AUTOMATION SYSTEM BASED ON ARDUINO
(Case Study in AQUAPONIC TOURISM VILLAGE)

Apito Wahyu Harsoyo, Setiyo Adi Nugroho
Undergraduate Computer Systems Study Program
College of Electronics and Computers
Email: D0g008003@gmail.com

ABSTRACT

Problems often faced by Perum Kandri residents regarding Aquaponics during the dry and rainy seasons. Residents still use tarpaulins to cover aquaponics manually, and feeding is still done manually. Aquaponic maintenance tools can be a solution for residents, to detect temperature and raindrops automatically, the author uses a DHT temperature sensor, raindrop sensor, RTC, mini servo, continuous servo and Arduino Uno R3 to design this maintenance tool. The tool that the author created can handle hot temperatures and during the rainy season, as well as feeding fish automatically , thereby reducing the possibility of the danger of death to vegetables and fish . The writer's tool can also close the roof automatically if it rains or hot during the day.

*Keywords : DHT Temperature Sensor, Raindrop Sensor, RTC, Mini Servo, Continuous Servo, Arduino Uno **R3** .*

1. INTRODUCTION

Along with the times and increasingly advanced technological developments, people's need for certain tools is also increasing. So many tools have been created with innovative technology to support the needs of society. Whether used for business purposes, government agencies, academics and many more. Many corporate agencies and society are increasingly relying on technology to make work easier and can also be used as a security tools for companies and society. This makes people compete to create tools with the latest technology. Including the technology applied in Aquaponics.

Currently there is one study group which is attended by many people in Central Java who are involved in the world of Aquaponics, namely "Learning Aquaponics Indonesia (BAI JATENG)" . This learning facility was formed as a forum for consultation between aquaponics enthusiasts. With this, people know that fish farming can be compared with farming. Apart from that, even among entrepreneurs who are involved in aquaponics, they don't want to stop finding out and gaining knowledge about aquaponics. By cultivating and raising aquaponic fish , they admit that the products produced, such as vegetables, are fresher than the products they take from conversional farmers, this is because the vegetables get nutrients from fish ponds. Therefore, many housewives, traders and business people are interested in it.

In this community, many problems are often discussed in the chats of community members both when they meet in seminars, on social media and electronically. Common problems that occur in hydroponics are hot temperatures during the day, excessive water levels (during the rainy season) and others. It's not just plants that are often discussed, fish care is also very important. This is because plants also need nutrients from the fish pond.

In some of the problems above, the author will examine a problem that occurs in the aquaponics study group located at Balai RW IV, Perum Kandri Pesona Asri Gunungpati-Semarang, namely problems that occur during the dry season. The dry season, apart from reducing the volume of water, also affects temperature stability. pool water. Days can be very hot, while nights can be very cold. To deal with the dry season which causes many catfish to experience disease and sudden death. Therefore, residents still use tarpaulins to manually cover the pool from hot temperatures. white mouth disease , white stripes, which are mostly caused by viruses and fungi. Not only does this happen to fish, it can also make mustard plants turn yellow and infertile. Because mustard plants need cool air to grow and grow faster if planted in a humid atmosphere. And also problems that occur during the rainy season, because excess water supply to mustard plants will cause the plants to look yellow, growth is stunted, thin and then the plants will die. For catfish ponds, there is also concern that if an excess water supply results in the pond becoming full, which will then cause the catfish to jump out of the pond, and in terms of feeding it will still be done manually.

The author conducted this research with the aim of reducing the problems that occur in aquaponics, namely increasing water temperatures above normal and also increasing water supply during the rainy season. The solution that the author will create is an Automatic Plant and Fish Pond Maintenance Tool with Continuous Servo Motor Drive, Mini Servo, RTC, HL-83 Raindrop Sensor and Using Arduino Mega. The supporting modules for this tool are Arduino Uno, continuous servo, mini servo, RTC, and raindrop sensor. This tool has a working principle, namely during the dry season or during the day. Then the RTC which has been set at a time will automatically move the protective roof which aims to keep the plants and fish ponds shaded. Likewise, during the rainy season, the HL-83 raindrop sensor will detect raindrops and then the protective roof will automatically cover the plants and fish pond. RTC will also open the lid of the fish food container when it is time to feed the fish .

2. RESEARCH METHODOLOGY

The development model used is a development method based on considerations of suitability and the nature of the research being carried out, namely *the Research and Development (R&D)* method . This research consists of several stages, namely as follows:

a. Potential and problems , research begins with the existence of a potential or problem. Potential is anything that, if utilized, will have added value. Problems can also be used as potential, if you can utilize them. Problems will occur if there are deviations between what is expected and what happens . This problem can be overcome through R&D by researching so that an effective model, pattern or integrated treatment system can be found that can be used to overcome this problem.

b. Data collection , after potential and problems are then collected various information and literature studies which can be used as material for planning certain products which are expected to overcome these problems. This study is aimed at finding concepts or theoretical foundations that strengthen a product. On the other hand, the literature study will examine the scope of a product, breadth of use, optimal conditions, as well as its advantages and limitations. Literature studies are also needed to find out the most appropriate steps in developing the product.

c. of product designs , products resulting from R & D research. To produce a new work system, a new work design must be created based on an assessment of the old work system, so that weaknesses in the system can be found . In addition, research is carried out on other units whose work system is considered good and must review the latest references related to the system. modern work and indicators of a good working system . The final result of this activity is a new product design complete with specifications. This design is still hypothetical because its effectiveness is proven, and will be known after going through tests. The product design must be realized in pictures or charts, so that it can be used as a guide for assessing and making it, and will make it easier for other parties to understand it.

d. Design validation is an activity process to assess whether the product design, in this case a new work system , will rationally be more effective than the old one or not. It is said to be rational, because validation here is still an assessment based on rational thinking, not field facts. Product validation can be done by bringing in several experienced experts or experts to assess the design, so that the weaknesses and strengths can then be identified .

e. Design revision , after the product design has been validated through discussions with experts and other experts. Then you will know the weaknesses . These weaknesses were then tried to be reduced by improving the design. Those tasked with improving the design are the researchers who have produced the product.

f. Product testing , product designs that have been created cannot be tested immediately. But it must be made first, produce the product and the product is tested. The study can be carried out by experiment, namely comparing the effectiveness and efficiency of the old work system with the new one.

g. Product revision , product testing on a limited sample shows that the performance of the new work system is actually better than the old system. The differences are very significant, so the new work system can be implemented.

h. Use trials , after testing the product is successful and there may be revisions that are not too important, then the product in the form of a new work system is then applied in real conditions for a wide scope. In the operation of the new work system, deficiencies or obstacles that arise must still be assessed in order to make further improvements.

i. Product revision , this revision is based on input from usage trials. This step will further refine the product being developed. Refining the final product has resulted in a product whose level of effectiveness can be accounted for.

j. Mass production , this is done if the product that has been tested is declared effective and suitable for mass production. For example, making a machine to convert waste into useful materials will be produced as long as it is based on feasibility studies from technological, economic and environmental aspects. So to produce it, researchers and entrepreneurs must work together .

3. **RESULTS AND DISCUSSION**

Based on the results of research conducted in the Aquaponics Village at Perum Kadri Gunung Pati, Semarang, which is managed by Mr. Syafei about how to maintain aquaponics, the difficulty of maintaining aquaponics for hobbyists or aquaponics enthusiasts who are busy working or even traveling for long periods, which can result in the death of plants and fish due to hot temperatures during the dry season and heavy rain during the rainy season, as well as feeding the fish. still done manually.

The working principle of this tool is that users only need to connect this tool to electricity then it will work automatically. In the morning and evening, fish feeding can be

done automatically using the time specified in the RTC, then moving the mini servo to open the valve of the fish food container. in the afternoon, driven by a continuous servo, the temperature sensor will turn on the LED if the temperature at that time is very hot. The Rain Sensor functions to maintain the water supply when it rains. If the rain sensor is hit by water droplets when it is raining, the roof cover which is moved by a continuous servo will cover the aquaponics.

From the explanation above, the difference between the old and new systems lies in the involvement of human power. In the old system, humans were fully involved in the aquaponics maintenance process directly, whereas in the new system, hobbyists do not need to worry about doing other activities or traveling for long periods of time.
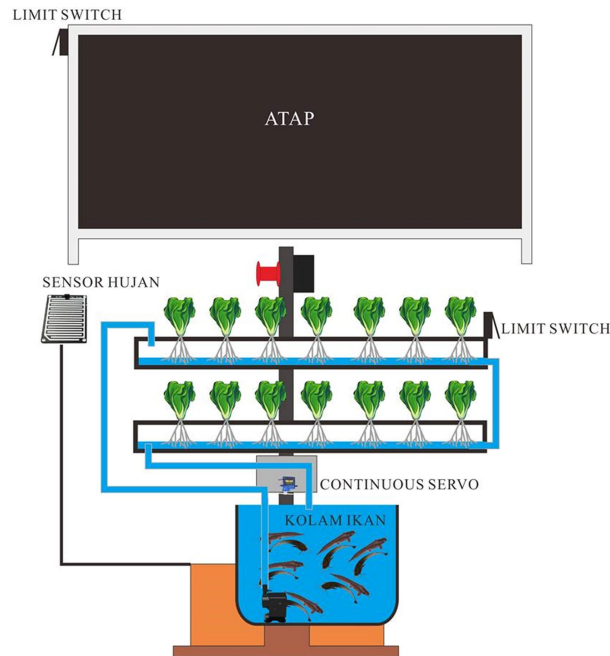
3.1 Design Scheme to be Built

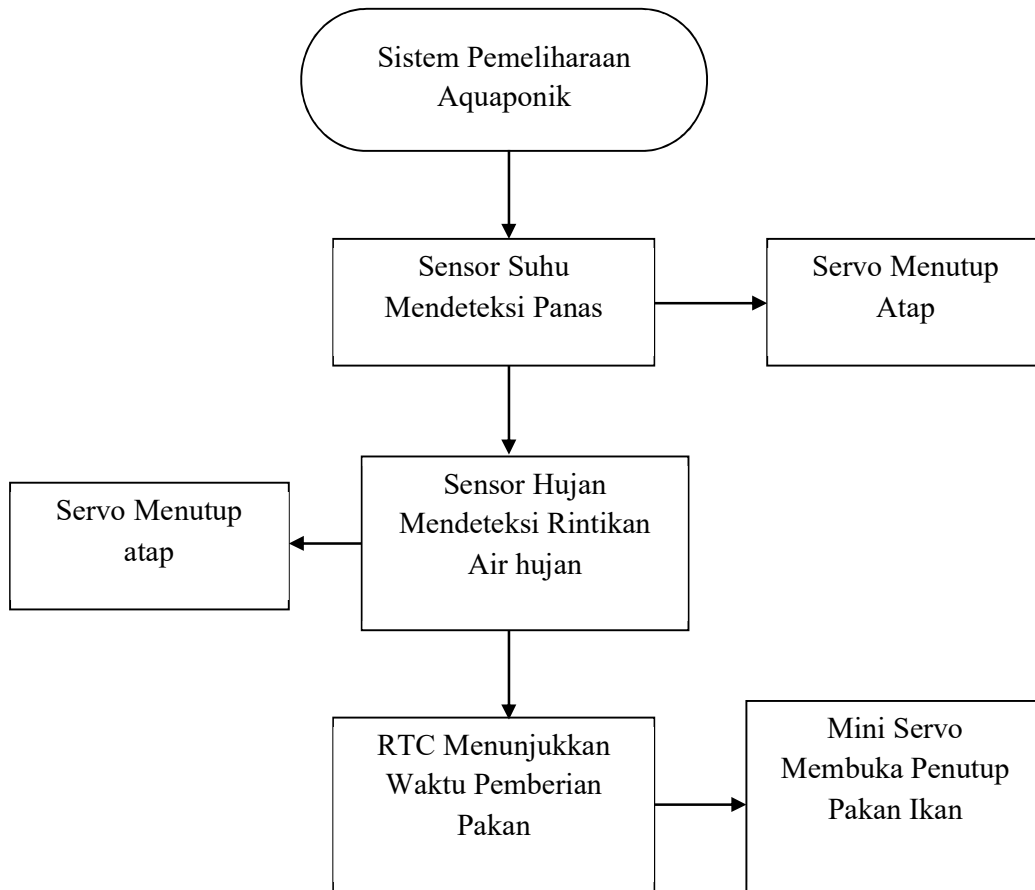**Figure 1. Scheme of the design to be built**

3.2   Tool Workflow Diagram

```
           ┌─────────────────────┐
           │  Sistem Pemeliharaan │
           │     Aquaponik        │
           └─────────┬───────────┘
                     │
                     ▼
     ┌──────────────────────┐        ┌──────────────────┐
     │    Sensor Suhu        │───────▶│  Servo Menutup   │
     │  Mendeteksi Panas     │        │      Atap        │
     └──────────┬───────────┘        └──────────────────┘
                │
                ▼
┌──────────────┐   ┌──────────────────────┐
│ Servo Menutup│◀──│    Sensor Hujan      │
│    atap      │   │  Mendeteksi Rintikan │
└──────────────┘   │     Air hujan        │
                   └──────────┬───────────┘
                              │
                              ▼
     ┌──────────────────────┐        ┌──────────────────┐
     │  RTC Menunjukkan      │───────▶│   Mini Servo     │
     │  Waktu Pemberian      │        │ Membuka Penutup  │
     │     Pakan             │        │   Pakan Ikan     │
     └──────────────────────┘        └──────────────────┘
```

Figure 2 . Working principle of the tool

3.3   RTC and mini servo testing

Figure 3. Open and Closed Feed Cover

Figure 3. When the RTC shows the feeding time, the feed container cover which is initially closed is then moved by a mini servo and the feed container opens

3.4   **Rain Sensor and Continuous Servo Motor Testing**

Figure 4 . Open and Closed Roofs

Figure 4 . When the rain sensor is dry, the roof is open. Then, when the rain sensor is wet, the roof cover, driven by a continuous servo motor, will close.

3.5   **DHT and Continuous Servo Motor Testing**

Figure 5. Open and Closed Roof

Picture. When the DHT shows excessive heat during the day, the roof will close to protect Aquaponics from hot temperatures. The roof will open again when the temperature is felt to have dropped.

3.6   **Research result**

Figure 6. 3 week old mustard greens

In picture 6 you can see mustard greens that are ready to be harvested. The leaves are very wide and numerous. The trunk is very large. The roots are also very dense. From direct observations of the plants above, all the plants

looked fertile from the first time the plants were transferred to hydroponic growing media until the plants were 3 weeks old and ready to be harvested. So the effect of the tool that the author created is very helpful for residents in maintenance I have a pony. The result is more fertile plants and better fish growth .

4. CONCLUSION

Based on the results of tests carried out by experts, this product received a score of 2.3 which is considered good. Meanwhile, testing by the aquaponics owner got a score of 2.5, which is also considered good. So the conclusions from the research that has been carried out are:

1. Mini Servo is able to open and close fish food containers based on commands from RTC .
2. Continuous servo is able to move the roof cover when it rains and also during the day based on input from the rain sensor and DHT .
3. This aquaponic maintenance tool is able to minimize excess water in the fish pond, and is able to keep the plants shaded.
4. From the results of planting mustard greens, aquaponic maintenance tools are able to reduce yellowing mustard plants.

BIBLIOGRAPHY

Al fatta, Hanif, 2007; *"Information Systems Analysis and Design"* , Yogyakarta : Andi Offset.

A. S, Fathulloh, 2015; *"Aquaponics Harvest Vegetables, Bonus Fish"* , Jakarta: Self-Help Distributor

Hansen and Mowen , 2009 : " *Managerial Accounting"* , Jakarta: Gramedia Pustaka Utama

Puspitawati , Lilis , and *Anggadini, Sri Dewi , 2011* ; *"Accounting Information Systems* " *,* Yogyakarta: Graha Ilmu

Rachmat, Antonius, 2010; *"Algorithms and Programming with C Language"* , Yogyakarta : Andi Offset.

Sugiarto, Teguh, and Ismawati, Eny, 2008; *"Natural science"* ,
    Jakarta: Grasindo.

Sugiyono ,, 2010; *"Quantitative Qualitative Research Methods and R&D"* ,
    Bandung: Alphabeta.

Suryani, Reno, 2015; *"Easy Hydroponic Plant Cultivation Without Soil,
    Clean and Fun"* , Yogyakarta : ARCITRA.

Syahwill, Muhammad, 2013; *"Easy Guide to Simulation and Practice
    Arduino Microcontroller"* , Yogyakarta: Andi Offset.

Watiningsih , Tri , 2015; " *Controlling Watering Time in Plants
Aquaponics Using IC 555",* Purwokerto : University
    Wijayakusuma.