MONITORING AND CONTROLLING SYSTEM OF GREENHOUSE BASED IOT IN BUSINESS INCUBATOR STUDENTS ASSOCIATION WINAYA MUKTI UNIVERSITY

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ABSTRACT

The set of Student Association Business Incubator is a unit of student activity in the field of entrepreneurship plants and crops. The student union has a greenhouse used to grow the plants whose purpose is sold directly to the merchant. In the cultivation there is the process of monitoring for indicators of plant health, but besides that it made HMIB there are several issues that members are given the task of monitoring does not pay attention to indicators of crops such as soil moisture, temperature, light intensity and soil pH is also growing media often not appropriate moisture levels for has a busy outside HMIB own activities. This study aims to assist member HMIB in monitoring and controlling in greenhouses using the internet of things so that the indicator value from the sensor is more easily seen and done simultaneously. Monitoring and controlling systems using microcontrollers and Arduino Mega sebaga ESP8266-01 module as the sending of data to the database. The stored data will be displayed on the website so that members can see the value of the indicator HMIB humidity, light intensity, soil pH and temperature, and controlling via the website. Results from the study implementation of monitoring and controlling system based greenhouse is yatu internet of things can help Student Business Incubator Association in the process of monitoring and controlling in the greenhouse for the cultivation of plants.

Keywords : *Internet Of Things, Greenhouse, Arduino, ESP8266-01, Monitoring, Controlling.*

1. INTRODUCTION

1.1. Background

Business Incubator Students Association (HMIB) is a unit of student activity under the auspices of the University of Mukti Winaya this work program in running the business of crops cultivated in greenhouses one with the approval of the university. In greenhouse crop cultivation in growth and plant health monitoring is that could be considered very important, because of the healthy plant will provide maximum yields. Healthy plants have several external factors such as plant soil moisture, air temperature, soil pH and light, is very influential factor for plant growth.

Based on the survey results and interviews with members of HMIB, HMIB have several types of plants for cultivation also diwirausahakan like a bowl of lettuce, cabbage, orchid, chrysanthemum and others. Bowl lettuce is vegetable plants or horticulture to be one HMIB cultivated plants, the planting of this plant ranges from 12 weeks to 5 months to harvest. Lettuce bowl includes plants that are not too affected by the condition of the nutrients contained in the soil or commonly called as long as the nutrient-poor soil and fertilizing regularly watered regularly. These plants can live in the soil with 60-75% humidity, HMIB members are often too late to do the watering for members who are on duty was not in the greenhouse environment,

In addition to lettuce bowl, crops cultivated by HMIB is chrysanthemum, chrysanthemum is one of ornamental plants cultivated by the Student Association Business Incubator, chrysanthemum has various types such as local chrysanthemum, chrysanthemum carinatum, Chrysanthemum segetum and so forth, but that is cultivated by HMIB only local kind chrysanthemum chrysanthemums or red. These plants can be harvested about 13-15 weeks after seeding or removal of indukannya. Chrysanthemum plants will grow very well at pH 5-7 and are very sensitive to soil pH, soil moisture, if the soil pH is very high then planted chrysanthemum chrysanthemum will show early symptoms of such diseases are not straight and flower stalks his will wither.

Then HMIB members are still difficulties in monitoring the health of the plant with sberbagai factors such constraints, inconsistencies in the monitoring process due to busy members in lectures often HMIB monitoring use estimates in determining the health needs of plants. Monitoring indicators of plant health is very important, because of the limitations of the tools used by members HMIB so could only see Events soil moisture, soil pH, and temperature of the room. While external factors that plants need not only that, there is the intensity of light and humidity play an important role. Light plays an important role for the plant as an indicator

for the photosynthesis of plants, because photosynthesis is very useful for plants and humans.

Business Incubator Students Association needed a solution to address it, in today there are technologies emerging today is IOT (Internet Of Things), a hardware device embedded in a wide variety of real objects until the object can be connected to the Internet. Therefore research intends to create a system of "Implementation Monitoring and Controlling System of Greenhouse Based Internet Of Things In Business Incubator Students Association of the University of Winaya Mukti" that will apply in Greenhouse cultivation of horticultural crops and ornamental monitored by HMIB.

1.2. Research methodology

The method used in this research is experimental.

1.2.1.Analisis Domain Case

1. Review of Literature

A method of collecting data by reading books or literature related to the topic of the thesis is taken and then studied to obtain more accurate information.

2. Data Collection

A method to obtain data from the concept to be designed to conduct interviews to parties associated with all things learned during this final project.

3. Survey and Analysis

The process of direct observation of where the research and take some of the issues contained therein.

a) Problem analysis

Analysis of the problem is a process by observing and analyzing the concerns expressed in the greenhouse HMIB.

b) Analysis System Ongoing analysis of the current system is

An analysis of plant cultivation system that is running in greenhouse HMIB.

- Ongoing Monitoring Analysis
- Controlling Process Analysis Ongoing
- Ongoing Analysis Tool

d) Ongoing Evaluation System

Evaluation of the current system that is process evaluation of all activities undertaken in the greenhouse HMIB, so they can get a conclusion and solution to the problem contained in the study.

1.2.2. design Tools

a) IOT Device Software Designing and Implementing all the theories derived from the literature, so that in getting a system design to software and hardware.

b) IOT Software Implementation and Software Application stage of designing the system that has been designed previously.

c) IOT Testing and Software
A method to obtain and find out the results of the design of the system are made, tests are carried out regularly sehinggal can get accurate data or close to that performed on its software and hardware.

d) IOT Devices and Software Maintenance
A process that is done to keep the software and kersanya to be used for a long time [1].

2. THEORETICAL

2.1. Greenhouse

According to Herry Suhardiyanto, Greenhouse is a house plant to provide an environment that is much closer to the optimal conditions for plant growth, light required by the plants can enter into greenhouses while plants protected from conditions that are not supposed to be, that the temperature is too low, very high rainfall and wind gusts were too tight. In the greenhouse, environmental parameters that influence plant growth, ie sunlight, air temperature, humidity, supply of nutrients, anginya speed, and the concentrations of carbon can be controlled more easily [2].

2.2. Internet of Things

IOT (Internet Of Things) allows the user to be able to manage and maximize electronic and electrical equipment that uses the internet. It is able to answer that in the near future communication between computers and electronic circuits capable of exchanging information between them so that IOT can reduce the interaction of human intervention. With this also will make Internet users is increasing with a wide range of facilities and services Internet network [3].

2.3. Arduino Mega

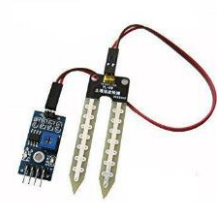
Board Arduino Mega 2560 is an Arduino board using a single unit named ic ATmega 2560. This board comes 54 digital input / output (15 pieces can be used as PWM outputs), 16 pieces of analog inputs, 4 UARTs (universal asynchronous receiver / transmitter) , 16 MHz crystal oscillator, a USB connection, a power hole, socket ICSP (In-Circuit System Programming), and a reset button. Arduino this type have the expertise to be able to communicate with a computer, another Arduino board, even the other microcontroller. [4].

2.4. censorship

The sensor is a device used to detect or measure a natural event such as gas, light, smoke, air and pH, and converted to a digital representation or analog output value that depends on the type of sensor used [5].

2.4.1. Sensor YL-100

YL-100 sensor is a sensor to measure soil moisture between 0% and 100%, and accuracy of about ± 3%. Sensor YL-100 requires an input of 3.3V to 5V and has two modes, namely digital output and analog [4].



Picture 1 Sensor YL-100

2.4.2. LDR Sensors

LDR (Light Dependent Resistor) js one part of the discharge resistor value can change at any time nccordance with the detected light intensity sensors. The light intensity sensor can also be used as a light

(dark), then the value will become greater obstacles so that the electrical current flowing will be retarded [4]

Figure 3 sensor LDR

2.4.2. Sensor DHT-21

DHT21 sensor is a sensor to measure the temperature and humidity of 0% and 100%. Besides detecting the temperature and humidity information, these sensors also measure the temperature. This sensor requires 3 lupang pin to be placed, which means ground black wire, red wire means voltage, and yellow are analogs of data that must be applied to the microcontroller [4].

Figure 2 sensor DHT21

2.4.4. Soil pH Sensor

Soil pH sensor is a sensor detecting the level of acidity or alkalinity in the soil. The pH value can be measured by the soil pH sensor has a limit of 3.5 to 8. This sensor can be directly connected to the analog pin analog pin microcontroller arduino or more without having to use an additional amplifier modules sensor. Keep in mind that the value of the resistance of the sensor is highly dependent on light intensity. The more light that hits, it will decrease the value of the resistance. Conversely, if the less light the sensor

Figure 4 Soil pH sensor.

3. ANALYSIS OF DESIGN

3.1. analysis System

3.1.1. Domain Analysis Case

Domain analysis of the case is an assumption arising from the problems described in the development of monitoring and controlling system on greenhouse-based internet of things in a business incubator university student associations Winaya Mukti. Here is an analysis of the problems of the current system at this time.

a) Planting media often do not correspond to the normal conditions due HMIB members still use estimates and limited manual tool to get information ketersediaanya plant growth factors, such as soil moisture, humidity, air temperature and soil pH.
b) Planting media often lack the moisture level because when it's time to do the watering HMIB members were not in a greenhouse environment.
c) Planting media often have excess soil moisture, because during the watering process has been carried out, member HMIB often does not check back and mengandalakan estimates.
d) Plants are still experiencing a shortage of light is needed or excess light, because there is no tool for monitoring the light intensity and estimates rely on light intensity by doing set paranet or shade.

3.1.2. Running Monitoring Analysis

Analysis of the monitoring that goes namely dambaran monitoring process that runs at the moment and have a purpose not give details on how the work of monitoring the running today.

a) HMIB member comes to greenhouse
b) HMIB members to check the temperature, soil moisture and soil pH of the plant as a sample.
c) HMIB members get the information of temperature and humidity, soil moisture and pH in the monitoring.
d) HMIB Member recording monitoring information.
e) If there are indicators of the health of the growing media below the standard value it will be doing the watering (if the soil moisture is not in accordance with the standards of soil moisture the plant), open shade / paranet (if the temperature and humidity and light intensity does not correspond to the needs of the plants) and the addition of lime (if the pH is not in accordance with the needs of the plants).
f) The monitoring activity is done 3 times a day at 07:30, 13:00 (if required) and 16:00.

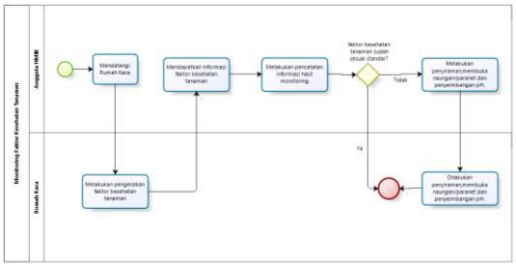


Figure 5 Monitoring Processes Running

3.1.3.Analisis Controlling Running

Analysis of controlling running processes which is a process where the picture of the process of controlling the running at the moment and has a goal to provide details of how the current running control

a) HMIB members to check soil pH indicator and soil moisture also air temperature.
b) HMIB members get value indicator of the results of checks on the planting medium.
c) If the pH value of the growing media under the standards set HMIB value, it will be giving the lime with appropriate levels.
d) If the value of soil moisture at planting medium below the standards set HMIB value, it will do as much as 100ml per plant watering or if the bulk polybag right watering as much as 2 liters of water.

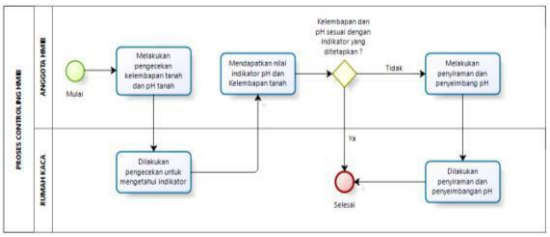


Figure 6 Controlling Processes Running

3.2. Design Systems and Devices

3.2.1. System Architecture Design

System architecture design is a process to describe the whole physical system to be built and also the supporting components. Beikut is an overview of system architecture to be built.

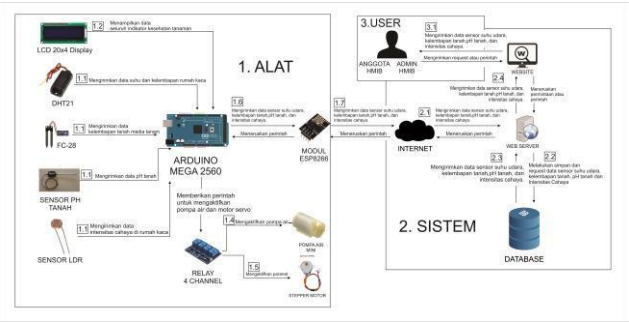


Figure 7 System Architecture Design

Here is an explanation of the architecture of the system implementation monitoring and controlling greenhouse business incubator university student associations Winaya Mukti:

a) Arduino Mega 2560 will take the input data of pin which is set to receive input data to be processed according to the needs and the results of its output will be sent back to the output pin.
b) Sensors
Detects air temperature, soil moisture, light intensity and soil pH in the greenhouse.
c) Relay 4 Channel
Running the logic functions and provide a delay time that is sent through the command and run the command. The water pump and the stepper motor is a device that is connected to the relay.
d) module Esp8266
Connecting a microcontroller with a web server, database and website through the Internet.
e) LCD Display
Showing the value of plant health indicators that have been read by all the sensors.
f) web Server
Bridge database with the website.
g) website
Showing information transmitted by the microcontroller via a web server and database. Can do the controlling of the watering and paranet.
h) database
Storing data from the microcontroller is transmitted through the webserver.
i) user
As a user, and have privileges to access the entire system works

3.2.2. Functional Needs Analysis

Analysis of functional requirements intended to the whole process of activities to be implemented into the system and explain the necessary requirements for the system that is designed to run well and in accordance with the needs of the system. By using UML (Unified Modeling Language) as an analytical model.

3.2.2.1. Use Case Diagram

Use Case Diagram the modeling of workflow systems and tools that will be built. Use Case will explain a workflow and communication interactions between the actors or with the application system to be built. Use Case is intended to be aware of any existing functionality in an application system and who is entitled to use the function - the function.

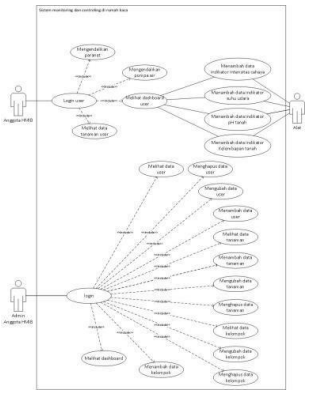


Figure 8 Use Case Diagram

3.2.3. Percancangan Database

Database design is the mapping stage concept model database model to be used.

3.2.3.1. Relationship diagram

Relationship diagram is a description of the relationships in the database. Scheme relations of Monitoring and Controlling System of Greenhouse Based Mahasisa IOT at the Business Incubator Association of University Winaya Mukti is as follows:

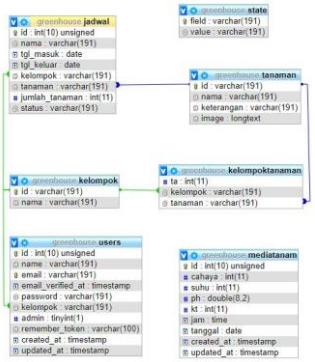


Figure 9 Relationship diagram

4. IMPLEMENTATION AND TESTING

4.1. System implementation

At this stage, performed system implementation of a draft that has been done before. This stage contains specifications hardware implementation, the implementation of databases, software specifications, blackbox testing and monitoring system on greenhouse Controlling Students Association of University Business Incubator Winaya Mukti.

4.2. Hardware Implementation IOT

Here are a hardware implementation the IOT are used to run the system for monitoring and controlling greenhouse HMIB.

table 3 IOT hardware implementation

No.	Hardware	Information	
1	*microcontroller*	*Arduino Mega 2560*	
2	*temperature sensor*	*DHT21*	
3	*censorship*	*Yl-100*	
	humidity		
	Soil		
4	*Soil pH sensor*	*Soil pH sensor*	
5	*Semsor intensity*	*Light*	*Dependent*
	Light	*resistor*	
5	*Internet module*	*ESP2866-01*	
6	*LCD modules*	*I2C module 20X4*	
7	*Relay module*	*2 Channel Relay Module*	
8	*Pump*	*Water Pump Mini*	
9	*paranet*	*paranet*	*and Motor*
		stepper	

4.3. Software Implementation

Software (software) used to implement applications and monitoring system in the greenhouse cotroling HMIB.

Implementation of the software can be seen as follows:

4.3.1 Software Implementation IOT

Monitoring and Controlling System Greenhouses Berbasi IOT in Business Incubator Student Association can run the computer from the client side that used to be attached software needed. Software Implementation IOT

table 6 Software implementation IOT

No.	Device	Information	
	Soft		
1	*Arduino IDE*	*As application overall configuration tool Arduino that be used in system.*	

4.4 Testing Overall System

Testing of the system is the cornerstone that aims to find errors or omissions in the information system to be tested. System testing is to determine the performance of the system that has been made in accordance with the purpose of system design.

4.4.1 Website testing

Testing a website is important in the use of systems that aim to locate faults and flaws in the system that is built to secar user directly.

4.4.1.1 Testing Dashboard page

Testing is done to the dashboard page HMIB members as well as to monitor the results of sensor readings are displayed on the main page of this

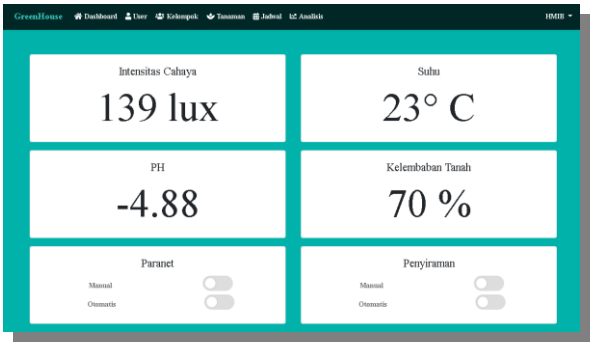


Figure 10 Implementation of the dashboard page

4.4.1.2 Testing User Guide

Testing is done to the user page admin memanagae HMIB as well as for user data using this system

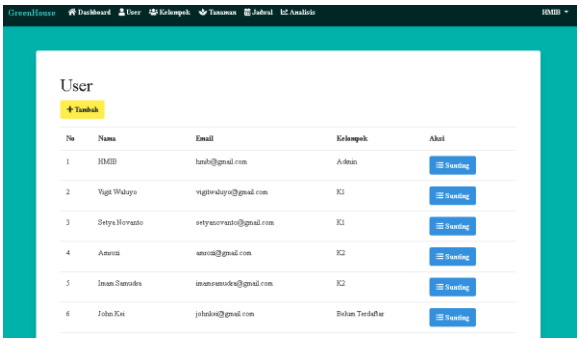


Figure 11 Implementation User Guide

4.4.1.3 Testing Page Plant

Testing is done to the plant page admin memanagae HMIB well as for plant data to be cultivated and the use of this system

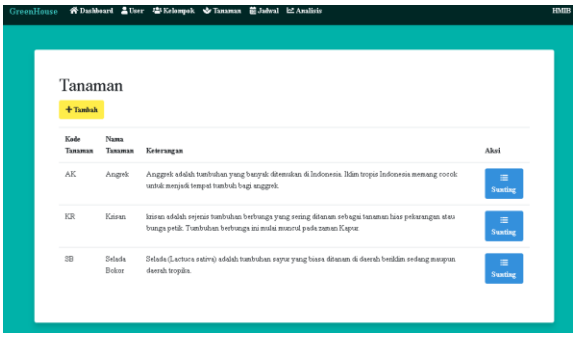


Figure 12 Implementation Guide Plant

4.4.1.4. LDR Sensor Testing

LDR sensor is a sensor used to capture the intensity of light into the greenhouse HMIB. Testing is done with the condition sensor is a sensor Sawal in an open state.

table 7 LDR Sensor Testing

to-testing	Value
1	153 Lux
2	153 Lux
3	150 Lux
4	153 Lux
5	851 lux

LDR sensor reads the light intensity value in the absence of treatment with a value of 150-153 lux light intensity. LDR sensor then transferred to a place exposed to direct sunlight so that the system and the sensor can read the value of the light intensity with the temperature value 851 lux. From the testing that has been done on LDR sensor can be concluded that the sensor and the system can work in accordance with the requirements can be seen in the monitoring system that the temperature in the detection of change

4.4.1.5. Testing Sensor DHT-21

DHT21 sensor is a sensor used to capture the value of the air temperature in the greenhouse HMIB. This sensor testing performed by the initial condition that the sensor in the original position without any treatment.

table 8 Testing the sensor logs DHT21

Time	Temperature (OC)
14/02/2019 19:32	22oC
14/02/2019 19:33	22oC
14/02/2019 19:34	24oC
02/14/2019 19:35	23oC
02/14/2019 19:36	25oC

DHT21 read the temperature in a cool place with a stable temperature value 22-25^{o}C. It can be concluded that DHT21 sensor and the system can work in accordance with the requirements can be seen in the monitoring system that the temperature in the detection of change

4.4.1.6. Sensor Testing YL-100

YL-100 sensor is a sensor used to determine the value of soil moisture at planting medium. This sensor testing performed by the initial condition that the sensor in the original position before watering the planting medium. Testing sensot YL-100.

table 9 Joe-100 sensor testing

Examination to-	Treatment	Humidity Values (%)
1	Without	55%
	Treatment	
2	After do	66%
	sprinkling	

YL-100 sensor reads the percentage of moisture in the planting medium with a percentage value of 55%. Then the planting medium is treated with watering controlling process performed by the system and pump as much as 100 ml of water, then sensot YL-100 detects the media condition tanman with a percentage value of 66%. From the testing that has been done on YL-100 sensor can be concluded that the sensor and the system can work in accordance with the requirements can be seen in the monitoring system that the temperature in the detection of change.

4.4.1.7. PH Sensor Testing

Soil pH sensor is a sensor used to capture the value of the acidity of the growing media. Testing is done with sensor sensor ditancabkan into the planting medium and the system will display the results of the detection sensor to the LCD.

table 10 Testing the soil pH sensor

Time	The pH value
14/02/2019 16:25	-63.51

02/14/2019 16:26	1:49
02/14/2019 16:27	-8.35
02/14/2019 16:28	6:07
02/14/2019 16:29	-15.21
02/14/2019 16:30	-59.49

It can be seen that the soil pH sensor reading level of acidity the growing media, but data generated by sensor detection results are not consistent

5. CLOSING

5.1 Conclusion

Based on the results implementation and testing of software and hardware that is built, it could be concluded, system implemented to monitor indicators of the health of plants, soil moisture, air temperature, soil pH and light intensity in the greenhouse and can make controlling ie watering media planting and paranet opener.

5.2 Suggestions

The system has been implemented still need to be developed and enhanced to system This is built to work with better and can work in accordance with the objectives and needs. This is the many of suggestion of the addition of raspberry PI mini PC for data transfer for more rapid and pH sensor configuration to make it more stable.

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