Arduino-based Catfish Seed Counter Read on Mobile Devices

Erinda Febrian Ike Putri¹, M. Nourman Hadi², Umi Masfufah³, Moechammad Sarosa⁴

¹²³⁴Digital Telecommunications Network, Electrical Engineering, State Polytechnic of Malang
³ Telecommunication Engineering, Electrical Engineering, State Polytechnic of Malang

Email: ¹1erindafebrian3@gmail.com, ²umimasfufah95@gmail.com, ³muhammadnourman@gmail.com, ⁴msarosa@polinema.ac.id

Abstract. The calculation of catfish seeds is done conventionally, by sorting the size of seed catfish using a tub hollow then manually calculate the number of seeds. Because the development of catfish is often not the same, in which some fish seeds grow faster than others, so the farmers have to sort the fish seed according to its size. On the other hand, if the size of the fish is relatively the same, sorting fish is done to avoid the possibility of large fish eats smaller fish. With these problems, a tool is developed to sort the fish seed by size. Sorting technique is done mechanically using a hole line trajectory with small, medium and large size. The prototype is made using hole sizes with diameters of 6, 8 and 10 mm. After sorted by the size, calculation is done on each size group by utilizing an electronic circuit using photodiode sensor. The calculations were performed using Arduino Uno based on information from the photodiode sensor, and the results are displayed on the LCD. To make it easier to see the results of the calculation then the calculation results are also shown on the smartphone. By using the ESP8266 Wi-Fi module, the calculated data is sent to the server to be read using application on the smartphone. Test results showed that the process of sorting the seeds of fish based on the size went accordingly and the seeds are classified according to size. Moreover, the test of electronic calculation yielding the percentage of small fish seed count error 0%, medium 1%, and big 0,64%, so that the average error is 0,56%.

Keywords: Catfish Seeds, seed sorting, seed counting, Arduino, wifi module ESP8266

1. Introduction

Fish and aquatic animals are foods that contain lots of protein and are consumed by humans since a few centuries ago. The Ministry of Marine Affairs and Fisheries Republic of Indonesia (KKP) continues to improve its role in supporting national food security. Fish-based food products are now become the mainstay, as shifting consumption patterns of red meat-based protein to white meat protein (fish) begins. Currently, Indonesian fish consumption only reaches 40 kg per capita per year. This value is still far below the level of use of other countries such as Japan which reached 110 kilograms per capita per year, and Malaysia which reached 70 kg per capita per year. Therefore, the KKP projected up to 2019, the rate of fish consumption rose to 50 kg per capita per year. With the target, at least 14.6 million tons of fish supply per year is needed, of which about 60 percent of that figure will depend on cultivated aquaculture production. [1]

The fish seed is one of the important basis to produce full-size fish. The process of developing fish seeds into full-size fish takes a long time and requires more care in its growth. So that qualified full-size fish can be produced from quality seeds as well. Hatchery and fish cultivation business plays an essential role in the market. Fish hatchery business is the spearhead of successful freshwater fish farming.
Therefore, fish hatchery business can supply main ingredients for fish farming business in each growing season. Seed cultivation plays important role in this business. However, for the successful implementation of fish hatchery business, not only determined by the ability of the carrying capacity of the environment, but by the strength and mental management [1] [2] [3].

In the process of seed sales, there are still problems faced by the cultivation of catfish seeds. This usually happens during counting the number of seeds that will be sold to buyers. On the problem of sorting the size of catfish seeds, farmers use a hollow tub to sort the size. But in this case, sort size is not to classify the size, it is used to sort the larger size so the desired size will be left in the tub while for the unwanted size will escape from the perforated tub. [4] [5] [6]

In the problem of sorting the size of the fish seed, a method for separating fish size is needed. The technique used in this work use mechanical selection. By applying the function of a perforated tub to the selection of fish’ sizes, a tool with a hollow design was made for sorting the size. The size is differentiated from small, medium and large. This sorting is different from the tub one. In this work, the desired size will pass in a hole of appropriate size.

In calculating the seeds of catfish, farmers still use conventional calculations. The seed is taken by the hand and calculated manually. Sometimes farmers are assisted by a tool such as a digital tasbih in its calculations, but this is still considered inefficient and likely to produce errors.

Problems in calculating the seeds must be overcome to support the success of fishery business. To overcome the problem of calculating fish seed, a fast and accurate method is required that will result in labor and time efficient. With the existence of these problems, the technology that developed at this time is a seed counter tool called Fry Counter. But this tool only calculates quickly without any sorting of fish by size.

Based on the stated problems, we propose a mechanism that can facilitate fish breeding entrepreneur to know the number of fish and classify it according to the size of the seed. Another advantage of this tool is the results of calculations displayed in the smartphone [7]. This tool can help farmers to count more efficiently because it does not require waiting time and can be seen directly on the smartphone. The designed tool could calculate fish seeds using a photodiode to determine the number of fish and classify fish seeds between small, medium and large size through selection by displaying the data obtained on the Android smartphone via data transmission using Wi-Fi module ESP8266 [8] [9]. In this case, this tool can help fish seed entrepreneurs in calculating the existing seeds according to the size of the fish.

2. Related Work
Calculation System of fish seed or fish has been widely performed by researcher, one of method used for automatic fish seed counter. On this research, These calculations for all kinds of fish and excess of this research at the accuracy calculation. [4]

Meanwhile, the research conducted by Padiyono, Automatic Catfish seed counter based on ATMEGA8. On this catfish seed calculation done by the censors and processed by mikrokontroler ATMEGA 8 and displayed on lcd but the percentage error in this research was still high.

Further research conducted by Indra Jaya [6], fry counter (seed counters high speed and accuracy). The calculation can be done quickly and accurate. But this research has a weakness, it can’t select the size.
3. Proposed System

This research referred to research that have been previously proposed [4][5][6]. The method undertaken in this article is divided into 4 sections, first, designing a mechanical design for size selection; second, creating an Arduino system to read the readings on the photodiode that is the result of the fish seed calculation on each size; third, designing the database for the storage of the calculation results; fourth, developing catfish seed counting system to read the calculation result sent by Arduino through ESP 8266.

3.1 System Planning

Block diagram of the proposed system is shown in Figure 1.

![Block Diagram Planning of catfish seed counting system](image)

The first selection stage is mechanical based selection, in which we flow the fish seed into a hole that could separate seed based on its size. There are three categories of fish seed; small, medium, and large. This selection starts from the small size first by letting the seed pass through the smallest hole. If the larger size seed is selected first, there is the possibility of small size fish come into the hole. If the catfish cannot enter the small fish hole, the seed will be passed to the medium size hole. Finally, the remaining seed will enter the next hole which is the largest. After the mechanical size selection, then the fish seed will enter the stage for the calculation of the number of seeds. In the calculation process, there is a photodiode that serves to calculate how many fish enter each hole, the sensor data will be processed through Arduino Uno board as a microcontroller. The results of these calculations are displayed on the LCD and farmers’ mobile phone via Wi-Fi module ESP 8266 which will be sent on cloud computing to be accessed via Android.

3.2 System Planning Flowchart

From Figure 2, it can be explained that the workflow of our proposed catfish seeds counter. First, the selection of catfish seed based on its size with mechanical design, then the fish seeds of each will be calculated with photodiode sensor. Finally, Arduino will read the sensor data and display it on the LCD and send it to user’s smartphone via Wi-Fi module to be seen online.
3.3 Mechanical Planning

Figure 3 (a) shows the mechanical drawing of the front side of the designed tool, while Figure 3 (b) shows the mechanical design drawing from the top to show the hole design. As in the picture, the selection is made for small size first, medium size and large size. The holes were designed in a zigzag model so that the fish can enter the hole.

Figure 2. Catfish seed counter mechanism flowchart

Figure 3. (a) Mechanical design drawings of front, (b) mechanical design of for hole selection model (right)
3.4 Hardware Planning

Figure 4 illustrates the design of connected hardware. The used hardware are Arduino as a microcontroller, a photodiode as a sensor, a trim pot as a value regulator on the photodiode, the I2C LCD as the resultant viewer of the calculation, and a connected ESP8266 module to transmit the seed reading data to the database for access via the smartphone.

3.5 Data Delivery Planning

During data transfer from sensor to Arduino, each sensor should be provided with unique identity to differentiate the source data, whether it came from the small, medium, or the large hole. If the identification is correct, then the data can be displayed on the smartphone. The same identity will also be used to transfer data through the internet.

3.6 Interface Planning

There are five menus displayed in the Android application, which are Home page, Data, History, Contact Us and Report. Home menu contains information and descriptions of the created tool and its advantages. Data menu can be used to access the data read by the photodiode. History menu displays the calculation history in one day, and Contact Us menu contains the contact of the Admin as a manager, while Report menu includes the calculation and sales information from the farmers.
Figure 5. App design view (a) Home, (b) Data, (c) Contact Us

The design application above to be applied on smartphone as an application for monitoring the result of catfish seed calculation. These application also have a history and report menu. History menu to display the result in a day. And report menu to display the report from the calculation each day.

4. Result and Discussion

There are some trial to make sure that the system work well.

4.1 Design Results

The advantages of this tool are not only it could calculate the seed but also classify the size of the seed. The designed tools shown in Figure 6.

Figure 6 The results of designed tool

There are three holes shown in the figure; the first hole (right) is a hole to accommodate fish with a small size in which the diameter of the seed is 6mm, while the second hole (center) serves to select the medium size seed with the diameter of 8 mm, and the last is for the catfish seed with 10 mm diameter size.

Once grouped, each size will be calculated using a photodiode and the result of the sensor will be processed by Arduino Uno to be displayed on the LCD and also sent to the smartphone.
4.2 Test Results of LCD Display and Android Display

Figure 7 shows the test results on the LCD and also the android display of corresponding result. On the LCD display, a is the small sized seed, while b is the medium one, and c is the large size. The display between LCD and android one shown the same value.

![Figure 7. Test result of calculation for photodiode on LCD (left) on a smartphone (right)](image)

4.3 Calculation Result of Catfish Seed on Tool

Table 1. Selection test size

| Trial no | Size of fish seed | Number of Fish |
|----------|-------------------|---------------|
|          | Small | Medium | Large |          |               |
| 1        | 3     | 91     | 186   | 280     |
| 2        | 3     | 94     | 183   | 280     |
| 3        | 3     | 94     | 183   | 280     |

After calculating the seeds of catfish with the tool, we calculate the percentage table error. Error percentage is calculated using formula [1].

\[ E = \frac{(D1-1)}{Total\ of\ Trial} + \frac{(D2-1)}{Total\ of\ Trial} + \frac{(D3-1)}{Total\ of\ Trial} \]

(1)

Table 2 Result of error calculation

| Trial no | Ukuran Ikan |
|----------|-------------|
|          | Number of small | Counting result of the small size | Number of medium | Counting result of medium | Number of large | Counting result large |
| 1        | 3 | 3 (0%) | 94 | 91 (3%) | 183 | 186 (2%) |
| 2        | 3 | 3 (0%) | 94 | 94 (0%) | 183 | 183 (0%) |
| 3        | 3 | 3 (0%) | 94 | 94 (0%) | 183 | 183 (0%) |
| % average | 0% | 1% | 0.67% |

Based on the result of Table 2, the error obtained is tiny that is for the small size of the percentage of errors received by 0%, the error for medium size of 1% and errors in the large size of 0.67%, while for the average error that occurred for 0.56%.
5. Conclusion

- The designed tool could function correctly in the process of sorting the size of the catfish, because catfish seeds can be correctly selected based on size. For a small size of 3, medium size of 94, and a large size of 183.
- The designed tool could also calculate the fish seed correctly. The error percentage of the device is, the small size of 0%, medium size 1% and large size 0.64. From these results can be seen the average percentage of error of 0.56%.
- The data transmission between Arduino and android devices could run well. The display on LCD and smartphone shown the same results.

6. Acknowledgment

The Authors would like to thank the Directorate of Student Affairs, Directorate General of Learning and Student Affairs for the funding that has been given so that this research can be done in Student Creativity Program (PKM) Year 2018.

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