MIFORTEKH (Jurnal Manajemen Informatika & Teknologi)
p-ISSN : 2808-7550 (print) e-ISSN : 2798-0235 (online)
Vol. 5, No. 2, Oktober 2025
https://journal.stiestekom.ac.id/index.php/mifortekh/index

Comparative analysis of automatic betta fish feeding devices based on IoT (Internet of Things) using Telegram bots

Cristo Maretus Seran
Department of Informatics, Uyelindo Kupang College of Computer Informatics Management (STIKOM)
Author email: seranterate27@gmail.com

Article Info

Article history:

Received July 25, 2025
Revised August 06, 2025
Accepted September 03, 2025

Keywords:

Control
Farm
Feed
NodeMCU
Telegram

ABSTRACT

Technology development in the That electronic industry own developed very fast recently. For push social entrepreneurship associated with using modern technology , A technology system For control fish food in the fish pool own has been built, planning to become implemented effectively And under control from a distance. That development information technology NO longer it seems to become only A complete, But A need. One example is technology in the That world from animal farm Which is develop quickly, offering farmers a variety of ways to manage their livestock more efficiently. Fish farming is A popular hobby in the Today public. Fish own A special attractiveness For fish lovers And demands in the That market continue to increase. That objective from This research is to develop an automatic fish feeding system based on NodeMCU ESP8266 and integrated with Telegram. Therefore, a microcontroller-based fish feeding device was developed. utility A NodeMCU ESP8266, And A drive/servo motor That Can move return And move on to open And close That feeding channel hole to take fish food from That fish feeding tube using Telegram application Which Can become under control from a distance. . Users Can monitor using Telegram robot with That available feature. Test results show That system potential to optimize food, allows remote control, And allows farmer to care For theirs fish more effective.

Corresponding Author:

Cristo Maretus Seran,
STIKOM Uyelindo Kupang, Indonesia
Jl. Perintis Kemerdekaan 1 Kupang, Indonesia
Email: seranterate27@gmail.com

1. INTRODUCTION

Many people in cities and villages cultivate fish, including ornamental fish, which are widely cultivated because they are very popular for cultivation. Some people manage it as a hobby and there are also those who make fish farming profitable. Fish themselves are easy to keep in aquariums, ponds, etc. Managers must also properly care for their fish, starting with regular feeding and cleaning the water in the aquarium or pond. Freshwater fish are fish that spend part or all of their lives in

freshwater, such as rivers and lakes, with a salinity of less than 0.05 % . Freshwater environments differ from marine environments in many ways, the most distinctive being their salinity levels. To survive in freshwater, fish require physiological adaptations aimed at maintaining a balance of ion concentrations in their bodies (Warjono, 2022). 1% of all fish species can live in fresh water. This is because the species have a fast pace of life, which allows them to inhabit scattered habitats. Freshwater fish differ physiologically from marine fish in several ways. Their gills must be able to break down water while maintaining salt levels in body fluids (Aprilliana et al., 2020; Mahbub & Fitriana, 2022).

Fish keeping has been a popular hobby for many people from the past to the present. In both villages and cities, many people keep fish as livestock or as ornamental pets. Fish farming is a very promising business venture and attracts many people. Fish farming is also an important area of ongoing research aimed at meeting human protein needs. Providing too little feed will result in suboptimal fish growth due to nutrient deficiencies. Providing too much food can lead to a buildup of food waste and waste. By providing sufficient and regular fish feed, this problem can be prevented. The most important aspect in fish farming is effective feed management to provide fish feed on time and in sufficient quantities. This tool can be used to create a fish feeding schedule based on the schedule determined by the fish farmer (Agusta et al., 2019).

Rapid technological developments can help make human work easier, especially through the use of Internet of Things technology, commonly known as IoT. IoT is a computing concept that exists in objects that can be connected to the Internet. Essentially, the Internet of Things (IoT) is the idea that all objects in the real world can communicate with each other as part of an integrated system using the Internet as a connection. In today's digital era, IoT technology has created new opportunities to improve the efficiency of fish processing. The application of IoT to the production of fish feeding equipment will simplify the work of aquarium owners because they no longer need to do manual feeding work. One solution is to use a NodeMCU ESP8266 connected to a WiFi network to distribute data automatically, and a DS3231 RTC is used to send time data to facilitate scheduling.

Based on the background of the problem described, the researcher chose the title "IoT-Based Fish Feeder Using a Telegram Bot." This tool is designed to schedule fish feeding according to a predetermined schedule. The feeding process is carried out in real time and can be controlled through the Telegram application .

2. Theoretical Basis

Study related design tool giver Eat fish based IoT use *bot* telegram, has done study as much as with study related among them

(Regita, & et al, 2023), conducting research on Design IoT-Based Automatic Fish Feeder. System using NodeMCU ESP8266, RTC DS3231 for setup time, and mobile applications for monitoring. The system automatically provides fish feed at time Which has been determined and provides notifications via mobile app. The research uses RTC for timing, while this research uses NTP Server GMT for time synchronization and Telegram Bot for notifications and feeding bird.

A microcontroller is a small computer that is presented as a IC (*Integrated Circuit*) *chips* And designed For do task or operation certain. On basically a microcontroller consists of from One or more core CPU (*Central Processing Unit*), RAM (*Random Access Memory*), ROM (*Read Only Memory*) And device I/O (*input/output*) that can be programmed. According to Budiharto (2014:19) *a microcontroller* is a controller main device electronics moment This, including robot And machine others.

Although speed processing data And capacity memory Which owned much smaller when compared to a computer or PC, but the capabilities of a microcontroller Already Enough For can used on Lots application especially because of the size shape microcontroller Which more simple. Microcontroller frequently used on application system And device Which No too complex And does not

require high computing. Some examples of microcontrollers are AVR microcontrollers, Arduino microcontrollers, ATmega328 microcontrollers and many others .

3. METHOD

In this chapter , the author creates a system diagram equipped with supporting theory with the aim of clarifying the system diagram so that it can facilitate understanding of the creation of this tool. [5] – [7] . The writing of this final assignment uses a design concept which refers to a remote fish feeding tool based on a telegram bot using NodeMCU ESP8266 as a microcontroller, no additional Wi-Fi receiver is required. because the ESP8266 microcontroller already supports Wi-Fi network access. Research Tools and Materials

This block diagram is a basic description of the system to be designed. Each part of the system block has its own function, by understanding picture block diagram so system Which designed Already can built with good (MH) Barkatulah. 2019). Block diagram is graphical representation from a system or process Which use block (box) For describe components or elements of the system and the relationships and flow of information between these components. Diagram functioning as reference channel system Work *hardware* . Diagram block right will determine results idea Which desired moment make project the task was finally achieved .

The tool design is made to determine the function and flow of each component Which used. Series tool depicted with diagram block to facilitate in understand draft from tool Which made. Following block The diagram created for the automatic fish feeding device is shown in this Figure. [2] , [4] . The working process of the block diagram of the fish food container opening and closing system generally starts from a smartphone and an ESP8266 device connected to the internet network and preferably not using an internet cable. The smartphone must have the Telegram application installed which will support giving commands to the ESP8266. The ESP8266 device will be the main processor that controls the input and output that will be sent via Telegram. The device supports ESP8266 which is Arduino IDE software that will be used as a means to create a sketch program and downloaded to the ESP8266 NodeMCU. The ESP8266 device is then connected to a servo motor to do the physical work, specifically opening and closing the bird food container based on commands given by the user via Telegram. [5] , [8]–[13] .

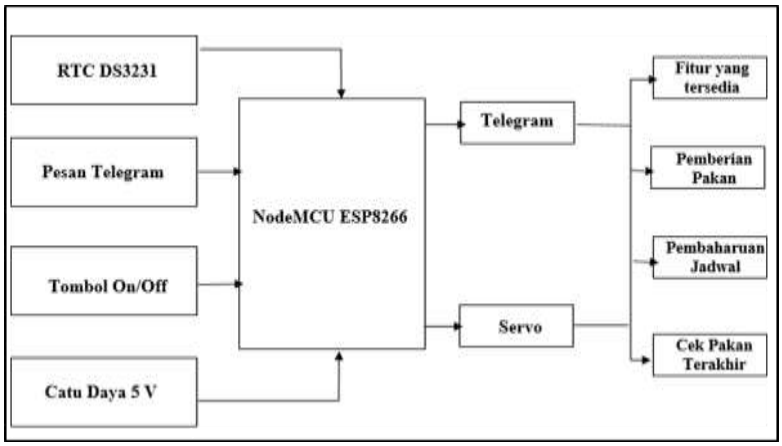

Figure 1. Diagram of fish feed tool blog

p-ISSN: 2808-7550
e-ISSN: : 2798-0235

Table 1. Summary of Tips & Tricks for Good Scientific Articles

Contents	Must be Fulfilled	Checklist
Title	1. Maximum 15 words 2. Explicitly contains PMR (Problem, Method, and Results, e.g.: "Automatic Text Summarization using Deep Learning for Indonesian Language Documents") 3. Does not contain Locus (Case study or location that is too specific, for example: at SMA XX) 4. Does not contain words such as: Overview/brief/Introduction, R 5. Review, Case Study/Study, Survey, Approach, Comparative, Analysis, Comparative Investigation, Investigation	✓
Abstract	1. Maximum 250 words. 2. Straight to the point explaining: objectives, methodology, and results, may add a little contribution/implication. 3. May not contain quotes.	✓
Keywords	1. Consists of 3-5 keywords that are easy to find on the Google search engine. 2. In alphabetical order. 3. It is highly recommended that keywords be tailored to the title.	✓
Introduction	At least 3 paragraphs containing: (1) Paragraph I contains the background/problems/facts that support the research/study; (2) Paragraph II contains the state of the art/related works that contain at least 5 previous related studies; (3) Paragraph III contains the position/gap/differentiation of the research and defines the objectives of the research/study.	✓
Methodology	1. Explicitly explain whether qualitative/quantitative/mixed methods/other specific methods/algorithms were used in the study. 2. Describe the case study and data sources (data sets) used.	✓
Results and Discussion	1. Written systematically according to the method used 2. Explain the research results in full 3. In the discussion, there must be references cited as a comparison/analysis of the relationship between the findings and previous research.	✓
Conclusion	1. Don't repeat the abstract 2. Contains results and discussions (findings), contributions, implications, and can also explain the “lack of study” of a study. 3. There should be suggestions for further research	✓
Reference	1. Minimum 20 references 2. 80% are sourced from reputable journal articles (clear sources and DOI) up to date, maximum in the last 5 years 3. 20% comes from sources other than journal articles (books, news portals, etc.) 4. Using the Mendeley reference manager	✓

4. RESULTS AND ANALYSIS

4.1 . Tool Design Results 1

When designing the "NodeMCU ESP8266-Based Automatic Fish Feeder with Telegram Time Settings, " there are several important considerations. The following is an overview of the device's design.

Figure 1 results of tool design

4.2 . System and Telegram Testing

It is important to ensure that the framework and tools are aligned with the plans that have been made. Tests were conducted to test the capabilities of the telegram bot.

No	Order	Action
1	/start	Starting the telegram bot system to connect with ESP8266
2	"EAT"	Give a message to the fish directly via a Telegram bot message.
3	"TIME"	Gives a command message to check the history of the last fish feeding time.

Table 1 Telegram bot menu

Next, test the test menu on the tool and test the reply test results from the Telegram bot if the available menu has been entered. [16]

No	*Bot input*	*Bot output*	information
1	Type /start	Notification : "Welcome to the automatic fish feeding system 'FEED' => feed the fish 'TIME' => check the last meal"	Success
2	Type "EAT"	Notification : "Successfully fed"	Success
3	Type "TIME"	Notification : "Last meal time: date/month/year hour/minute/second" If there is no history:	Success

		Notification : "there is no history of feeding"	
4	Type other than the command above	Notification : “Welcome to the automatic fish feeding system 'FEED' => feed the fish 'TIME' => check the last meal”	Success

Table 2 Telegram bot test results menu

[17] The display in Figure 2 shows the results of a telegram bot trial for an automatic fish feeding application. When users command the bot by inputting a menu, they will receive a welcome notification and information about the features: feeding and direct feeding time . [18] …” Users can feed directly with the EAT command , which activates the servo to provide immediate feed. After inputting EAT , [19 users get a notification that the feeding was successful . During feeding , the system will open the feed tube valve for 3 seconds. A notification will appear after each feed, and the user can choose to feed TIME command to provide the last feed information. The system also tests data transmission between the NodeMCU ESP8266 and the Telegram bot to ensure proper reception. [20] – [25] .

4.3 How the Tool Works

The device that has been designed is a fish feeding device that uses an ESP8266 based on IoT Telegram. The operation of this device involves a 5-volt battery current to activate a servo controlled via a relay. After the feeding command, the device will work automatically, including the food coming out of the tube. Then, Telegram will automatically display a message such as: feeding successful. The device can be used when the yellow LED light is on. The green LED light is on when the device is connected to WiFi and the Telegram bot.

4.4 . Tool Trial Results

Testing aims to assess the reliability of the developed tool. Tool testing is the process of determining the tool's efficiency during use. This ensures that the desired objectives are achieved. This testing involves a series of trials of the tool until successful results are achieved. The following table shows the effect of servo rotation delay on the feed output mass.

Table 3 Effect of servo rotation delay time on the mass of feed output

No	Delay time	Mass of feed that comes out
1	1 second	14 grams
2	5 seconds	44 grams
3	10 seconds	81 grams
4	20 seconds	157 grams
5	30 seconds	245 grams
6	40 seconds	322 grams
7	50 seconds	454 grams
8	60 seconds	643 grams

From the test results above, the average calculation is as follows:

Average delay time of servo rotation to the mass of feed coming out

Average =Σ xi / n

= 1,960/8

= 245 grams

From the calculation above, the percentage can be calculated as follows:

Percentage of servo rotation delay time to the mass of feed coming out

Average = average/total number x 100% = percentage

245/1,960 x 100% = 0.125%

4.5 . Pengjian ESP8266

Testing the ESP866 microcontroller is done by supplying voltage using a 5V/1.5A adapter and measuring the voltage on the ESP8266 pins. This voltage is used as *input* and *output,* which will then be used to run the system.

output is tested by probing the digital pins on the ESP8266 with a digital multimeter. The device's design includes several pins that are used as digital *outputs* .

Table 4 ESP8266 digital pin measurements

No	Measurement	Vin (Volts)	Vin read (Volt)	Error (%)
1	No-load I/O	5 volt	5.9 volts	1.8%
		3.3 volts	3.3 volts	0%
2	I/O With load	5 volt	5.07 volts	1.4%
		3.3 volts	3.3 volts	0%

The voltage supplied to the ESP8266 module is 5 volts. The *output* voltage must be a value that meets the data specifications. The *output power* must be 5 volts. Conversely, the measurement results for each *output* voltage are less than optimal according to *the datasheet* . Therefore, an *error value is calculated* to determine the electrical voltage. Measuring the *output voltage* at each power terminal shows a different error.

Error calculation :

Error Pin 5 volts (No Load) $=\frac{5.09\ volt - 5\ volt}{5\ volt} x \quad 100 = 1.8\%$

Error 5 volts (With Load) $=\frac{5.07\ volt - 5\ volt}{5\ volt} x \quad 100 = 1.4\%$

4.6 . Power Consumption Calculation

Testing this fish feeder is done in several steps: The automatic fish feeder is connected to a 5V DC power source using a battery . When a command is received from the Telegram bot, the servo motor moves and food flows out of the feeder.

Equipment testing done on at 0 8.00 and 1 6.00 is the right time to feed the fish. Feeding fish begins by adding fish food to the food container .

Table 5 Power testing

Time	Servo		
	Voltage)	Ampere current	Power (Watts)
0 8 .00	5 volt	0, 2	1
1 6 .00	5 volt	0, 2	1

Where in table 5 it is shown that the current produced is 0.2 A with a voltage of 5 volts, then the power used for 1 servo motor is:

P = V x 1

Information :

P = Power (Watts)

V = Voltage (Volts)

I = Current (Amperes)

At 0 8.00 P = 5 V x 0.2 A = 1 Watt

At 1 6.00 P = 5 V x 0.2 A = 1 Watt

The power consumption required per day is 2 watts.

4.7 . LCD display testing

Display testing is performed to ensure the LCD is active, allowing the results to be displayed in graphical form, consistent with the data displayed on the serial monitor. This process has been tested, as shown in the image below .

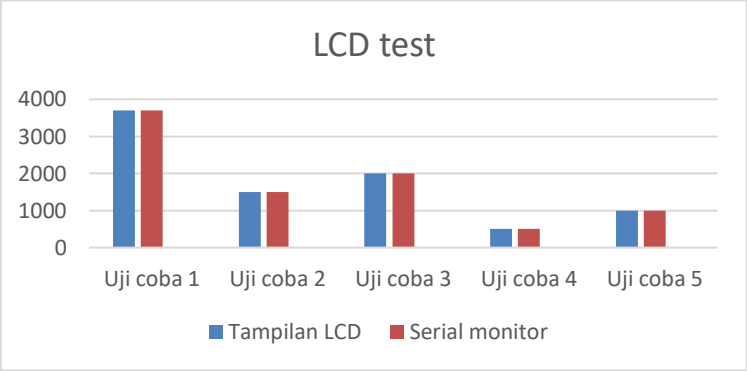

Figure 2 LCD test graph

In the image above , the LCD display shows that there were no errors during the test, and the results displayed on the LCD match those seen on the serial monitor.

5. DISCUSSION/CONCLUSION

This research describes the development of an automated fish feeding system using NodeMCU ESP8266 technology and Telegram communication to manage fish feeding times. By integrating NodeMCU, servo motors, RTC, and a Telegram bot, the authors have created a solution that allows fish farmers to feed their fish remotely according to a predetermined schedule. Implementing this system makes it easier for fish owners to feed their fish and eliminates the need to worry about forgetting or having to be present when feeding their pet fish.

ACKNOWLEDGEMENTS

This research is supported by [Stikom Uyelundo Kupang, Grantor]. I would like to thank my parents who always support me in this research, and thank you to [Stikom Uyelindo Students] who always support and provide motivation and are very helpful in this research, even though they may not fully agree with all the interpretations/conclusions in this paper.

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