Distributed Arduino for Communication Agriculture

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Abstract

The needs of human life today, are felt to require the help of technology. Utilization of information technology has reached the countryside and all regions, beaches, mountains and cities. Information on agricultural or plantation products is very important for rural and urban communities, where yields and their development are indicators of decision-making and policy. Currently this information is very difficult to obtain, let alone collided with the complexity of problems in life. The method used is a distributed system method where the information produced by farmers regarding their harvest is distributed host to host (distributed system) via Arduino Uno. The use of Arduino Uno devices means the use of minimalist devices or embedded systems to minimize resources, and save energy.

Keywords *—Arduino, Embedded System, Arduino*

1. INTRODUCTION

The use of technological advances, the internet and minimalist devices in control systems is urgently needed at this time, work something that was initially done manually (done by human power) then with the help of technology can be done automatically, systematically (replacing the role of humans). This reduces the error rate and of course without compromising the end result and the intent of the end goal. Current trends and in the future all electronic devices can communicate and exchange data.

The use of Solar Panels and embedded technology combined with , which is an embedded system technology that is used as the brain of the control farming system. Relatively embedded systems combined with agriculture, for one purpose which is the good for mankind. They are dominated by hardware (memory, power, charging resources) [3]. In the future, the Internet of Things (Arduino) also called the Internet of Everything or Industrial Internet, is a new digital technology that will bring about changes envisioned as a global network of machines and devices capable of interacting with each other. Arduino is one of the most important areas of future technology and is increasing the attention of various industries. The true value of Arduino for enterprises is realized when connected devices can communicate with each other and integrate with vendor-managed inventory systems, customer support systems, business intelligence applications, and business analytics[5].

Agricultural data collection is a reference information to be able to determine future policies. Information or harvest data is currently not well collected (still private and not well documented). From this we need a system that collects agricultural information and data in real time. So that farmers can make decisions about what to do next for the next growing season. The term Distributed system refers to the collection of scattered data. With the wide spread of computers, distributed systems, its utilization can be used in various fields of life[1].

In the picture below is the schematic flow of server side and client

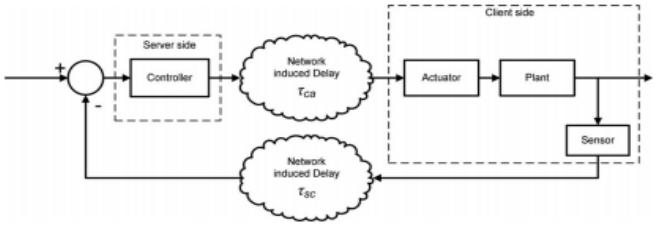

Figure 1. Scheme Client Server

This writing uses a combination of distributed network methods between Arduino uno and other Arduino uno, the first communication is arduino with arduino and ardino with sensors. Arduino is used as a generator input, sensors are placed at the ends of the fields as well as communication between Arduinos.

For the origin of the power source, solar panels are used. The efficiency of the panels is calculated by dividing the power output of the cells (in watt) at the maximum powerpoint (Pm) by the input light (E, dalam W / m^2) and the surface area of the solar cell (Ac di m^2).

$$\eta = Pm / (E \times Ac)$$

$$\eta_{max}\,(\text{maximum efficiency}) = \frac{P_{max}(\text{maximum power output})}{(E_{S,\gamma}^{SW}(\text{incident radiation flux}) * A_c(\text{area of collector}))}$$

In general, a solar panel has an efficiency of only approx 20-30%, which means simply a solar panel can convert only approx 20% of all the light energy received by the solar panels. While the rest is reflected back into the air. So that under standard conditions, solar panels with an area of approx 1 square meter can generate approx 200 W hours of operation. [10]

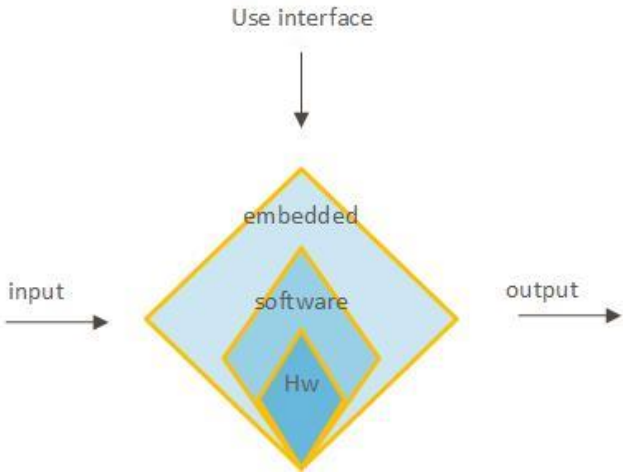

Figure 2. Embedded system

In figure 2 is programming and algorithms in the scope of embedded systems. For the implementation of these logic-based algorithms and concepts, there must be a hardware-software interface. The system where this can be achieved is "Embedded systems". An embedded system is a hardware built system consisting of a memory chip / hardware with special software programmed in it. This paper discusses various presission of growth agriculture applications in aquaponic systems connected to Arduino.

2. RELATED RESEARCH

The following are some studies as literature reviews or related research, this is useful to see if there are similar writings or studies, to avoid plagiarism and as literature to add input to written research.

1. In the research conducted by Lathifah Arief with the title "Study of Blockchain Utilization for the Internet of Things (Arduino)" Universitas Andalas. (2019) [6]
2. In the research conducted by Oris Krianto Sulaiman with the title "sistem internet of things (Arduino) berbasis cloud computing dalam campus area network" Universitas Islam Sumatra Utara. (2017) [7]
3. In research conducted by Tai Ci Bui by title " Sistem pertanian cerdas berbasis ARDUINO" Universitas Bina Nusantara.(2018) [9]
4. In journals written by Husni "Monitoring agricultural soil moisture by using sensor Soil Moisture and arduino uno" ILKOM journal 2018. [4]
5. Prototype solar water pump system to increase agricultural productivity, ABDIMAS Desember 2017 UNS Surakarta. Yang ditulis oleh Chico Hermanu Brillianto Apribowo, Teguh endah. [11]

The related research describes previous research reviews by other researchers that are relevant to the research conducted. This section also includes the differences between previous research conducted by previous research and research conducted by the author so that it can be seen the differences in the research conducted.

Table 1. Some Supporting Journals

Journal Title	Problem	Metode	Refrence
FEMAN: Fuzzy-Based Energy Management System	efficiency of energy issues in a smart house	Fuzzy system	(Chehri & Mouftah, 2013)
Enabling Technologies for Green Internet of Things	Green Arduino, energy utilization efficiency	Arduino application, project and standarisasi	(Chen et al., 2017)
Design of an Intelligent Management System for Agricultural Greenhouses based on	Conventional greenhouses to modernizing greenhouses, large scale	smart network sensor and web base teknology	(Li et al., 2017)
Green Arduino: Advancements and Sustainability with Environment by 2050	improve the LCA assessment model with Deep Learning and Data Mining techniques with various impact factors for better and efficient results .	Machine Learning , deep learning, Smart device	Neha Sharma Computer Science Engineering Department, Amity University, Rajasthan, 2020
Green house based on Arduino and AI for societal benefit	Greenhouse based on Arduino and AI for societal benefit	The data has been tested for algorithms such as Naïve Bayes, C4.5 and SMO (svm).	(Nargotra & Khurjekar, 2020)

Smart Green House using ARDUINO and Cloud Computing	The intention of this project is to design a simple, easy to install, user friendly to monitor and record the values of temperature, humidity, soil-moisture and sunlight of the natural environment that are continuously modified and controlled in order optimize them to achieve maximum plant growth and yield.	KNN	(Bhagwat et al., 2018)
Automation of Hydroponics Green House Farming using ARDUINO	This paper discusses the collection and decomposition of waste in the smart way so that benefit from the waste is maximized and the actual waste is minimized efficiently.	ARDUINO is used to transfer the retrieved data to the internet (mass storage) and mobile app is used to communicate the current status to the user through the use of internet to their mobile phones, so that monitoring & maintenance will be easier	(Saraswathi et al., 2018)
Hydroponic Nutrient Control System Based on Internet of Things	measure nutrient levels in hydroponics	in the Nutrient Film Technique (NFT) technique using a couple of sensors	(Adidrana & Surantha, 2019)

3. RESEARCH METHOD

Using this method, the use of control technology is applied to the microcontroller to provide information, which is described in Figure 2, which consists of three layers: data acquisition layer, data transport layer, and data processing layer. Data acquisition is obtained from the generated signal, given a transport layer, the signal is forwarded to a data signal so that it can be recognized by media that can be recognized through cellphones. As well as data transfer on the research method using a host to host system

Figure 3. Architectural Research Methods ARDUINO

In this study, the authors used the Arduino data acquisition method, because it is suitable for the problems faced and trying to find novelty from the resulting research. The novelty is a Arduino combined with agriculture and computer networks method.

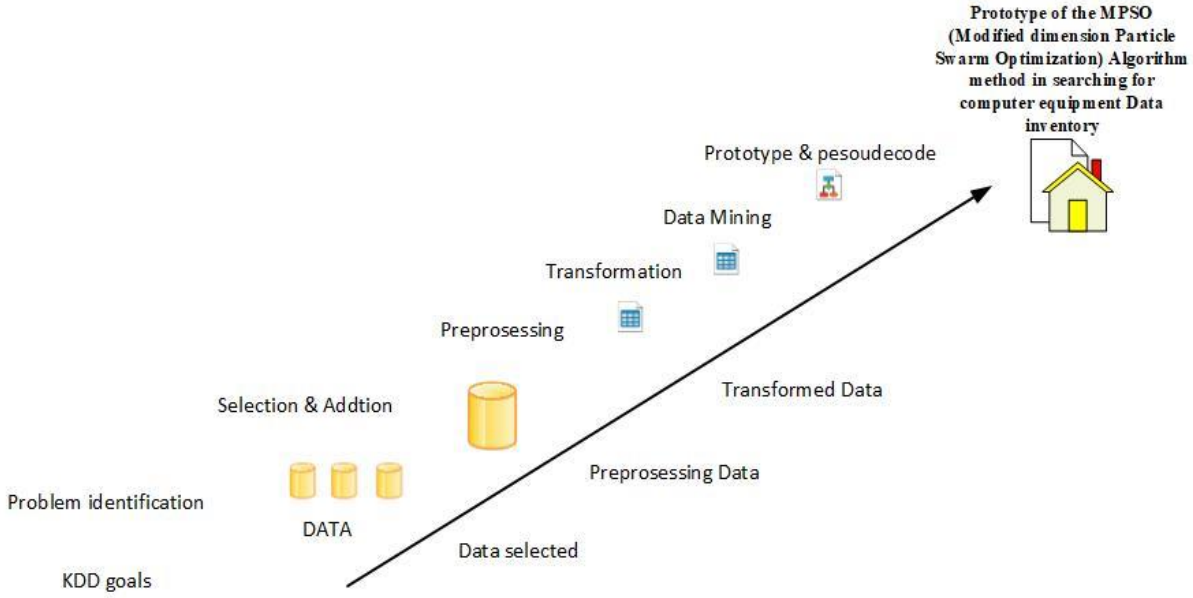

Figure 4. KDD Scheme

There is another term that has the same meaning as data mining, namely knowledge discovery in databases (KDD). Showed figure 4.

4. RESULTS AND DISCUSSION

At the design stage of this prototype, the use of hardware in the form of 2 Arduinos is used for host to host data communication and a compact power source sourced from solar panels. Arduino Uno which is connected host to host as data taker from sensors installed on it and the data is collected to the host server.The host to host communication line uses Tx and Rx, namely serial communication. As shown in Figure 5 there is a script that shows the transfer of data between one Arduino and another. The sensor that will be installed on each Arduino or host is a sensor related to the plant growth process and its measurement in the growing phase. Then after the data arrives at the Arduino it is collected to be sent and accessed by farmers.

```
void
setup()
{
        // put your setup code here, to run once:
        Serial.begin(9600); //start com baud rate 9600
        Serial.write("WELCOME \n");  //mengirim pesan serial
        }
        void loop(){
        while(Serial.Available()){  //activate
        Serial.read();  //read data
        Input data
        }
        }
```

Figure 5. Script to send Arduino Data With Arduino

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In Figure 6 you can see the relationship between the two Arduino Uno, the first Arduino takes a sensor from the surrounding environment the first Arduino, while the second Arduino takes a sensor in the second Arduino environment, the distance between the two Arduinos is noticed and measured after the two Arduinos can be connected to each other using serial communication , the use of serial communication, because this communication is wider in scope than parallel communication. Here is the main schematic image broken down.

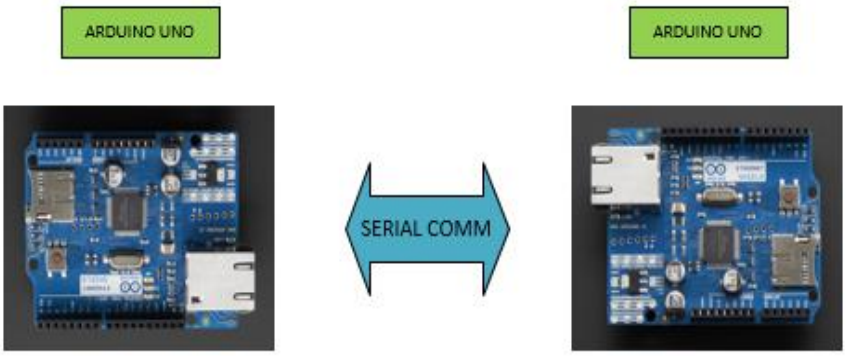

Figure 6. Arduino to Arduino Schemes

After the two Arduino Uno communicate in a distributed manner, which retrieves sensor data on each Arduino Uno's environment. Then the data is collected and given to Arduino Uno Central. And in the end it is collected and informed to the farmers. Various configurations associated with Arduino and compatible outputs can offer adequate solutions for measurement tasks and control systems can be found provided with the help of distributed computers. Distributed requirements, the system to be monitored and controlled must be concentrated with the appropriate components for measurement and control relatively close and within the scope of the cable connecting sensors and devices with Arduino.[10]. Through distributed system data communication between Arduino Uno, paired in pairs so as to get an area covered by the plant height sensor, sensor data can be captured and collected from each Arduino.

In figure 5, the Arduino Uno connection with ethetnet + GSM shield is one of the distributed systems or data connections that are collected from several Arduinos. The scattered sensor data is centered on the Arduino Master so that if it is collected. So that data can be provided to farmers.

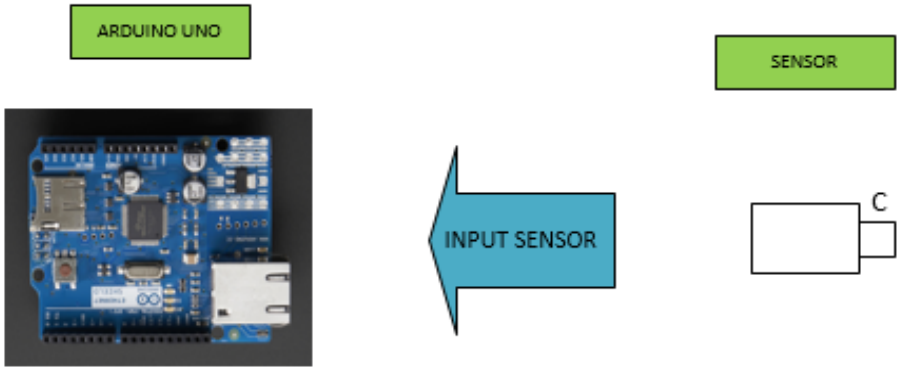

Figure 6. Arduino Schematic to The Sensor

The sensors used are the plant height sensor, to find out how high the growth of the planted plants is, the sensor of soil or soil moisture, then the sensor whether the fertilizer that has been spread is evenly distributed or not spread evenly All data from the sensors installed on the Arduino Uno, are conveyed to the data arduino master be a data base that is stored in storage on the Arduino master, and given / transferred to the Mobile in the form of information generated from these sensors.

Figure 7 illustrates the Arduino schematic of a proximity sensor that estimates the size of the height of the plant being planted, the size of this plant is the growth rate of the planted plant. The sensor used is a distance sensor from the time of planting to the time of planting or harvesting. This measure will be informed to the Arduino slave that the data is collected and will be transferred through a distributed system to the Arduino Master. From Arduino Master stored data from several Arduino slaves is collected. Stored and processed on thingspek to get information to be sent and viewed on iot, for future research.

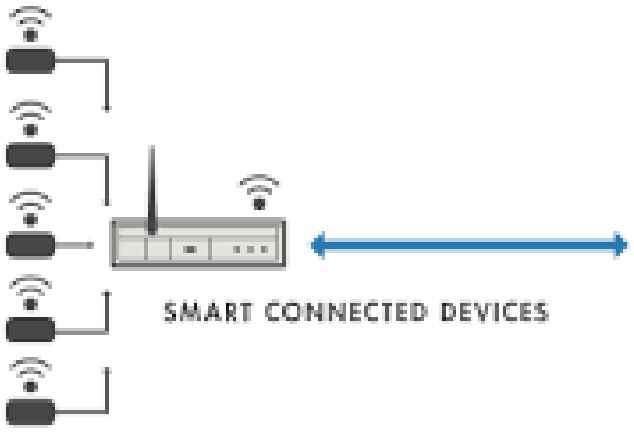

Figure 7. Scheme Distributed Arduino

Figure 7 describes the Arduino distributed system schematic from a proximity sensor that estimates the height of the planted plant, the size of this plant is the growth rate of the planted plant. The sensor used is a distance sensor from the beginning of planting to the time of seeding or harvest time.

The explanation in the image above is.

1. The brain of the distributed control system in the picture above lies on the Arduino, which functions to receive input from sensors.
2. Then through the Wi-Fi module of each arduino, the data is forwarded via WSN (wireless sensor network).
3. Using wireless media, here the distributed data media is continued with thingspeak, storing and processing data made of information patterns.

The measurement results will then be informed to the Arduino slave, the data will be collected and will be transferred through a distributed system to the Arduino Master. From the Arduino Master, the stored data of several Arduinos is collected. Storage on things to get information to be sent and viewed by the farmer's side. The development of distributed networks requires technology from three different research areas, namely wireless protocol technology related to the development of communication and communication devices and computing devices. The distributed wireless technology used in the computer network domain uses technology produced by vendors in the territory of Indonesia. In the development of the sensor used in this study, a proximity sensor was used, which can be seen in Figure 8. The sensor is easy to use and inexpensive.[12]

Figure 8. Proximity Sensor

The application of distributed networks in the agricultural sector and several applications are described in this paper. The different IEEE standards describing sensor networks, standards such as IEEE 802.15.1 PAN/Bluetooth, IEEE 802.15.4 ZigBee and thingspeak , are a topic of discussion in the future and there is much more to be aware of when planning their implementation. Future implementations also allow discussing IPv6, the Internet Protocol. And also a lot of hardware and software systems to support building distributed network technology. By using network technology, agriculture enables precision in the strategies used for crop management. Different real-time data is recorded by sensors and stored in the system. This distributed system was created to study previous data and data that will occur in the future. [13]

The flowchart flow can be seen in the picture 8.

Figure 9. Flow Chart ,Client Server , Arduino Master

Plant height sensor, This sensor refers to the growth of the plant on. The sensor that will be proposed later is that this humidity is very helpful for warning plant moisture levels or monitoring soil moisture[4]. From the research that has been done, it can be seen that, the results of a field survey to determine the specifications of the Solar Panel system require load data, daily loading hours, solar panel capacity, and required irrigation accuracy [11]. Because the power supply needed by Arduino Uno is not too big. Only 5 volts, so solar panels are enough to supply this power. In the prototype of this tool using several arduinos, Arduino sends data called arduino server. Ardino client receives data. In table 2, are the results of the experimental measurement of the communication prototype between the Arduino distributed system.

Table 2. Arduino to Arduino Distance Accuracy

No	Distance(m)	Status Data		Information
		On	Off	
1	50	√		RTO 0%
2	100	√		RTO 15%
3	150	√		RTO 30%
4	200		√	RTO 90%

5. CONCLUSION

The results of the information from collecting data from several Arduinos will be used by farmers to become data for evaluating the crop cycle for one period. By using data communication between 2 devices that are located far apart by using computer technology and communication technology as agricultural information. The communication distance between

Arduino is also a concern, because it is in accordance with the experiment. The safe distance for communication is under 50 meters

6. REFERENCES

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