NEWTON: Networking and Information Technology
Vol. 2 No. 3 February 2023, Page. 117 - 125
E-ISSN: 2797-0728

Design of Automatic Fish Feeding in Arduino-Based Catfish Farming

Sujono[1]*, Atika Chaula Azha[2]
[1,2] Informatics, Universitas KH.A. Wahab Hasbullah
Email: sujono@unwaha.com

ABSTRACT
This Arduino-based fish feed aims to design and build a catfish feeder automatically based on the Arduino Uno-based fish feeding schedule. This feeder uses the RTC DS3231 to set the time and schedule for feeding fish which is equipped with a Servo Motor as a feed valve opener and an LCD as a clock and date display on the feed schedule. The weight of the feed issued is based on the weight of the catfish and the number of fish. The number of catfish in this study is 100 fish with a pond size of 2 meters by 2 meters. The scheduled feeding schedule is morning, afternoon, evening and night, depending on the age of the catfish. Considering that catfish are cannibals that eat their own kind and are nocturnal, that is, animals that are active at night and sleep during the day, it is best if some of the feed is given more in the afternoon or at night because the catfish's appetite is high at night. The feeding schedule is in the morning at 08.00, noon at 12.00, in the afternoon at 16.00 and at night at 20.00. The button on the remote will control how many times the feed will come out of the feed tray. When the feed in a fish feed container has run out, the ultrasonic sensor will work and an alarm will sound from the buzzer which sounds as a reminder. From the test results, it was obtained that the feed weight was regular after designing an Arduino Uno-based automatic fish feed structure, and the servo moved according to a predetermined schedule.

Keyword *: Fish Feed; Catfish; RTC DS3231; Infrared Remote Control; Arduino Uno*

INTRODUCTION
Indonesia is a country that has many strong cultures in terms of fisheries. In line with the government's target to make Indonesia the largest fish-producing country, fish breeders must develop the production of fish farming in order to provide the expected results. However, many fish breeders still have problems in the development process, one of which is the manual feeding process. (Safrianti et al., 2019)

In general, feeding fish is done manually, namely by self-sprinkling fish feed in the form of pellets at a set time every day. And usually this manual feeding before sowing is not weighed first, causing a mismatch of the amount of feed given to the fish feed requirements (Florestiyanto et al., 2019). This has drawbacks which also affect fish growth such as scheduling errors and uncontrolled feed doses given. Giving fish feed is done 2 times a day in the morning and in the evening with the right dose and time. Fish keeping is a community hobby that is very popular from the past until now. Because of its ease in maintenance, it makes people want to keep fish (Permana & Doni, 2020) (Amarudin et al., 2020).

One of the technologies in regulating feeding is an automatic fish feeder. Namely in the form of a tool that can sprinkle fish feed automatically and can be adjusted according to the dosage and according to the age of the fish and also how to inform when the feed has run out. In addition, providing fish feed can also reduce the effort and time for fish farmers in providing feed because the time is automatically set by the tool. (Prijatna et al., 2018).

By looking at this background, research on Arduino-based automation is carried out which is beneficial for fish farmers and at the same time reduces the level of cannibalism in an ecosystem. And the purpose of this study is to design an Arduino-based catfish feeder based on feeding schedules and age.

METHOD
- Method Used
  - Study of Literature

This method is used to understand the basic theory related to research. So that it is expected to be able to provide an overview in the design of the system design.

- Research Design

  Prototyping is a software development method, in the form of a physical working model of the system and serves as an initial version of the system. With this method a prototype system will be produced as an intermediary for developers and users so that they can interact in the process of information system development activities. In order for the prototyping process to work well, it is necessary to define the rules at an early stage, that is, the developer and the user must have one understanding that the prototype is built to define the initial requirements.

- Tools and Materials Used

  Tools and materials used in the manufacture of this tool, as follows :

  - 1pc Arduino Uno
  - 1pc Servo Motors
  - 1pc LCD
  - 1pc RTC DS3231
  - USB Connector
  - Laptop/PC
  - Jumper Cables
  - Remote Control
  - Ultrasonic Sensor
  - Buzzer

- Literature Review
  - Characteristics of Catfish

    In catfish farming, there are many problems that can prevent breeders from getting satisfactory yields, because catfish are easily stressed and eat each other. The causes of cannibalism in catfish are delays in feeding at a predetermined time, and the weather is always changing and erratic.
  - Feeding Pattern

    Feeding greatly determines the growth of catfish but can be done by scheduling according to the age of the fish.
  - The Amount of Feed Given

    The amount of feed given to catfish should not be less than 10% of body weight because feed requirements greatly determine the height of growth in fish. Below is an age table and the amount of feed that must be spent per 100 fish. *(Interview with Mr. Muthi, Catfish Farmer, 08/2022).*

Table 1 Amount of Feed Given

Catfish Age (days)	Dosage of Feeding (% body weight / day)
20 – 30	15 – 20
31 – 40	10 – 15
41 – 55	5 – 7
56 – 90	3 – 4
90 - dst	3 – 4

Table 2 Age and Type of Feeds

Age	Type	Many Days	Grams
0 – 2 days	Larvae / Leftover Egg Yolk	2 days	-

3 days	Introduced to Silk Worms	14 days	± 2
15 days 3 weeks	Smooth Food	7 days	± 7

Table 3 Pellet Type

Pellet Type	Feeding Duration
Firs Pellet (Shrimp Fry)	2 weeks
PF 500	3 weeks
PF 1000	2 weeks

- Scheduling Plan For Feeding Fish Based on Time

Table 4 Feeding Scheduling Plan

No	Time	O'clock
1.	Morning	08.00
2.	Afternoon	12.00
3.	Evening	16.00
4.	Night	20.00

Feed dosage plan based on research, 1 pond contains 4,3 kg of fish, 1 kg = 30 fish, so in one pond there are 100 fish, so the weight of 1 fish is 4,3 : 100 = 43 grams. The plan for setting the dose of feed given is 7% of the fish body weight according to the feed needed for the development of fish aged 14 to 30 days.

Feed=(Fish Weight)/(7%)

Feed=(43 grams)/(7%)=3,01 grams

Based on interviews, 1 fish requires 3.01 grams of feed for one meal, catfish need 4 meals a day, so 1 fish requires approximately 12 grams of feed per day. The feed availability plan is based on research on 1 catfish aged 14 days requiring about 12 grams of feed every day, the feed container will be filled with feed for 5 days, for example the distance of the ultrasonic sensor to the available feed is 6cm, and the distance of the feed and the ultrasonic sensor will decrease by 3cm every day, eat when the distance of the ultrasonic sensor and the feed reaches more than 10cm, the sensor will send a notification in the form of an alarm from the buzzer that the availability of feed will run out.

- Flowchart

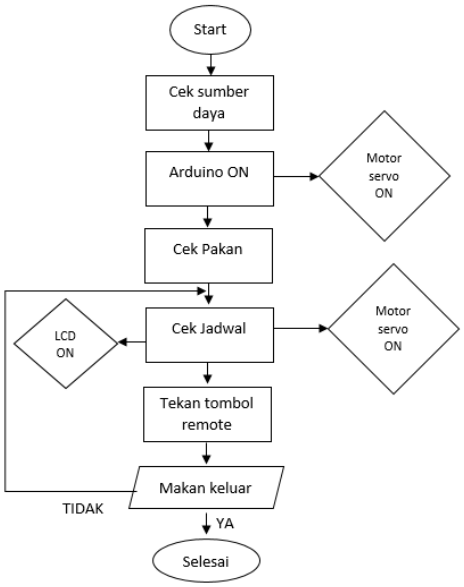

Figure 1 Research Flowchart Diagram

The flowchart above explains how the catfish feeder works in an easy and structured way(Khesya, 2021). Strating from how the sensors work until the flow of the system will arrive at food expenditure. By looking at the flowchart you can see how this automatic fish feeder system works.

- System Chart

The system of automatic catfish feeding consists of several components, namely Servo, RTC DS 3231, Remote control, LCD. The relationship of some of these components can be described in a block diagram as follows

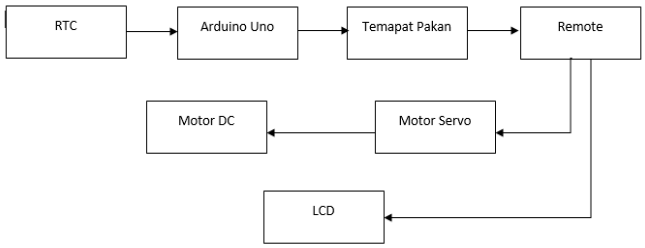

Figure 2 system workflow

Explanation of the block diagram above

1. RTC DS3231 : used for digital timers
2. Arduino Uno : as a source of all components
3. Remote Kontrol : feed controller
4. Motor Servo : used as a fish feed valve lid opener
5. LCD : as a marker of the emergence of hours or time

- Tool Design
  - Design of RTC DS3231

    The RTC is connected to arduino with pin GND to GND, VCC to 5v, analog pin A4 for SDA and analog pin A5 for SCL. To more clearly connect the circuit can be seen in the image below

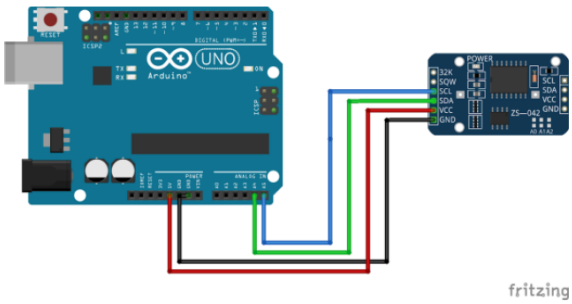

Figure 3 Design of RTC DS3231

  - Design of LCD I2C

    The LCD functions as a status display of the running device. In this project the LCD will be connected to arduino with pin GND to GND, VCC to 5V, SDA pin to A4 and SCL to A5

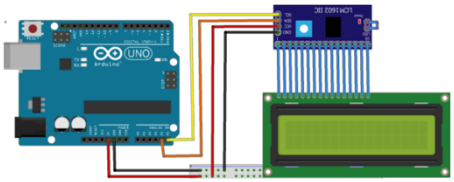

Figure 4 Design of LCD I2C

  - Design of Servo

    The image below will show the design of the servo. Brown to GND, Red to VCC, and analog pin to pin 12.

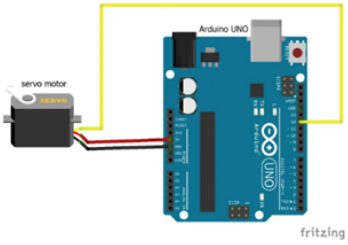

Figure 5 Design of Servo Motor

- Overall Design

  The design of this tool will explain the assembly of the tools/hardware required by the system, both in terms of the whole and per part that support the running of the system:

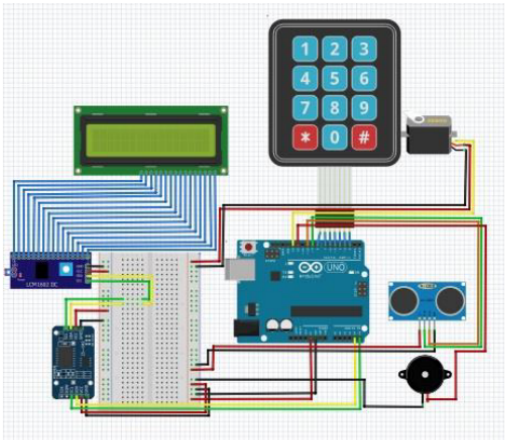

Figure 6 Overall Component Design

The entire series of systems that can be seen in the picture above can be understood how the RTC DS3231 works which can send LCD data as a sign of the appearance of the clock and remote time as a feed controller, number 1 feed controller from the age of 5-14 days onwards. The output of this tool is in the form of feed that has been driven by a servo that opens.

Table 5 Remote Control Function

Knob	Function	Information	Time
1	Feed Schedule	1 time	08.00
2	Feed Schedule	2 times	08.00, 12.00
3	Feed Schedule	3 times	08.00, 12.00, 16.00
4	Feed Schedule	4 times	08.00, 12.00, 16.00, 20.00
5	Releasing Feed for 2-3 weeks	Round 1 time = 300gr	
6	Releasing Feed for 3-4 weeks	Round 2 times = 600gr	
7	Releasing Feed for 4-5 weeks	Round 3 times = 900gr	
8	Releasing Feed for 5-6 weeks	Round 4 times = 1200gr	
9	Releasing Feed for 6-7 weeks	Round 5 times = 1500gr	
0	Releasing Feed for 7-9 weeks	Round 6 times = 1800gr	

Table 6 Overall Circuit Pin Path

Pin	Board	Component
GND	GND	LCD – RTC
VCC	VCC	
SDA	SDA	
SCL	SCL	
A4	SDA	RTC
A4	SCL	
5V	VCC	
GND	GND	
GND	GND	Ultrasonic Sensor
12	Echo	
11	Trig	
VCC	VCC	
GND	Brown	Servo Motor
VCC	Yellow	
3	Red	
8	S	Remote Infrared
GND	GND	
VCC	VCC	
4	VCC	Buzzer
GND	GND	

RESULT AND DISCUSSION

At this stage testing is carried out on each series to find out whether the tool is running as expected, which is then followed by testing the tool as a whole which will be presented as a whole which will be displayed in the form of a table or figure which then ends with evaluating the test results to get the level of success of the tool that has been made.

Result

Overall of Tools

Testing is carried out by setting the time as a feed schedule according to the age of the fish, then putting the feed into the feed reservoir, then input the number of times it is fed via remote infreared so that the system will know how many times the valve will open and the feed will come out according to the schedule that has been set. The purpose of this test is to find out that the overall tool has worked properly ("Jurnal Ikan," 2019).

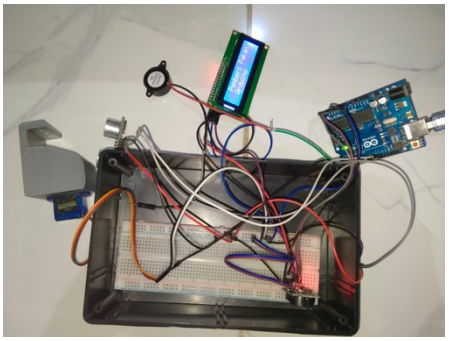

Figure 7 whole network

Figure 8 The end result of the project

Figure 9 The end result of the project

Table 7 Testing 1 time feed

No	Trial 1 Time Feed		Age Catfish 14-30		Error
	Day	Time	Auto(gr)	Manual (gr)	
1	First	08.00	312	320 gr	2.5 %

Table 8 Testing 2 time feed

No	Trial 2 Times Feed		Age Catfish 31-36		Error
	Day	Time	Auto(gr)	Manual (gr)	
1	First	08.00	160	170	5,8 %
2	Second	12.00	160	170	5,8 %

Table 9 Testing 3 time feed

No	Trial 3 Times Feed		Age Catfish 36-46		Error
	Day	Time	Auto(gr)	Manual (gr)	
1	First	08.00	85	95	10,5 %
2	Second	12.00	85	95	10,5 %
3	Third	16.00	85	95	10,5 %

Table 10 Testing 4 time feed

No	Trial 4 Times Feed		Age Catfish 46-60		Error
	Day	Time	Auto(gr)	Manual (gr)	
1	First	08.00	40	50	20 %
2	Second	12.00	40	50	20 %
3	Third	16.00	40	50	20 %
4	Fourth	20.00	40	50	20 %

Discussion

Testing the DS3231 RTC Module

Testing is carried out by first adjusting the DS3231 RTC module with an accurate time ratio so that it can produce the correct time and then showing it on the LCD which aims to ensure the DS3231 RTC is running properly.

Table 11 RTC DS3231 Testing

Feed Hours	*Gear* Servo Moto
08.00	On
12.00	On
16.00	On
20.00	On

Pengujian Motor Servo

The test is carried out by activating the servo motor with the Arduino that has been programmed. The function of this servo motor is to open or close the fish feed outlet valve.

Table 12 Servo Motor Testing

Gear Servo Motor	Feed Weight
1x	320 gr
2x	160 gr
3x	85 gr
4x	40 gr

CONCLUSIONS

From the results of tests that have been carried out on the tool, it can be concluded:

- The main components used are Arduino Uno, RTC DS3231, Ultrasonic Sensors, LCD and plastic bins are used as feed containers that function properly.
- Making this Automatic Fish Feed Tool uses the RTC as a time scheduler so it works in the tool box.
- RTC can function properly as scheduling the tool according to the actual time.Alat ini bekerja memberi pakan sesuai umur terjadwal di jam 08.00 WIB, 12.00 WIB, 16.00 WIB, 20.00 WIB.
- This tool is still limited to design and prototype.

REFERENCES

Amarudin, A., Saputra, D. A., & Rubiyah, R. (2020). Rancang Bangun Alat Pemberi Pakan Ikan Menggunakan Mikrokontroler. *Jurnal Ilmiah Mahasiswa Kendali Dan Listrik*, *1*(1), 7–13. https://doi.org/10.33365/jimel.v1i1.231

Florestiyanto, M. Y., Prasetyo, D. B., & Handigar, M. H. R. (2019). Pengembangan Alat Pemberi Makan Ikan Otomatis Menggunakan Arduino. *Telematika*, *16*(2), 73. https://doi.org/10.31315/telematika.v16i2.3185

Jurnal Ikan. (2019). *Sistem Otomatisasi Alat Pemberi Pakan Ikan Lele Berbasis Arduino Uno*, 33–37.

Khesya, N. (2021). Mengenal Flowchart dan Pseudocode Dalam Algoritma dan Pemrograman. *Preprints*, *1*, 1–15. https://osf.io/dq45ef

Permana, D., & Doni, S. (2020). Alat Pakan Ikan Aquarium Otomatis Berbasis Arduino Uno. *Jurnal Ilmiah Mahasiswa Kendali Dan Listrik*, *2*(2), 2723–598.

Prijatna, D., Handarto, H., & Andreas, Y. (2018). Rancang Bangun Pemberi Pakan Ikan Otomatis. *Jurnal Teknotan*, *12*(1), 30–35. https://doi.org/10.24198/jt.vol12n1.3

Safrianti, E., Sari, L. O., & Fadilla, A. (2019). Sistem Otomatisasi Alat Pemberi Pakan Ikan Lele Berbasis Arduino Uno. *Jurusan Elektro Fakultas Teknik Universitas Riau*, 33–37.