IOT FRAMEWORK FOR SMART AGRICULTURE TO IMPROVE AGRICULTURAL PRODUCTION

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Abstract:
Indonesia is one of the agricultural country with an area of agriculture, especially rice which millions of hectares in extent. It certainly makes Indonesia one rice producing countries with variants and quality vary. In addition, Indonesia is also the majority of the population are farmers of fruits, grains and vegetables become one of the staple diet. Apart from the abundant production of rice, vegetables and fruits farmers also always have constraints that could affect the decline in yields, in terms of both quality and quantity. In terms of loss of quality, usually caused by human error factor, or errors in the care of the rice farmers themselves, vegetables and fruits. As for the reduction in the quantity of rice, vegetables and fruits are the main factors in the form of pest pests (Plant Pest Organisms). To overcome these problems conventional farmers using the tool midges and control of agricultural land by hand. Hence, we need a smart agricultural model that can control the agricultural land of automatically and can be accessed anytime and anywhere with a base of IOT (Internet Of Things). So that farmers can further reduce human error in maintenance of land and agricultural products so as to increase agricultural production in Indonesia.

Keyword :agriculture,IoT,Framework,Smart,Production.

I. INTRODUCTION

Indonesia is one of the agricultural country with an area of agriculture, such as rice, vegetables and fruits that reach millions of hectares in extent. This is certainly making Indonesia one of the countries producing rice, vegetables and fruits with the variant and the quality of the assortment, in addition, Indonesia is also the majority of the population are farmers of fruits, rice and vegetables into one of the ingredients staple food. Apart from the abundant agricultural production, farmers also always have constraints that could affect the decline in yields, in terms of both quality and quantity. In terms of loss of quality, usually caused by human error factor, or errors in the care of the rice farmers themselves, such as errors in excess fertilizer. As for the decline in production quantities, the primary factor is that pests such as various pest (Plant Pest Organisms).

Internet Of Thing (IOT) is a concept that aims to extend the benefits of Internet connectivity are connected continuously. As for capabilities such as data sharing, remote control, and so on, as well as the objects in the real world. Examples of foodstuffs, electronics, collectibles, any equipment, including all living things are connected to local and global networks through an embedded sensor and is always active. Basically, the Internet of Things refers to objects that can be uniquely identified as virtual representations in an Internet-based structure. How it Works Internet of Things is by using an argument programming in which each command argument that resulted in an interaction among the machines are connected automatically without human intervention and within whatever, internet that be a liaison between the interaction of these machines, while humans only served as a regulatory and supervisory operation of the tool directly

The essence of the concept of Internet Of Things intelligence is intelligence, control of intelligent automation with command, can be operated easily and can be accessed anytime anywhere so that independent nature, according to the context, circumstances or environments

faced. In terms of architecture, IOT consists of several connected networks that can be regulated and controlled by a complex system with strict security so that IOT can be used for all sectors such as industry, agriculture, trade, security and other sectors that can use technology IOT to provide increased production, safety, service and other improvements in the sector.

Model IOT smart agriculture is the implementation of IOT (Internet Of Things) in the agricultural sector that can provide convenience to farmers in terms of supervision, control and management of agricultural production so as to provide the quality and quantity of agricultural production. This model was made by the network with a system of control and supervision that can be done remotely and can be accessed anytime and anywhere. Model IOT farm is equipped with a control system of agricultural land such as plowing, irrigation, fertilizer, midges, quality of production (harvest), the quantity of production (harvests), making production (harvest) and the marketing of the crop so that farmers do not need to market their agricultural products are offline or manual.

Model IOT smart agriculture to improve agricultural production in this study is merely a control model of irrigation, fertilizer, pest pegusir and control of agricultural land from a distance. Model control irrigation in this study were made by several sensors to control irrigation by identifying soil moisture and needs or the height of the water, while fertilizing identified through time and the crop needs for fertilizer, midges on this model is devoted to the expulsion of pests (Pest Organisms Plants) discussed in this project in the form of sparrows eating rice, the pest will be detected by sensors that have been installed in area pear fields and agricultural land use camera controls. All of the controls can be accessed and controlled anytime and anywhere.

II. METHODE

The methodology used is approach to IoT (Internet Of Things) Framework such as input from sensor, microcontroller to process analog data from sensor and output data from mikrocntroller in the form of digital data is presented by lcd caracter,led,buzzer and phone for control and monitor agriculture.

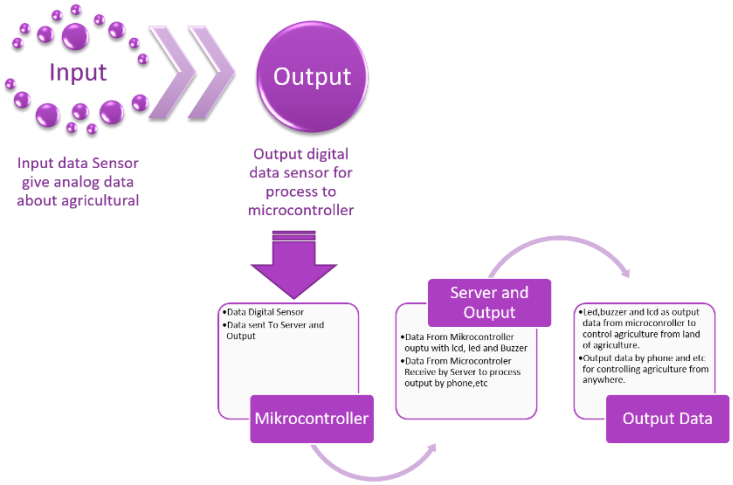

Figure 1: IoT Framework

A. INPUT

Input analog sensors that provide data which will be processed mikrocontroller to generate digital data before the data is reprocessed by mikrocontroller to be output as desired.

B. OUTPUT

Output of the sensor in the form of digital data input into mikrocontroller to produce the next output in the form of data base.

C. MIKROCONTROLLER

Microcontroller is a device that can receive analog and digital data to be processed into uotput to be displayed in the form of a database that can then be accessed by a variety of media.

D. SERVER DAN OUTPUT

Server as the recipient of the data from mikrocontroller entered into the data base to be processed and displayed on various media so that it can control and memonotoring farmland, output other than the server can be either analog output and digital are displayed in the form of lcd character, LED, buzzer and so forth Dapa was used as control and monitor agricultural land.

E. DATA OUTPUT

Output data is the data that is presented as it is processed through the database server so that the data can be presented other media such as mobile phones, tablets, and others.

III. RESULT AND DISCUSSION

Results of IOT produce a framework as in figure 2.

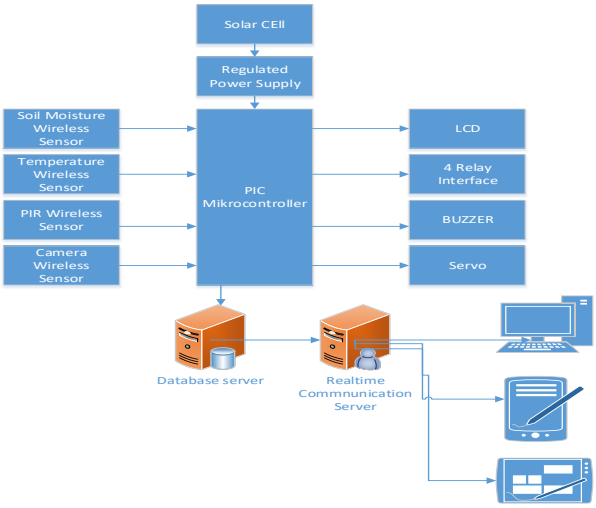

Figure 2: IoT Framework

A. SOIL MOISTURE WIRELESS SENSOR

Soil moisture sensor is given a voltage of 4V and 0V to microcontroller contained in the watering system, connect pin A0, GND, VCC on the converter after the output voltage is checked at pin converter that is connected to the positive and negative phobe on the multimeter.

Table 1. Sensor Soil Moisture Testing

Mikrocontroller Voltage	***Input* Soil Moisture Voltage**	**Info**
5 V	3VDC	actif
4 V	3VDC	actif
3 V	3VDC	actif not Stabil
2 V	2 VDC	actif not Stabil
1 V	1 VDC	Not actif
0 V	0VDC	Not actif

B. TEMPERATURE and PIR WIRELESS SENSOR

Temperature wireless sensor is given a of 4 V and 0 V to microcontroller contained in the watering system, connect pin A0, GND, VCC on the converter after the output voltage is checked at pin converter that is connected to the positive and negative phobe on the multimeter.

Table 2. Temperature and PIR Testing

Mikrocontroller Voltage	***Input* tempt and PIR Voltage**	**Info**
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3 V	3VDC	actif not Stabil
2 V	2 VDC	actif not Stabil
1 V	1 VDC	Not actif
0 V	0VDC	Not actif

C. CAMERA WIRELESS SENSOR

Camera wireless sensor is given a voltage of 4V and 0V to microcontroller contained in the watering system, connect pin A0, GND, VCC on the converter after the output voltage is checked at pin converter that is connected to the positive and negative phobe on the multimeter

Tabel 3. Camera Wireless Testing

Voltage	LED Indicator	Info	
3,5Volt DC	RX	actif	actif
	TX	actif	actif

D. POWER SUPPLY SOLAR PANEL

Power supply solar panel is input voltage for all scheme. Input voltage is checked by multimeter.

Table 4. Power Supply Testing

Tegangan Tidak Murni (Volt)	Tegangan Hasil Pengukuran (Volt)
+8	4,91
+9	4,91
+12	4,91

E. MICROCONTROLLER

This framework mikrocontroller a sensor analog signal converter menjadu digital signals and then forward the data into the desired form of output such as servers and LCD otuput character, buzer and led. therein processed in the form of fuzzy logic so that every decision taken in the mikrocontroller. thus, each ouput issued by mikrocontroller is the result of decisions tailored to the needs of agricultural land.

DETERMINING VARIABEL

Determining Variable done to get the variable to be displayed and controlled so that the acquisition of the data received in the control of agricultural IOT device is more accurate.

Table 5. Determining Variabel

Function	Variabel	Limit	Info
Input	Temp	[31-100]	Temp
	Soil Moustoriseur	[0-890]	
Output	Minus of temp	[0-100]	control
	Minus of Soil	[0-890]	control

FUZZY ASSOCIATION

Fuzzy Association used to get a mean required by each sensor so the need for control can be upgraded into low, medium and high.

Function	Variabel	Fuzzy Association	Limit	Domain
Input	Temp (C)	Low	[31-100]	[31-35]
		Medium		[33-37]
		High		[35-100]
	Soil Moisture	Low	[0-890]	[500-890]
		Medium		[200-600]
		High		[0-300]
Output	Control Temp (%)	Very Low	[0-100]	[0-20]
		Low		[15-45]
		Medium		[40-70]
		High		[65-95]
		Very High		[90-100]
	Control Soil	Very Low	[0-890]	[0-20]
		Low		[15-45]
	Moustur (%)	Medium		[40-70]
		High		[65-95]
		Very High		[90-100]

MEMBERSHIP FUNCTION

Membership function is a function that shows the mapping of points of data input into the value of membership, which has the interval between 0 and 1.

Temp Variabel

Variable temperature has such low 3 fuzzy sets (31-35), medium (33-37), and high (35-100). Variable temperature can be seen in Figure 3.

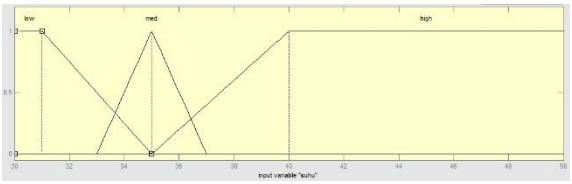

Figure 3: temp Variable

In this variable was divided into several fuzzy sets with membership functions including the following:

$$\mu low[x] = \begin{cases} 1, & x \leq 31 \\ \frac{35-x}{35-31}, & 31 \leq x \leq 35 \\ 0 & x \geq 35 \end{cases}$$

$$\mu med[x] = \begin{cases} 0, & x \leq 33 \; atau \; x \geq 40 \\ \frac{x-33}{35-33}, & 33 \leq x \leq 35 \\ \frac{40-x}{40-35} & 35 \leq x \leq 40 \end{cases}$$

$$\mu high[x] = \begin{cases} 0, & x \leq 35 \\ \frac{x-35}{40-35}, & 35 \leq x \leq 40 \\ 1 & x \geq 40 \end{cases}$$

Membership value temperature set low, medium, and high is:

- μlow[x] = 0,25
- μmed[x] = 0,5
- μhigh[x] = 0

Soil Moisture Variable

Soil Moisture Variable has 3 fuzzy set them low (500-900), medium (200-600), and high (0-300). Variable flame can be seen in Figure 4.

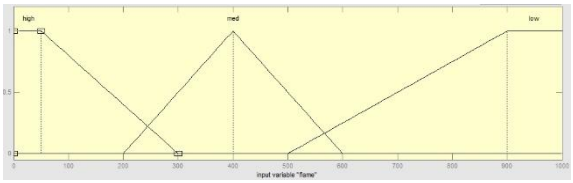

Figure 4: Soil Moisture Variable

In this variable was divided into several fuzzy sets with membership functions including the following:

$$\mu high[x] = \begin{cases} 1, & x \leq 50 \\ \frac{300-x}{300-50}, & 50 \leq x \leq 300 \\ 0 & x \geq 300 \end{cases}$$

$$\mu med[x] = \begin{cases} 0, & x \leq 200 \; atau \; x \geq 600 \\ \frac{x-200}{400-200}, & 200 \leq x \leq 400 \\ \frac{600-x}{600-400} & 400 \leq x \leq 600 \end{cases}$$

$$\mu low[x] = \begin{cases} 0, & x \leq 500 \\ \frac{x-500}{890-500}, & 500 \leq x \leq 890 \\ 1 & x \geq 890 \end{cases}$$

Membership value moisture set low, medium, and high is:

- μlow[x] = 0
- μmed[x] = 0.75
- μhigh[x] = 0

Output Variable

Variable Output has 5 such fuzzy set very low (0-20), low (15-45), medium (40-70), high (65-95) and very high (90-100). Variable output can be seen in Figure 5.

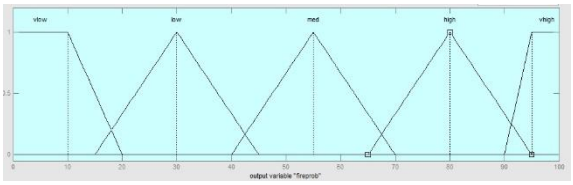

Figure 5: Output Variable

At this output variables can be known the magnitude of the intensity of fire is detected in the room. This variable is divided into several fuzzy sets with membership functions including the following:

$$\mu vlow[x] = \begin{cases} 1, & x \leq 10 \\ \frac{20-x}{20-10}, & 10 \leq x \leq 20 \\ 0 & x \geq 20 \end{cases}$$

$$\mu low[x] = \begin{cases} 0 & x \leq 15 \; atau \; x \geq 45 \\ \frac{x-15}{30-15}, & 15 \leq x \leq 30 \\ \frac{45-x}{45-30} & 30 \leq x \leq 45 \end{cases}$$

$$\mu med[x] = \begin{cases} 0 & x \leq 40 \; atau \; x \geq 70 \\ \frac{x-40}{55-40}, & 40 \leq x \leq 55 \\ \frac{70-x}{70-55} & 55 \leq x \leq 70 \end{cases}$$

$$\mu high[x] = \begin{cases} 0 & x \leq 65 \; atau \; x \geq 95 \\ \frac{x-65}{80-65}, & 65 \leq x \leq 80 \\ \frac{95-x}{95-65} & 65 \leq x \leq 95 \end{cases}$$

$$\mu vhigh[x] = \begin{cases} 0, & x \leq 90 \\ \frac{x-90}{95-90}, & 90 \leq x \leq 95 \\ 1 & x \geq 95 \end{cases}$$

In Mamdani method, application functions used are Min, Based on sensor input value that has been obtained, then the rules are used as follows.

[R2] *If* temp *is LOW and Soilmuisture is MEDIUM then control is LOW*

α-predikat$_1$ = μlow ∩ μmed
= min (0,25;0,75) = 0,25

[R5] *If* temp *is MEDIUM and Soilmuisture is MEDIUM then control is MEDIUM*

α-predikat$_5$ = μmed ∩ μmed
= min (0,5;0,75) = 0,5

composition rules

$\frac{A1-15}{30-15} = 0{,}25 \rightarrow A1 = 18{,}75$

$\frac{45-A2}{45-30} = 0{,}25 \rightarrow A2 = 41{,}25$

$\frac{A3-40}{55-40} = 0{,}5 \rightarrow A3 = 47{,}5$

$$\frac{70-A4}{70-55} = 0{,}5 \quad \rightarrow A4 = 62{,}5$$

F. OUTPUT

The output of the entire system in mikrocontroller there are two outputs are output to the control and monitoring on the farm and off-farm monitoring. dilahan for agricultural output led, lcd caracter,buzzer and other.

The output of the microcontroller can be in the form of a database that can be presented to various media such as mobile phones, tablets, and other PC-lain.pada Figure 6 shows the final output of all IOT Framework.

Figure 6. Output IoT Framwork

IV. CONCLUSION

Model IOT smart agriculture to improve agricultural production in this study is merely a control model of irrigation, fertilizer, pest pegusir and control of agricultural land from a distance. Model control irrigation in this study were made by several sensors to control irrigation by identifying soil moisture and needs or the height of the water, while fertilizing identified through time and the crop needs for fertilizer, midges on this model is devoted to the expulsion of pests (Pest Organisms Plants). each sensor into the microcontroller processed using fuzzy logic to obtain accurate data so that the data are indicated is the data that has been processed in the system.

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