxes with soil moisture below 30% will be watered.
c. Watering plants is more precise because the determination of watering time is according to soil moisture obtained from the Soil Moisture YL-69 sensor and soil moisture measurement data is more valid. Then there will be no more problem with plants dying from excess water when watered.
d. The process of monitoring soil moisture, temperature and air humidity elements is easier, and you can see the monitoring results of the previous days, because the monitoring results are directly stored into a database and displayed on a web.

After analyzing the system built, there are several things that are lacking of sprinklers and plant monitoring:

a. *Power Supplay* the tool is still very dependent on the electric current from PLN, if when the PLN electricity goes out, the tool will stop working.



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b. *Stepper motor* which is used is still small, this makes the watering process a little slow.
c. The component circuit of the tool still uses a breadboard and jumper cables. This makes the appearance uncluttered, and makes the tool sometimes interrupted its performance, because one of the jumper cables is sometimes dislodged.

## 4 Conclusion

After the sprinklers and plant monitoring tools have been implemented and have passed the testing phase, it is concluded:

a. The tools that have been produced can operate properly and work as expected as a whole.
b. The resulting tool can be an alternative and a solution for the needs of watering plants automatically.
c. Monitoring of plants, soil moisture conditions, air temperature conditions, water levels in the container can be monitored up-to-date with the support of a web-based monitoring system.

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## 5 Reference

[1] A. Abdillah and YM Anaperta, "Simulation of the Effect of Soil Water Content on Mechanical Parameters for the Design of Soil Slopes in Bukit Tui, Tanah Hitam Village, West Padang Panjang District, Padang Panjang City, West Sumatra Province," vol. 4, no. 1, pp. 124–139, 2019.
[2] NA Fitriani, A, G. Fadillah, B, and Riri Enriyani, "Soil Quality Testing as an Indicator of Environmental Pollution Around Tanjung Lesung Beach, Banten," vol. 01, no. 01, pp. 29–34, 2018.
[3] F. Erwan, A. Muid, and I. Nirmala, "Design of an Automatic Weather Measuring System Using Arduino and Integrated with a Website," vol. 06, no. 03, pp. 255–264, 2018.
[4] N. Putri, Astriana Rahma Suroso, "The Design of Automatic Plant Sprinklers for Miniature Greenhouse Based on IOT," pp. 155–159, 2019.
[5] A. Al-fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Internet of Things: A Survey on Enabling Technologies, Protocols and Applications, "no. November 2015, 2018, doi: 10.1109 / COMST.2015.2444095.
[6] D. Triadiawarman, "Soil Condition of Ulin Habitat (Eusideroxylon zwageri T & B) in Prevab Kutai National Park, East Kutai Regency," vol. 6, no. 1, pp. 11–20, 2010.
[7] H. Imtiyaz, BH Prasetio, and N. Hidayat, "Decision Support System for Chili Cultivation Based on Rainfall Prediction," vol. 1, no. 9, pp. 733–738, 2017.
[8] A. Jupri and A. Muid, "Design of Measuring Temperature, Humidity, and pH in Soil Based on ATMega328P Microcontroller," 2017..
[9] DJM Erricson Zet Kafiar, Elia Kendek Allo, "Arduino Uno-Based Plant Watering Design Using YL-39 and YL-69 Humidity Sensors," vol. 7, no. 3, 2018.
[10] OB Kharisma, "Development of a Greenhouse Control System through the Web with the Interaction of the Social Media Network Facebook," no. August, 2016, doi: 10.15575 / telka.v2i2.18.
[11] E. Permana and S. Herawati, "Design and Development of a Room Temperature Monitoring System for Web-Based Bookkeeping Using an Arduino Uno R3 Microcontroller," no. April, pp. 18–33, 2018.
[12] R. V Palit, YDY Rindengan, and ASM Lumenta, "Design of a Web-Based Church Financial Information System in the Bukit Moria Malalayang GMIM Congregation," vol. 4, no. 7, pp. 1–7, 2015.



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