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Automatic System to Fish Feeder and Water Turbidity Detector Using Arduino Mega

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Abstract. This tool system works automatically, which functions to feed the fish and detect the water turbidity. The fish that being feed and the water that is detected are in Aquarium or in Pond. Input for this tool are RTC (real time clock), Turbidity sensor and on/off button. To start or turn off the tool is used on/off button, to feed the fish automatically is used RTC component and to detect water turbidity is used turbidity sensor. Output for this tool is an LCD (liquid crystal display) display, Buzzer, Servo Motor and LED (light emitting diode) component. To display information in writing format is used LCD display, to sounding information in sound format is used buzzer, to move waterways door and foodways door is used servo motor and to indicate the tool is activated and processing is used LED component. The main component of controlling all component and program in this tool is Arduino Mega 2560. To make a tool program that will install in Arduino Mega is used C programming language for Arduino. By using this tool, will make activity in feeding the fish and detect turbidity of water be more effective, more efficient and easier than manually.

1. Introduction

Basically, The human has two behaviors they are social behavior and selfish behavior. As social creatures, human need friends in daily life for sharing each other and playing together. As selfish creatures, the human need to fulfill all of they want and hard to different idea whit the others. Friends of human can be in the form of human or an animal. An animal raised by human called pets. Besides raising an animal, human also cultivating animal. One of the pet that being raising or cultivating by the human is fish. For raising pets for example fish, people usually raising fish in an aquarium and for cultivating example fish, people usually cultivating in a fish pond.

When raising fish in an aquarium or cultivating fish in a fish pond, we need to feed it. The fish should be feed every day for minimum 4 times a day and maximum 8 times a day [1]. That activity can be done manually or automatically. By manually, we should prepare the food that will be feeding every time before we want to give them and we should go walk to the place where the fish that will be feed if we want to give feed eight times a day then we should prepare and go there eight times too. That daily activity will spend too much our time, energy and mind every day so that it's not effective and not efficient.

Pets not only need feed but it but also need environment. Environment means everything around creatures like soil, water, air, etc. The environment of pets is in many forms depending on the kind of pets. For example, birds need cage or fish need water. Water for fish need container to place that water like an aquarium or pond. Water that is the environment for fish must clean without dirt of fish, dust or



many others. With clean water, the fish will feel enjoy and health so that fish like to eat very much feed and breed so many [2].

Nowadays the development of technology is growing very fast. Many fields of technology are growing very fast like technology in telecommunication, computer and robotic. About telecommunication technology has changed the generation of communication from the 1G signal into the 5G signal. About computer technology has changed the generation of the microprocessor from 1st generation into the 8th generation. About robot technology has changed the controlling from manual controlling into automatic controlling [3]. With the growth of technology makes human activity faster, easier and more accurate.

Robot technology can be applied in raising fish in an aquarium or cultivating fish in a pond [4]. Especially in how to feed the fish and how to detect the turbidity of water in aquarium or pond. We can feed the fish automatically for 8 times a day and we can detect the turbidity of water 2 times a day. This tool is very used full to help us to feed fish and change the schedule of water. We don't need more energy, more time and more mind to handle that activity.

This tool has an impact on the ease, speed, and accuracy of activities in giving fish feed and detecting turbidity of water. In terms of providing fish feed, this tool has an impact:

- It's easier because humans don't need to go to places where fish are like aquariums or ponds when they want to feed fish.
- Faster because humans do not need to remove, distribute and store feed again.
- More precisely because humans don't need to doubt when to feed fish.

In terms of detecting water turbidity, this tool has an impact:

- It's easier because humans don't need to directly detect turbidity of water into the aquarium or pond.
- Faster because detection uses sensors instead of the human eye.
- More precisely because measuring sensors is more accurate than human measurements.

This tool is highly recommended for people who have a hobby of raising fish or fish breeders so that it can be used to facilitate, accelerate and ensure the maintenance of fish in aquariums and fish ponds.

In this research we will answer the following questions remain:

1. How does the automatic fish feeder system work by using Microcontroller Arduino Mega?
2. How does the automatic water turbidity detector system work by using Microcontroller Arduino Mega?
3. How does the automatic system send the output signal to LED, LCD, buzzer and servo motor?
4. How does the program control all input, output, and microcontroller work well?

This paper organization are: first introduction and background, second literature review, third methodology, forth the result, fifth the discussion, sixth the conclusions.

2. Literature Review

2.1. System and Automatic System

The system is most often used to refer to methods or paths and something set or component that is interrelated with each other into a single unified whole. The system is a set of elements / which are interrelated and influence each other in carrying out joint activities to achieve goals. The System that has a section called a system or subsystem component. In general, the system has inputs needed by the system for the process and will produce outputs or outputs that contain information [5].

A bookkeeping system as an example of A manual system is which records maintenance is done by handwriting, without using a computer system or any automatic system anymore. In this system type, the transactions are written in journals, that information is manually retrieved into a set of financial statements. These systems have a higher rate of inaccuracy, and much slower than computerized systems [6]. The definition of an automated system is a combination of software and hardware which is designed and programmed to work automatically without the needs of any human operator that use to provide inputs and instructions. Automated systems allow you to monitor your

processes in real time and identify problems as they arrive, enabling quick adjustments along the way. [7]. As shown in figure 1.

2.2. Fish Feeder

As a creature, Animal need food. Food should be eaten every day. It can be eaten for one a day, twice, triple or more a day. It depends on kinds of animal. Especially for fish. It can be eaten for 4 until 8 times a day. More food that is eaten can make fish bigger and health. It is essential for fish that be pet or cultivating [8].

2.3. Water Turbidity Sensor

The sensor of water turbidity is a sensor that can determine turbidity level of water that is around it. This sensor emits light from the LED then captured by the sensor receiving the light brightness level [9]. The higher the brightness of the light received by the sensor, the cleaner the water, the lower the brightness of the light received by the sensor, the dirtier the water is [10]. As shown in figure 2.

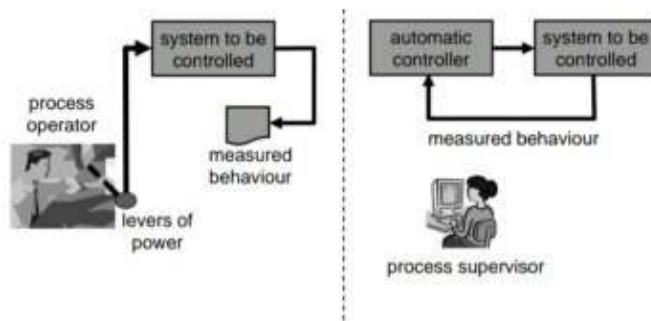


Figure 1. Manual system and automatic system

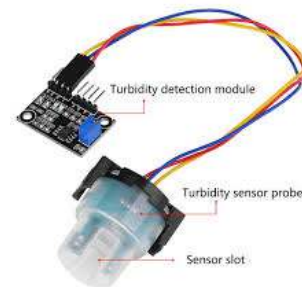


Figure 2. Water turbidity sensor

2.4. Arduino Mega

A single source microcontroller named Arduino is open source. Wiring platform derived and facilitate electronic use designed in various fields. This hardware has an Atmel AVR processor and its own programming language software. At present Arduino is very popular throughout the world [11]. Arduino is used by many beginners to learn about robotics and electronics because it is easy to learn. Not only are the beginners using Arduino but the professionals and hobbyists also develop Arduino. The programming language used in Arduino is a simplified C language with the help of Arduino libraries [12].



Figure 3. Arduino Mega 2560 board

3. Methodology

3.1. Research Framework

Research framework is the concept or stages that will be carried out in the study. To create new technology or information that can improve the effectiveness of products or make the production of

products more efficient we need research (R) and development (D). R & D are more important to some companies than to others. For example, a computer software company would spend much more on R & D than a retail sales company would [13]. Technology companies survive by developing more effective technology than their competitors Research and development is a research method used to produce certain products and test the effectiveness of these products. Related to the characteristics of R & D research, Borg and Gall (1989) explained 4 main characteristics in R & D research [14], namely:

1. Studying research findings pertinent to the product to be developed
2. Developing the product base on this finding
3. Field testing it in the setting where it will be used eventually
4. Revising it to correct the deficiencies found in the field-testing stage

For the framework that will be carried out in this study can be seen in figure 4. below:

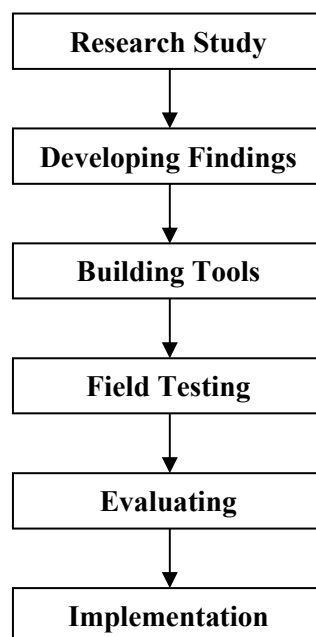


Figure 4. Research framework

3.2. Research Framework Details

The following are details of frameworks namely:

1. The Research study is several phases they are design, performance, analysis, and reporting. The first critical step to ensure the validity of the obtained results is The Careful study design [15]. In this research, a research study is done by observing human activity to feeding fish and clean water in an aquarium or pond.
2. Developing Findings. Developing Findings. The principal outcomes of a research project are Findings, what the project suggested, revealed or indicated.[16]. The totality of outcomes is usually referred to this, rather than the conclusions or recommendations drawn from them [17].
3. Building Tools. Tools should be built in order to the finding can be solved and implement it in the real world.
4. Field Testing. The tools that have been built should be tested in the field. In this research the tool that is testing in an aquarium or pond. We can see how the tool run and value that will appear at testing.
5. Evaluating. When we do field testing we also should evaluate the result of tools. Are the tools run as planning or not? If it is yes, then the tool is correct but if it is not we should fix the missing of the tool.

6. Implementation. Implementation is applying the tool in the field for a long time. In this case, we apply the tool in an aquarium.

4. Result

4.1. Context Diagram (CD)

In analyzing an object, the first thing to do is to define it thoroughly, especially the system to be designed. This means that there must be a clear picture of the scope to be discussed. The media used for the discussion of this system is the context diagram [18]. The context diagram in this system is in figure 5 below:

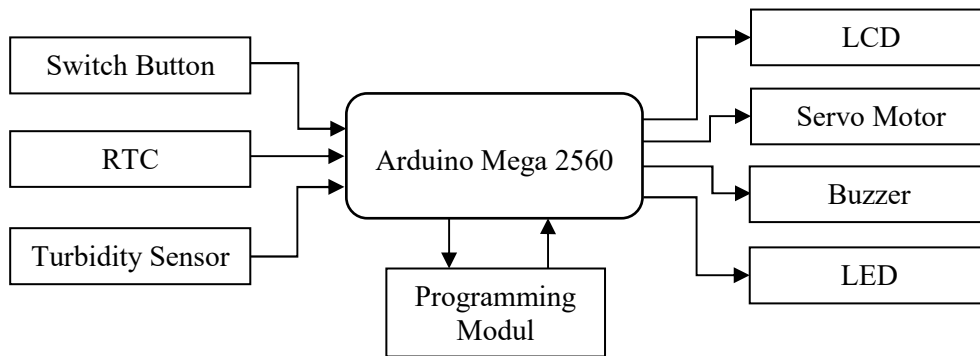


Figure 5. Context Diagram

4.2. Data Flow Diagram (DFD)

The data flow diagram is detailed picture of the tool designed. This DFD is a programming workflow on the automatic system to fish feeder and water turbidity detector using Arduino mega. The data flow diagram as follows:

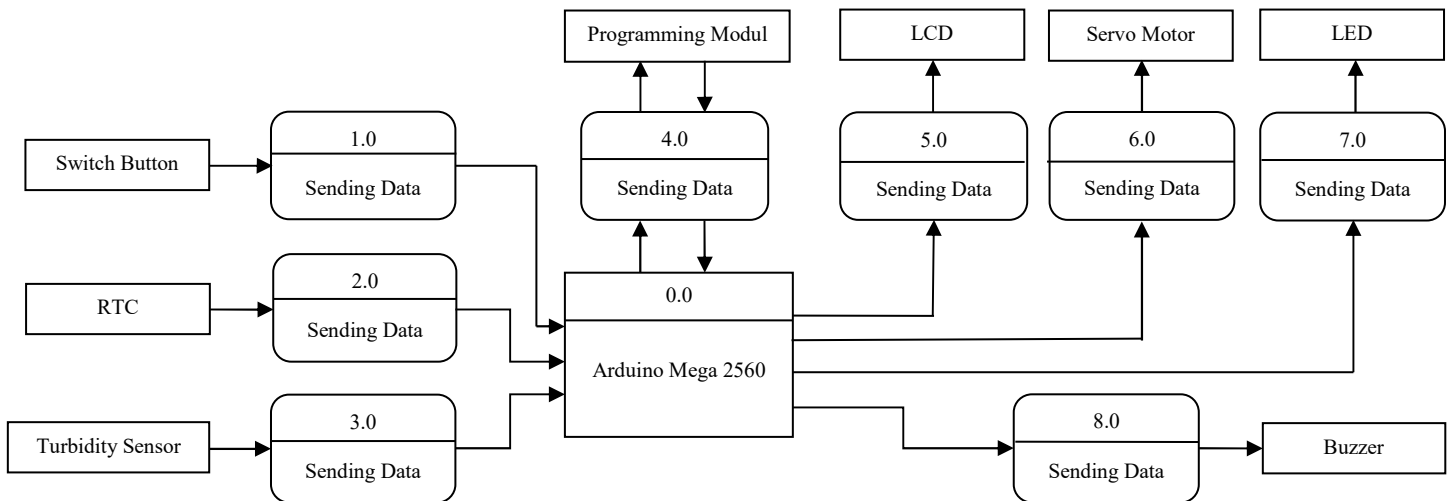


Figure 6. Data Flow Diagram

4.3. Block Diagram

A diagram of a system in which principal parts or functions are represented by blocks and connected by lines that show the relationships of the blocks named block diagram. They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams. Block diagram of this tool as follows:

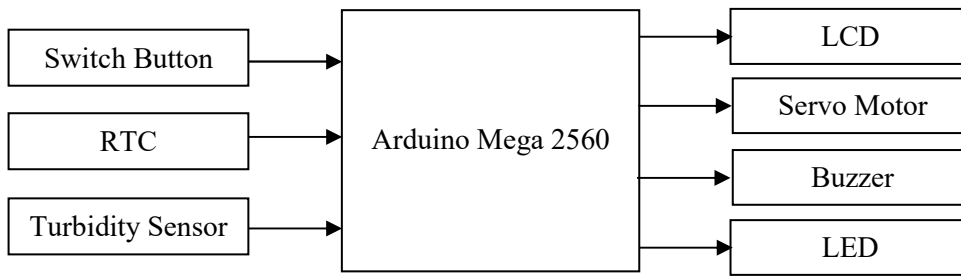


Figure 7. Block Diagram

4.4. Flow Chart

A diagram that depicts a process, system or computer algorithm named flowchart. Flowchart widely used in multiple fields to document, study, plan, improve and communicate often complex processes in clear, easy-to-understand diagrams. Flowcharts, sometimes spelled as flow charts, use rectangles, ovals, diamonds and potentially numerous other shapes to define the type of step, along with connecting arrows to define flow and sequence. The flowchart can range from simple, hand-drawn charts to comprehensive computer-drawn diagrams depicting multiple steps and routes. Flow chart of this tool as follows:

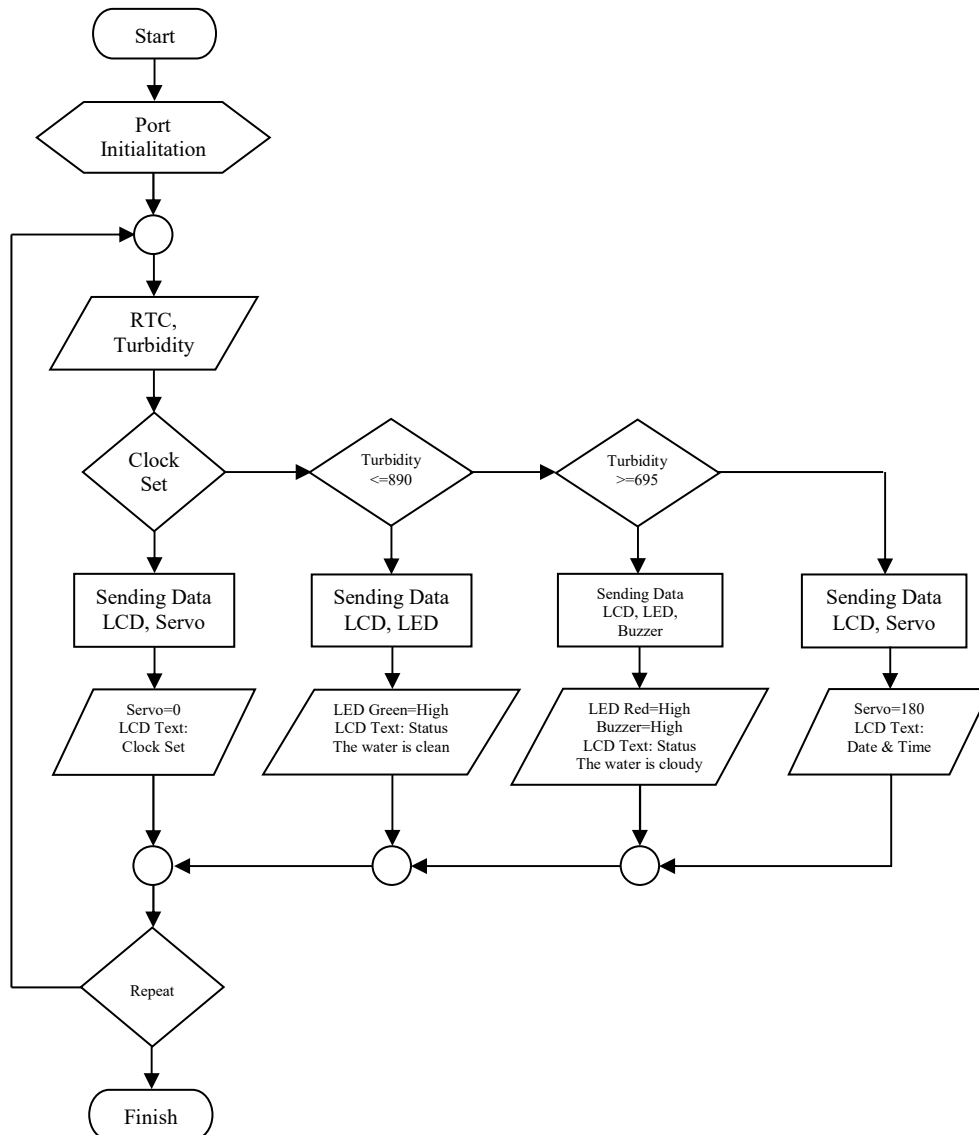


Figure 8. Flowchart Diagram

4.5. Tool Works Principle

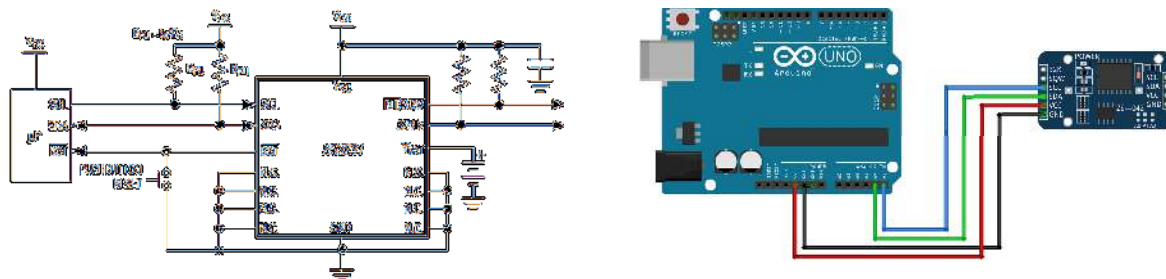
Tool work principle is the steps of how the tool works. The tool works principle as follows:

1. Keypad function is to set time for feeding the fish.
2. After setting the time the RTC will save the time and date before Arduino Mega doing the process of input that is given
3. When the time to feeding the fish is coming, Arduino mega will process in the formatted text on LCD (*Liquid Crystal Display*) size 16 x 2 as output whit the message "TIME TO EAT".
4. Servo motor directly works as instruction that is given by Arduino mega.
5. After processing feeding the fish is finish than LCD will show the message "TIME TO EAT IS OVER".
6. Turbidity sensor as input sending data to microcontroller Arduino mega.
7. If the turbidity sensor detects the turbidity of water then the tool will be sent output to the buzzer and LED.
8. Then LCD will show a message "TIME TO CHANGE WATER".

5. Discussion

5.1. Real Time Clock (RTC)

This tool use RTC DS3231 component to set time like date, month, year and clock. It is very important because is needed to scheduling the time to give the fish feeding. The component circuit, PCB design and wiring of RTC 3231 as follows:

**Figure 9.** Component circuit, PCB design, and wiring of RTC 3231

5.2. Turbidity Sensor

This tool use turbidity sensor to detect the turbidity of water. It is very important because is needed to scheduling the time to clean the water. The component circuit, PCB design and wiring of turbidity sensor as follows:

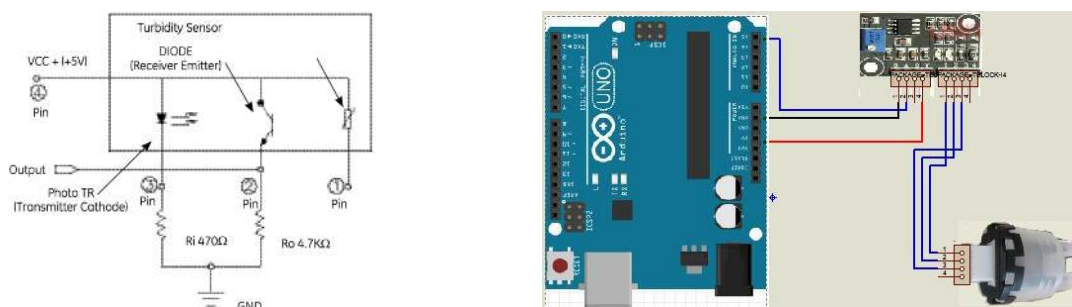
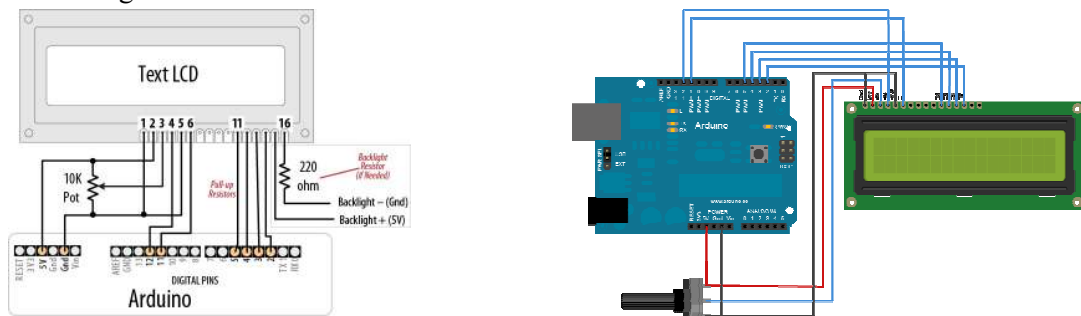


Figure 10. Component circuit, PCB design, and wiring of Turbidity Sensor

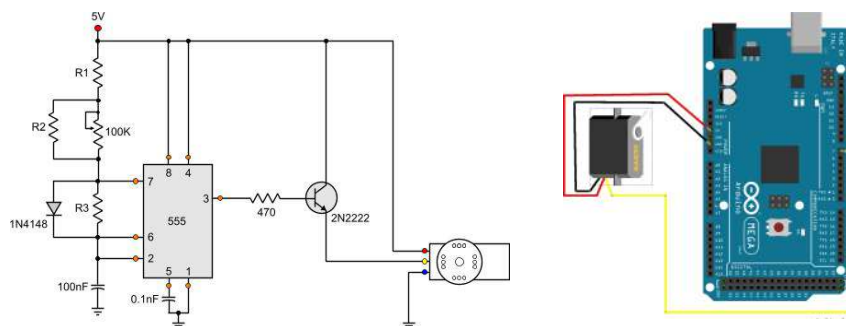
5.3. LCD Display

This tool uses an LCD display to inform the user in text format. It is very important because it needed to show the necessary information about tool condition in text format. The component circuit, PCB design and wiring of LCD as follows:

**Figure 11.** Component circuit, PCB design, and wiring of LCD

5.4. Servo Motor

In this series the servo functions to move an actuator that is in a fish-eating place so that it can work automatically when feeding the fish in accordance with predetermined provisions. At this network, the buzzer works for sound indicator or marker when the water in the aquarium begins to cloudy according to the one specified. Servo and buzzer is connected to a microcontroller. The component circuit, PCB design and wiring of servo motor as follows:

**Figure 12.** Component circuit, PCB design, and wiring of Servo Motor

5.5. Buzzer

In this series the buzzer functions for sound indicators or markers when the water in the aquarium starts to muddy according to what has been determined. The buzzer is connected to a microcontroller. The component circuit, PCB design and wiring of buzzer as follows:

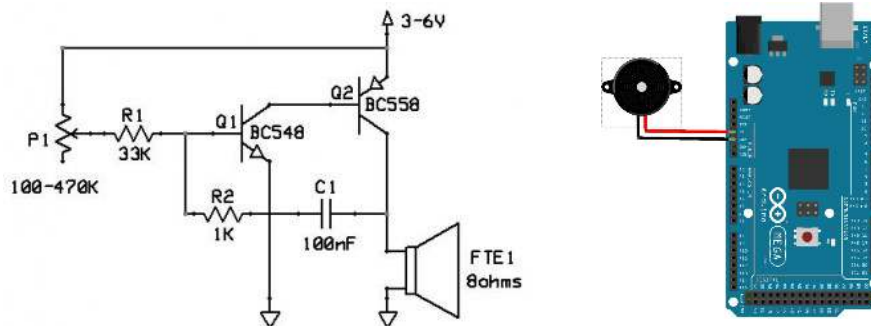


Figure 13. Component circuit, PCB design, and wiring of Buzzer

6. Conclusion

From this research we can conclude some conclusion they are:

1. The design and manufacture of hardware in automatic fish feeding and water turbidity detection based on Arduino Mega 2560 and RTC has been carried out. The parts of the tool that have been made consist of a microcontroller can function to control a system programmed.
2. The making of software has been done and is able to control the work of the microcontroller as a controller of the time of feeding the fish which input time from the RTC.
3. Turbidity sensor serves as a detector of water turbidity in an Aquarium, this sensor will send a signal to the Arduino Mega 2560 microcontroller. Next, the microcontroller will send an output signal to the buzzer as a reminder that turbidity in the aquarium has been detected as specified.

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