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AUTOMATIC FISH FEEDING SCHEDULE SYSTEM USING ARDUINO AND REAL-TIME CLOCK

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Abstrak. Penelitian ini bertujuan untuk merancang dan mengembangkan alat pemberi makan ikan otomatis menggunakan mikrokontroler Arduino. Penelitian ini bertujuan untuk membantu pemilik akuarium atau peternakan ikan dalam menyediakan pemberian makan yang konsisten dan terjadwal sambil mengurangi beban kerja manusia. Metode penelitian melibatkan perancangan komponen perangkat keras dan perangkat lunak. Perangkat keras tersebut meliputi dispenser pakan, penggerak motor, modul Real-Time Clock (RTC), LCD, dan mikrokontroler Arduino. Pengembangan perangkat lunak ini adalah untuk menjadwalkan waktu pemberian makan dan mengontrol jumlah pakan yang diberikan. Temuan penelitian menunjukkan keberhasilan perancangan dan implementasi alat pemberi makan ikan otomatis. Pengguna dapat dengan mudah mengatur jadwal pemberian makan dan ukuran porsi melalui antarmuka yang mudah digunakan. Sebagai kesimpulan, penelitian ini telah berhasil merancang alat pemberi makan ikan menggunakan mikrokontroler Arduino, yang meningkatkan kemudahan pemeliharaan ikan di lingkungan akuarium atau peternakan ikan, khususnya dalam pemberian makan ikan otomatis.

Abstract. *This research aims to design and develop an automated fish-feeding device using a microcontroller Arduino. This research intends to assist aquarium or fish farm owners in providing consistent and scheduled feeding while reducing the human workload. The research method involves designing both the hardware and software components. The hardware includes a feed dispenser, a motor drive, a Real-Time Clock (RTC) module, an LCD, and a microcontroller Arduino. The development of this software was to schedule feeding times and control the amount of feed dispensed. The research findings demonstrate the successful design and implementation of the automated fish-feeding device. Users can easily set feeding schedules and portion sizes through a user-friendly interface. In conclusion, this research has successfully designed a fish-feeding device using an Arduino microcontroller, which enhances the ease of fish maintenance in aquarium or fish farm environments, particularly in automated fish feeding.*

1. INTRODUCTION

The advancement of technology has experienced rapid growth, particularly in the field of electronics. This technological progress is widely employed to facilitate human tasks by creating electronic devices that work automatically with high precision. This technological advancement has made human life more efficient and automated. Automation in various sectors is unavoidable, and initial manual processes have shifted towards automation[1]. No exception applies even to hobbies, such as maintaining aquariums, which can utilize devices to enhance ease of use[2].

There are many fish enthusiasts, including those who keep ornamental fish and fish for consumption [3]. Maintaining the well-being of these fish requires careful attention to their feeding schedules, necessitating a regular and continuous feeding routine [4]. On fish farm, feeding is a routine activity. The quantity of feed provided often becomes a challenge during the fish-feeding process. Feeding too little can result in malnutrition and emaciation among the fish due to a lack of nutrition [5]. Overfeeding can lead to water pollution from food remnants. By providing an adequate amount of feed, these issues can be prevented[6]. The problem is that when someone travels a long distance for a long time, up to days, they will think about the condition of the fish they choose and how they can feed these fish continuously or on a schedule without disrupting their daily activities [7]. Automation technology can facilitate humans in feeding fish [8][9][10].

From this issue, there arises a need for a device that can automatically feed fish, capable of dispensing fish feed at predetermined intervals by setting the feeding time according to the user's desired schedule. With this automated feeding system, users can remember to feed their pets fish or be present during feeding times. Based on the background, the author proposes a solution by designing a device. "**Automatic Fish Feeding Schedule System Using Arduino and Real-Time Clock**".

2. LITERATURE STUDY

2.1 Software

The software for assembling this automatic fish feeding device includes the following:

2.1.1 Arduin IDE

The Arduino IDE is a software used for writing, organizing, and uploading program data into the Arduino. The Arduino software provides various features that support software development, including syntax highlighting, autocompletion, and debugging. This software allows users to easily program the Arduino board using the C/C++ programming language for Arduino [11]. The Arduino IDE interface is shown in Figure 1.

Figure 1. Software Arduino IDE

2.2 Hardware

The hardware for assembling this automatic fish feeding device includes the following:

2.2.1 Arduino UNO

The Arduino Uno is a circuit board based on the ATmega328 microcontroller. This integrated circuit (IC) features 14 digital input/output pins (6 of which are PWM outputs), 6 analog inputs, a 16 MHz ceramic crystal resonator, USB connection, an adapter socket, an ICSP header, and a reset button. These features make it easy to connect the microcontroller to a power source via a USB cable, AC to DC power supply adapter, or a battery. This device can be used to create electronic circuits ranging from simple to complex. It can be utilized for LED control, sensor applications, and even robot control, all implemented with this relatively small board.

Figure 2. Arduino UNO

2.2.2 DC Motor

DC motor is a machine that functions to convert DC electrical energy into motion or mechanical energy in the form of rotor rotation. In this study, a 12-volt, 935 rpm DC motor is used. The DC motor has a relatively small size, making it easy to apply in various applications.

Figure 3. DC Motor

2.2.3 Relay

Relay is a component in an electronic circuit that functions as a switch to control a circuit by activating or deactivating the switch contacts[12]. The components that make up a relay consist of an electromagnet (coil) and a mechanical switch (switching device). The function of the coil is to attract the contact points, allowing them to connect or disconnect depending on the type of relay used. Generally, the function of a relay is to interrupt or allow the flow of current according to the requirements. The basic operating principle of a relay is based on electromagnetic principles, where the movement of the switch can be controlled as needed. With the relay's function, the flow of electrical current with low voltage can be transformed into a flow with higher voltage.

Figure 4. Relay

2.2.4 RTC DS3231 Module

The DS3231 RTC module is a type of module that functions as a Real-Time Clock (RTC) or digital timer, along with an added feature of a temperature sensor, all integrated into a single module[13].

Figure 5. RTC DS232 Module

2.2.5 LCD 16x2 Display

The LCD (Liquid Crystal Display) is a type of display media that uses liquid crystals as the primary display element. The features provided by this LCD include:

- It consists of 16 characters and 2 lines.
- It has 192 stored characters.
- It includes a built-in character generator.
- It can be operated in both 4-bit and 8-bit modes.
- It is equipped with a backlight.

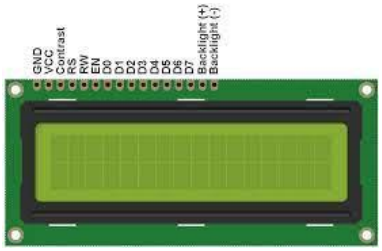

Figure 6. LCD 16x2 Module

2.2.6 I2C Module

The I2C module is a display system using a 16x2 character LCD dot matrix based on the Hitachi HD44780 IC, with a high-speed I2C serial bus produced by DFRobot. This 16x2 character LCD dot matrix system based on the HD44780 IC can be connected to an Arduino Uno board using only two pins, Analog A4 and A5, along with a DC +5 Volt power supply. The Analog A4 and A5 pins of the Arduino Uno are connected to the SDA and SCL pins of the serial board. A LiquidCrystal_I2C.h library file is required for the Arduino Uno board to control the 16x2 character LCD dot matrix based on the Hitachi HD44780 IC with the I2C serial bus. I2C is a bidirectional serial communication protocol using two dedicated channels for sending and receiving data. The I2C system consists of the SCL (Serial Clock) and SDA

(Serial Data) channels, which carry data between the I2C system and its controller.

Figure 7. I2C Module

2.2.7 DC voltage adapter

DC voltage adapter is a device that functions to convert AC voltage into DC voltage. The purpose of the adapter is to transform high electrical voltage into a lower one. It ensures that the electrical current flows according to the requirements of the device being used.

Figure 8. DC Voltage Adapter

3. RESECH METHODS

3.1 Blog Diagrams

The diagram of the fish feeder is divided into three parts: input, process, and output. The input section comprises the RTC module, setting button, and power source. The process section includes the microcontroller Arduino. The output section consists of display LCD and DC motor. The block diagram of the device is illustrated in Figure 8.

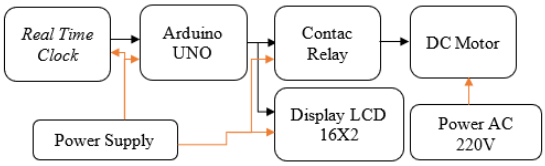

Figure 9. Blog Diagram

Arduino is a microcontroller and functions as a data processor from input to output. The Arduino microcontroller connects to the power source, setting button, RTC module, LCD, and drive motor. The DC motor functions to push fish food out of the container.

3.2 Working Principle

The working principle of this device was based on fish feed scheduling. Create the program using the Arduino IDE software. Schedule settings can be adjusted using the settings button. The device was programmed according to the flowchart.

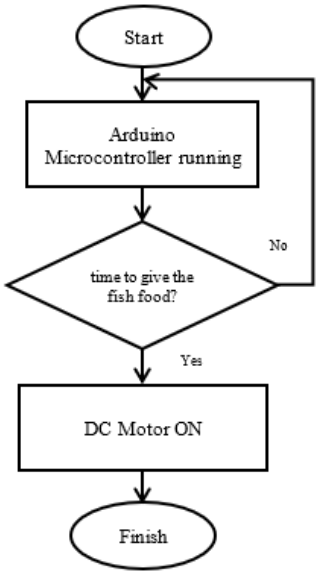

Figure 10. Flowchart of The Algorithm

4. RESULTS AND DISCUSSION

The automatic fish feeding device using Arduino has several important main components as: Arduino microcontroller, RTC module, LCD module, setting button, motor driver, DC motor, and feed dispensing system. The designed feeding device shown in Figure 11, Figure 12, and Figure 13.

Figure 11. Front View of The Device

Figure 12. Rear View of The Device

Figure 13. Control Panel Display

4.1 Current Time Clock Testing

The Clock time setting aims to adjust the current time to the device time. Setting the clock time can be done by pressing the menu button until "Atur Jam" appears on the display shown in the picture. Set the time by pressing the Up / Down button.

Figure 14. Time Setting Display

The time setting on the device can done for 24 hours. The time can adjust according to the user's needs. The test results for setting the clock on the device can show in figure 15.

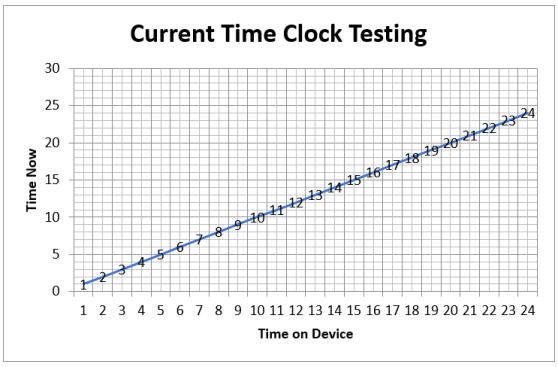

Figure 15. Graph of Device Time Setting Results

4.2 Fish Feeding Time Testing

The process of setting fish feeding times aims to regulate mealtimes. Process setting feeded times can done by pressing the menu button until "waktu makan ke-1" appears on display shown in the Figure 8. Set the time by pressing the Up / Down button.

Figure 16. Display Testing Fish Feeding Times

The test results for setting feeded times on the device shown in Figure 17.

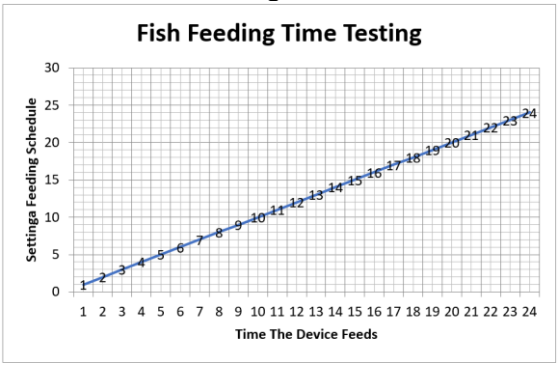

Figure 17. Graph of Fish Feeding Time Test Results

4.3 The Amount of Fish Food Testing

Setting the motor rotation time aims to regulate the amount of fish food released. Process of set the duration of rotation can done

by pressing the menu button until "lama putaran" appears on the display shown in the picture. Set the time by pressing the Up / Down button.

Figure 18. Testing the Amount of Fish Food Display

Motor rotation time testing was carried out from 1 second to 100 seconds with a repetition of the experiment every 5 seconds. The motor rotation duration can be adjusted for longer according to user needs.

The test results for setting the motor rotation time on the device can show in Table1.

Table 1. Testing the Amount of Fish Food Result

No	Duration of Motor Rotation (seconds)	Fish Food coming out (Gram)			
		Experimen 1	Experiment 2	Experiment 3	Average
1	1	4	4	3	3,67
2	5	12	13	12	12,33
3	10	21	21	20	20,67
4	15	29	30	29	29,33
5	20	37	38	37	37,33
6	25	46	46	46	46
7	30	54	55	55	54,67
8	35	63	63	63	63
9	40	71	71	71	71
10	45	79	80	79	79,33
11	50	88	88	87	87,67
12	55	97	96	96	96,33
13	60	105	105	105	105
14	65	114	115	114	114,33
15	70	122	124	123	123
16	75	130	132	130	130,67
17	80	139	140	139	139,33
18	85	148	148	148	148
19	90	156	157	156	156,33
20	95	165	166	165	165,33
21	100	173	174	173	173,33

5. CONCLUSIONS

The results of research on creating an automatic fish-feeding system can concluded as follows:

a. The automatic feeding device uses an Arduino Uno microcontroller module as a fish-feeding timer.
b. The results of testing the device's performance show that the device can provide feed as needed.

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