Design of Catfish Feeding Device Automatic Internet of Things (IoT) Based

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Abstract - The progress of electronic technology is growing rapidly and is very influential in the manufacture of sophisticated tools, namely tools that can work automatically and have high accuracy so as to facilitate work done by humans to be more practical, economical and automatic. In everyday life both in cities and in rural areas, there are many fish keepers in ponds both large and small. Catfish is a fish that has several features and is of great interest to the public for consumption. Catfish farming can be divided into 3 phases, namely the hatchery phase, the pededer phase and the enlargement phase. One of the main factors in the growth of catfish is feed. Problems that often occur due to daily feed needs must be in accordance with the daily feeding and feeding schedule. That is because catfish feed greatly affects the addition of weight, length or volume of catfish. In an effort to overcome this, it is necessary to make an automatic catfish feeder by utilizing Internet of Things (IoT) technology. With this tool, feeding can be done to catfish automatically regarding the time or schedule of feeding and the amount or dose of feed. so that the availability of feed can be controlled properly. The IoT-based catfish feeding device uses ESP8266 as its microcontroller besides that ESP8266 also functions to send fish feed capacity data to Thinger.io by using a connected wifi connection.

Keywords - Catfish feeder, Automatic, Internet of Things (IoT), Thinger.io, Ultrasonic Sensor

I. INTRODUCTION

The advancement of electronic technology is growing rapidly and is very influential in the manufacture of sophisticated tools, namely tools that can work automatically and have high accuracy so as to facilitate work done by humans to be more practical, economical and automatic. Automation in all sectors is unavoidable, so that the use of what was originally manual moves to automation. No exception to the activity of raising fish in a pond that can use tools as a helper for its convenience and use.[1]

Indonesia is a country that has a very strong culture, one of which is in fish farming, especially since Indonesia is a water country. Almost all parts of Indonesia can be found fish farmers. The creation of artificial lakes and the vast sea waters in Indonesia have made it easy for people, especially fish farming farmers, to be able to develop fisheries businesses in Indonesia. The fish farming business is very promising in Indonesia, so a lot of technology has emerged that is very helpful for fish farmers [2].

Keeping fish is one of the most popular hobbies of people from the past to the present. In villages and cities, many people keep fish as livestock or as ornamental pets. But the difficulty that occurs is in terms of feeding, lack of time, forgetting and often traveling for a long time is a factor in the owner not feeding his pet fish. In general, owners feed as much as they have time. Then how to always feed on time without interrupting daily activities or bothering others. [3]

Catfish is a fish that has several features and is of great interest to the public for consumption. The catfish farming business can be divided into 3 phases, namely the hatchery phase, the pededer phase and the enlargement phase. The hatchery phase aims to hatch eggs into larvae, the breeding phase aims to produce a certain size and the enlargement phase aims to raise fish to be ready for consumption. Catfish is a type of fish that is quite easy to cultivate because it has a strong enough resistance even in murky or clear water conditions. However, catfish farmers always have problems in cultivating catfish.[4]

One of the main factors in catfish growth is feed. That is because catfish feed greatly affects the addition of weight, length or volume of catfish. If feeding is not effective, it will affect the accumulation of residual feed and excretion of catfish, which can cause a decrease in the quality of fish ponds, which can indirectly affect catfish productivity.[5][6]

IoT-based catfish feeding device uses esp8266 as its microcontroller, besides that esp8266 also functions to send fish feed capacity data to Thinger.io using a connected wifi connection.[7] The workings of the tool itself use a servo to open and close the fish feed container then the fish feed is

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distributed using a pipe, to detect the availability of fish feed in the container using an ultrasonic sensor.[8] This ultarasonic sensor functions to measure the volume of fish feed capacity in the container, if the fish feed capacity runs out, the buzzer and led lights will turn on.[9] In addition, fish feed monitoring can be seen with the Thinger.io web by entering a code that is automatically connected to the tool itself. As for scheduling, it can be done with the android application then esp8266 will set the time according to what is scheduled on android using rtc as a time module.[4]

The problem that often occurs is that the daily feed needs must be in accordance with the daily feeding and feeding schedule. In feeding as much as 3 times a day. This is an obstacle to the activities of cultivators which causes time to be ineffective and efficient.[3] The current catfish farming business is very promising. In catfish farming activities a lot of work must be done, one of the important things in fish farming is feeding. Currently, catfish feeding is still very dependent on human resources for feeding, which is still manual in nature.[5]

Internet of Things (IoT) is a structure where there are two components in it, namely objects and users. Where the structure has the ability to transfer data over the network without requiring two-way human-to-human interaction, namely source to destination or human-to-computer interaction. [10]

II. Research Methods

The purpose of designing the system is to be able to design an automatic catfish feeding system based on the Internet of Things (IoT), can find out the availability of automatic catfish feed, and can set the feeding schedule automatically.

A. System Requirements Analysis

System analysis needs consist of software and hardware.

1) Software consists of :

a) Arduino IDE

Arduino IDE (Integrated Development Enviroenment) is a software used to write programs, compile into binary code and upload into the microcontroller memory on Arduino. Arduino IDE uses the C++ programming language with a simplified version, making it easier to use. An Arduino program code is generally called a sketch. The Arduino IDE is made from the JAVA programming language.[11]

b) *Thinger.io*

Thinger.io is a cloud IoT Platform that provides every tool needed to prototype, scale, and manage connected products in a very simple way. Our goal is to democratize the use of IoT making it accessible to the world, and streamline the development of large IoT projects.[12][13]

c) *Sketch-up*

The design of this tool is to get results in accordance with the desired physical form, it requires a software to draw the design, namely using the SketchUp application.

2) Hardware consists of:

a) *Power Supply*

Power Suplly serves as a DC voltage source for the tools used. The Power Supply value used is 12V.

b) Ultrasonic Sensors

The Ultrasonic Sensor functions as a sensor that detects the amount of feed available based on the distance available on the feed storage tube.

c) *Node MCU ESP8266*

The ESP8266 MCU node serves as the microcontroller and the connection between Arduino, and Thinger.io.

d) L298 Motor Driver

The L298 Motor Driver functions as a DC motor controller.

e) DC Motor

The DC motor serves as the actuator of the fish feeding valve.

f) *Motor Pump*

Motor Pump functions as a water pump to spread fish feed.

g) RTC DS3231

The DS3231 RTC is an inexpensive and accurate I2C Real-Time Clock with an integrated TCXO (Temperature Compensated Crystal Oscillator) and Crystal.[14]

h) *Buzzer*

The buzzer functions as an alarm or indicator if the amount of feed supply runs out. When the feed supply runs out, the buzzer will be active.

i) *Liquid Crystal Display* (LCD)

Liquid Crystal Display (LCD) is a widely used display module. The LCD here functions as a display of feeding time.[15]

B. Circuit Schematic

The circuit scheme of the Automatic Catfish Feeding Tool using IoT is in the picture below:

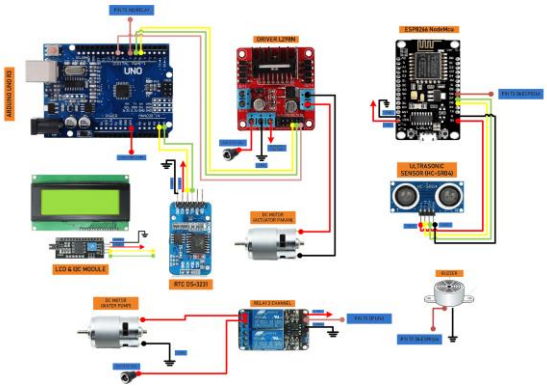


Figure 1. Circuit Schematic of Automatic Catfish Feeding Device using Internet of Things (IoT)

III. BLOCK DIAGRAM

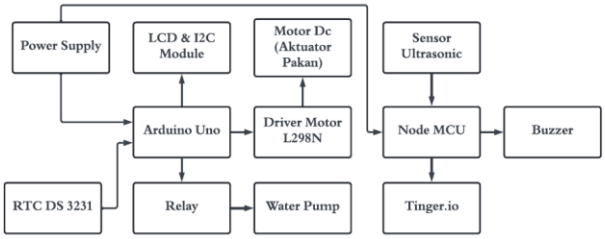
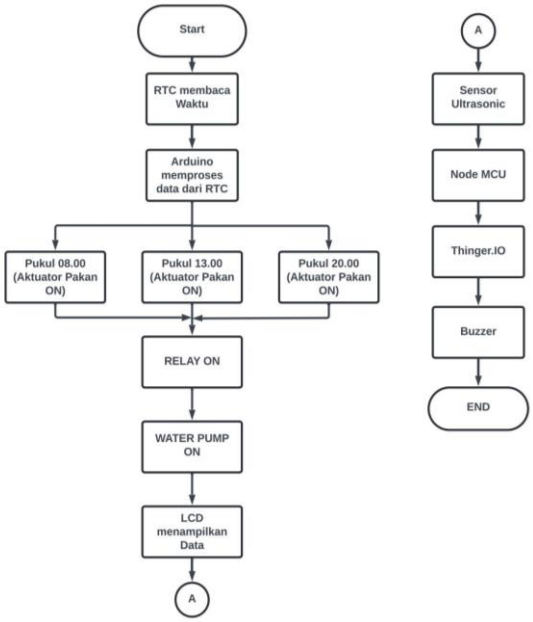


Figure 2. Block Diagram of Automatic Catfish Feeding Device using Internet of Things (IoT)

IV. FLOWCHART



Gambar 3. Flowchart of Automatic Catfish Feeders using Internet of Things (IoT)

V. WORK PRINCIPLES

The working principle of this fish feeder is twofold:

1) For feeding using RTC (Real Time Clock) and Arduino UNO.
   The principle works when the device is turned on, the NODE MCU will automatically connect the internet connection to the WiFi that has been configured to the device and the same mobile phone or laptop device, then the NODE MCU will send a high frequency signal to the Ultrasonic Sensor and the Ultrasonic Sensor will emit ultrasonic waves to the feed, the waves will reflect back to the Ultrasonic Sensor and be sent to the NODE MCU. The signal is processed in the NODE MCU and then sent to Thinger.IO and then the Feed Level and Feed Status are displayed there. The Feed Level depends on the distance reading of the Ultrasonic Sensor where the longer the sensor reading, the smaller the Feed Level displayed on Thinger.IO and the shorter the sensor reading, the higher the Feed Level displayed on Thinger.IO. And the Feed Level depends on the amount of feed in the box, there are 3 feed states, namely:
   a) When the feed is full, the NODE MCU will send data to Thinger.IO and the feed status will be displayed: FEED FULL
   b) When the remaining feed is medium, NODE MCU will send data to Thinger.IO and will display the feed status: MEDIUM FILLED FEED
   c) And when the feed runs out, the MCU NODE will send data to Thinger.IO, the feed status will appear: The feed is gone and the buzzer will blink.
2) For feeding using RTC (Real Time Clock) and Arduino UNO. The principle works when the tool is on Arduino will read the Real Time time on the RTC and appear on the Real clock LCD and then the Feed Valve will open a few seconds when it is time that has been set, there are 3 feeding times in 1 day:
   a) Morning feeding time at 8:00 am then the feed valve will open for about 2 seconds then the feed comes out about 250 grams, then the water pump will turn on for 1 minute then turn off until the next feeding time and the display on the LCD GIVES MORNING FEEDING.
   b) Lunch time at 13.00 then the feed valve will open for about 2 seconds then the feed comes out about 250 grams, then the water pump will turn on for 1 minute and then turn off until the next meal time and the display on the LCD TAKE LUNCH.
   c) And dinner time at 20.00 then the feed valve will open for about 4 seconds then the feed comes out about 500 grams, then the water pump will turn on for 2 minutes then turn off until the next meal time and the display on the LCD GIVE NIGHT FEED.

The function of the Water Pump here is used to channel water mixed with feed that has been released by the tool channeled through the pipe above the fish column so that all feed is distributed throughout the column.

VI. TOOL DESIGN

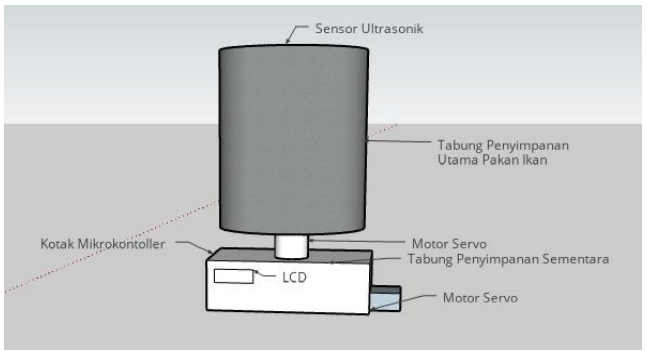


Figure 4. Design of Automatic Catfish Feeders using Internet of Things (IoT)

VII. RESULTS AND DISCUSSION

Testing on the tool is done to find out whether the tool made is functioning properly in accordance with the design made. Testing on this Automatic Fish Feeding Tool is done by setting the time with a range of 1 minute on the RTC, which in the 1st minute, the tool will issue 250 grams of feed, the 2nd minute the tool will issue 250 grams of feed, and the 3rd minute the tool will issue 500 grams of feed, then return to the first minute and so on repeating every time. Minutes 1 and 2 represent morning and afternoon conditions, minute 3 represents conditions at night. In the experiment conducted the tool will be active with 3 conditions:

1) Appliance ON 1 second, then OFF 1 minute
2) Appliance ON 1 second, then OFF 1 minute
3) Appliance ON 2 seconds, then OFF 1 minute
4) Conditions return to a), b), c) and so on.

A. Testing on RTC, Actuator Motor, LCD and Water Pump

RTC serves to display time in Real-Time. The actuator motor functions as a feed discharge valve, the LCD functions to display the feeding time, and the water pump functions as a feed distributor using water.

TABLE I
TESTING ON RTC, MOTOR ACTUATOR, LCD, AND WATER PUMP

Experiments	Real-time	Feed Actuator	LCD Display	Water Pump
1	Morning Time	ON	Give Morning Feed	ON
2	Daytime	ON	Give Midday Feed	ON
3	Nighttime	ON	Feed Nightly	ON
4	Morning Time	ON	Give Morning Feed	ON
5	Daytime	ON	Give Midday Feed	ON
6	Nighttime	ON	Feed Nightly	ON
7	Morning Time	ON	Give Morning Feed	ON
8	Daytime	ON	Give Midday Feed	ON
9	Nighttime	ON	Feed Nightly	ON

B. Testing on Ultrasonic Sensor and Thinger.io

Ultrasonic sensor in this tool serves to detect the amount of feed available in the supply tube. Thinger.io serves to display feed level information and the status of available feed on the supply tube.

TABLE II
TESTING ON ULTRASONIC SENSORS AND THINGER.IO

Sensor reading distance	Feed Levels available On Thinger.io	Feed status available On Thinger.io	Buzzer
1cm	16 cm	Full Feed	OFF
2 cm	15 cm	Full Feed	OFF
3 cm	14 cm	Full Feed	OFF
4 cm	13 cm	Full Feed	OFF
5 cm	12 cm	Full Feed	OFF
6 cm	11 cm	Full Feed	OFF
7 cm	10 cm	Full Feed	OFF
8 cm	9 cm	Full Feed	OFF
9 cm	8 cm	Full Feed	OFF
10 cm	7 cm	Full Feed	OFF
11 cm	6 cm	Full Feed	OFF
12 cm	5 cm	Full Feed	OFF
13 cm	4 cm	Medium Feed Fill	OFF
14 cm	3 cm	Medium Feed Fill	OFF
15 cm	2 cm	Feed Runs Out	ON
16 cm	1 cm	Feed Runs Out	ON

VIII. CONCLUSIONS AND ADVICES

A. Conclusions

Based on the testing of the tools that have been carried out, it can be concluded that the tool has worked well and in accordance with the working principles of the tool design that has been made. The tool can determine the remaining amount of feed in a container that can be monitored using the Thinger.io web. The tool can issue feed according to the amount determined based on the time set on the RTC. Which in each morning, afternoon and evening the amount of feed issued by the tool is different according to the needs of fish feed. In the morning the feed is released as much as 250grams, at noon 250grams and at night 500grams. Based on the tests carried out the success rate of the tool is 100%.

B. Advices

From the results of the tests carried out, of course, the advantages and disadvantages of the tools made were found. For the future this tool can be developed into a more complex tool, one of which can be made using scales (Load Cell) so that the amount of feed issued can be weighed and the amount of feed must be more accurate every time it is issued by the tool.

REFERENCES

[1] A. Waluyo, "Pemberi Pakan Ikan Otomatis Menggunakan ESP8266 Berbasis Internet Of Things (IOT)," *J. Teknosains Seri Tek. Elektro*, vol. 1, no. 1, pp. 1–14, 2018.

[2] H. Himawan and M. Yanu F, "Pengembangan Alat Pemberi Makan Ikan Otomatis Menggunakan Arduino Terintegrasi Berbasis Iot," *Telematika*, vol. 15, no. 2, p. 87, 2018, doi: 10.31315/telematika.v15i2.3122.

[3] Putra timur sinar perdana, "Rancang Alat Pemberi Pakan Jarak Jauh Berbasis Tele Respiber," 2021.

[4] H. Hidayat and W. Haryono, “Berbasis Mikrokontroler Node Mcu Pada Budidaya Ikan,” vol. 1, no. 3, pp. 937–944, 2023.
[5] Marisal and Mulyadi, “Rancang Bangun Alat Pemberi Pakan Ikan,” *Jurnal ELSains*, vol. 2, no. 1. 2020.
[6] M. E. A.H, “Rancang Bangun Sistem Pemberian Pakan Ikan Lele Otomatis Berbasis Internet of Things (Iot) Program Studi Teknik Informatika,” p. 9, 2021.
[7] L. Devy, “Rancang Bangun Alat Pemberi Makan Ikan Menggunakan Blynk Untuk Keramba Jaring Apung Berbasis IoT,” *Elektron J. Ilm.*, vol. 13, no. September, pp. 53–59, 2021, doi: 10.30630/eji.13.2.223.
[8] A. Rahmat, “Arduino Uno R3 Sensor Ultrasonic,” pp. 3–9, 2018.
[9] N. Fath and R. Ardiansyah, “Sistem Monitoring Alat Pemberi Pakan Ikan Otomatis Menggunakan NodeMCU Berbasis Internet of Things,” *Techno.Com*, vol. 19, no. 4, pp. 449–458, 2020, doi: 10.33633/tc.v19i4.4051.
[10] N. A. Putri, “Pengembangan Alat Penabur Pakan Ikan Otomatis Pada Aquarium Berbasis Internet of Things (Iot),” *Tugas Akhir*, 2019.
[11] A. Saputra and M. Rahmadani, “Alat Monitoring dan Pemberian Pakan Ikan Otomatis berbasis Arduino Uno R3,” *Snistek 4*, pp. 37–42, 2022.
[12] L. O. Aghenta and M. T. Iqbal, “Low-cost, open source IoT-based SCADA system design using thinger.IO and ESP32 thing,” *Electron.*, vol. 8, no. 8, pp. 1–24, 2019, doi: 10.3390/electronics8080822.
[13] S. S, D. Megah Sari, C. Nur Insani, and S. Aulia Rachmini, “Sistem Kontrol Dan Monitoring Pemberi Pakan Ikan Otomatis Berbasis Iot,” *Jumistik*, vol. 1, no. 1, pp. 2964–3953, 2022, [Online]. Available: www.ojs.amiklps.ac.id
[14] Y. Widiawati and P. H. Islam, “Pemanfaatan RTC (Real Time Clock) DS3231 Untuk Menghemat Daya,” *Pros. Semin. Nas. Tek. Elektro*, vol. 3, pp. 287–289, 2018, [Online]. Available: http://prosiding.pnj.ac.id/index.php/snte/article/viewFile/049 - 2017/1769
[15] S. Samsugi, R. D. Gunawan, A. T. Priandika, and A. T. Prastowo, “Penerapan Penjadwalan Pakan Ikan Hias Molly Menggunakan Mikrokontroler Arduino Uno Dan Sensor Rtc Ds3231,” *J. Teknol. dan Sist. Tertanam*, vol. 3, no. 2, 2022, doi: 10.33365/jtst.v3i2.2127.