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Development of Prototype: Fish Drying Electronic Roof

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Abstract: The fishing industry is an important part of the national economy. Basically, local fishing communities that produce fish -based products often face difficulties throughout the drying process. This problem is due to the hot climate change and rainy weather experienced by Malaysia throughout the year. Therefore, they need to monitor the fish drying process to ensure that the products produced are able to meet the needs of customers. This has led to an experimental prototype design of the "Fish Drying Electronic Roof," which will use a pulling machine that can go in when the weather is rainy and out when the weather is hot. As a result, the resulting project successfully produced machines that can help ease the burden on fish product operators even if they are out of the area. Finally, this project can provide guidance and thoughtful ideas to stakeholders through the creativity and innovation projects it produces.

Keywords: Fish drying, Electronic roof; Fishing industry, Prototype

1. Introduction

The fisheries, a sub-sector of the agriculture, makes a sizable contribution to the national economy of Malaysia. Fisheries contribute 11% of the nation's Gross Domestic Product (GDP), compared to a national GDP contribution of 8% [1]. In line with the National Agrofood Policy (NAP) 2011-2020 [2],

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the Department of Fisheries Malaysia (DOF) has set a mission to manage and grow the fisheries industry in a sustainable, competitive, and dynamic way based on scientific data and high-quality services. Therefore, the fisheries sector continues to be a major source of food, money, nutrition, and livelihood for Malaysians.

In many developing countries, subsistence fishers or small-scale processors use drying, smoking, and salting to process fish and its byproducts. Usually, the processing is done on lakeshores under temporary shelters with tools like wire mesh, wood spikes, and ropes for hanging fish. Due to their extreme susceptibility to degradation right after harvest, the processing and preservation of fresh fish and its byproducts is crucial. To avoid losses and extend the shelf life of fish that isn't sold fresh, the right preservation techniques must be used [3].

Drying is a technique for preserving food that eliminates the fish's water, inhibiting the synthesis of bacteria. This is because of the microorganisms that exist in the digestive tract of fish gills, they are vulnerable to the formation of food poisoning bacteria. Thus, drying it not only keeps the fish for a longer period of time, but also increases its nutritional quality when compared to raw meat by weight [4-5]. Therefore, effective fish drying is crucial to preserve these priceless sources of protein by minimising deterioration that can be used as human food.

However, the local fishing community encountered challenges during the drying process. This is because rainfall distribution in most parts of Malaysia is unpredictable and often irregular [6]. This situation will indirectly affect on the temperature control during drying, the moisture content, and the processing power. They had to keep an eye on the fish drying area because the weather was changeable and they needed to make sure the dried fish was of a high standard.

Due to the circumstances, this project aimed to create a prototype for a fish drying electrical roof. As a result, the innovation-focused in this study is to improve and construct a fish drying electronic roof prototype using a rain sensor module and software programs for the Arduino IDE and BLYNK that can interact with the phone reception system. The project's objectives are as follows:

i) To develop a fish drying electronic roof system.

ii) To control an automatic awning system using an Arduino microcontroller.

iii) To inform the user if it is raining during the day using an LCD.

2. Materials and Methods

2.1 Materials

To produce the development of a prototype of fish drying electronic roof, these hardware components are required as shown in **Table 1**.

Table 1: Materials for Prototype Development

Component	Figure	Description
Arduino UNO		The ATmega328 serves as the foundation for the Arduino Uno microcontroller board. Italian for "one," "Uno" was chosen to symbolise the forthcoming debut of Arduino [7].
Water Sensor		A switch actuated by rain is known as a water sensor or rain switch. In order to remove water droplets from the Mylar cover that maintains pressurised and dry air inside the wave-guides, professional satellite communications antennas also use a rain blower that is activated by touching the aperture of the antenna feed [6].
Linear Actuator		A linear actuator is an actuator that generates motion in a straight line as opposed to the circular motion of a traditional electric motor. A spinning motor can provide linear motion through a variety of additional processes [8]
LCD Display		There are 4 such lines, each with a character count of 20. The command and data registers on this LCD are its two registers [6].
Motor Relay		Relays are switches that are controlled by electricity. When the coil is energised, a relay contact that is open will turn on the circuit's electricity [6].
Jumper		Male-to-male, male-to-female, and female-to-female jumper wires are the three main types that are generally available. The most typical and often utilised jumper cables are male to male. A male-to-male wire is required to connect two ports on a breadboard [9].
Battery 12V		For the purpose of powering electrical appliances like flashlights, cell phones, and electric cars, batteries are made up of one or more electrochemical cells with external connections. The source of the electrons that will move from the terminal labelled "negative" to the terminal labelled "positive" is an external electric circuit [6].

2.2 Methodology

To carry out the study and prototype development for this electronic fish drying roof, the researchers used the waterfall method. Software development project processes are usually based on plans, but nowadays agile methodologies have introduced more adaptive approaches to software and system development [10]. Furthermore, many industries are increasingly developing and digitized today and this is leading to the development of new software to increase innovation activities [11]. The waterfall model is a traditional methodology used in the system development life cycle to build systems linearly and sequentially. It is known as a waterfall because it moves methodically from one phase to the next until the end. Each phase must be completed before proceeding to the next phase, and no phases can overlap during this process [12]. Dima and Maassen [11] highlighted that that there are two main models in software development in the IT sector namely Waterfall and Agile. Each of these software has features, advantages and disadvantages that are available depending on the project size, product profile and other relevant factors. The Waterfall model assumes the following sequence in the software development phase, starting with instructions on customer needs and then followed by its practical implementation with product construction [11, 13].

Based on **Figure 1**, there are 5 phases in sequence found in the Waterfall Model, namely: (i) requirement analysis and specification; (ii) design; (iii) implementation and unit testing; (iv) integration and system testing; and (iv) operate and maintenance.

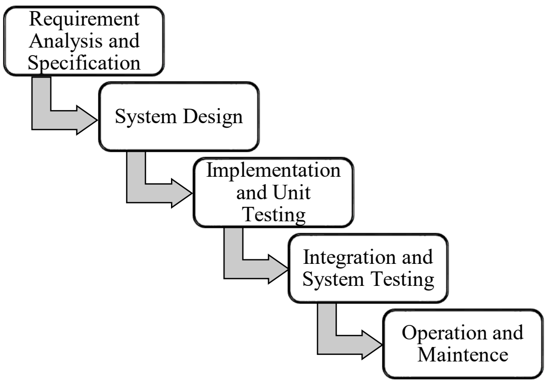

Figure 1: The 5 Stages of the Waterfall Method [13]

2.2.1 Stage 1: Requirement Analysis and Specification

Requirements refers to a process of aggressively gathering requirements to produce hardware and software so that users can understand the type of software required. In this phase, the software requirements specification must be recorded. The project research team initially analyzes the issues at this phase by finding information relevant to the project being undertaken. Researchers also identify difficulties faced by target consumers or consumers for the innovation products produced and solutions to the problems encountered. In addition, the researchers also searched for key electronic materials and components for the creation of this project [14].

2.2.2 Stage 2: System Design

This second phase next examines the requirements specification from the previous phase for designing the system. System design assists in hardware specifications and system requirements, as well as overall system development. Software code for the next stage has been identified and recorded at this phase. The system design is available or adapted according to the needs of the users in this study and project. The researchers set the system design to suit the developed prototype of Fish Drying Automatic Roof as per the requirements of the system [15].

2.2.3 Stage 3: Implementation and Unit Testing

Next, the design program must be converted to a software program for implementation and unit testing. This third phase produces a computer program in line with the design made during the design stage. Testing focuses on programming logically and functionally. This is to ensure all units have been tested, no errors have occurred and the results are as expected [16]. For this project, the researchers performed all the coding and connected all the hardware and software to complete all the parts for the Fish Drying Electronic Roof prototype developed. Then, the next stage is to test the encoding that has been installed into the Arduino Uno and make sure the encoding is correct.

2.2.4 Stage 4: Integration and System Testing

All units generated during the execution phase are integrated into the system. The program created must undergo continuous software testing to see if there are any defects or problems. These tests are also done to ensure that customers do not have problems using the products produced [16]. Once the process is defined and the online layout is built, code execution takes place. The researchers installed the encoder into the Arduino Uno, the encoder that instructs the raindrop sensor on the electronic roof.

2.2.5 Stage 5: Operation and Maintenance

This is the final phase in the Waterfall model where software solution updates after it is delivered and used to refine output, correct errors, and improve performance and quality. This can also involve adapting the software to its environment, adapting to the needs of new users and improving the reliability of the innovation products developed [17]. The final stage involves the operator and maintenance of the developed prototype, making sure everything runs smoothly.

3. Results and Discussion

3.1 System Configuration

An Arduino is required for the development of a prototype of the Electronic Fish Drying Roof to build the coding that will provide system instructions. Once the proposal is ready to be developed, the first step in creating an automatic fish drying system, the root of the project is then made to ensure the automatic awning system is developed without any errors.

The next step is to provide the project's required hardware, including a 12V battery, Arduino UNO, linear actuator, motor relay and jumper (male to male, female to female and male to female). To increase the success of system development, project -related coding searches were also implemented at the same time.

All connections are made (Refer to **Figure 2**) which are referenced throughout the prototype development process this is implemented. The Arduino UNO is then linked to the laptop to verify that the user code test is error -free.

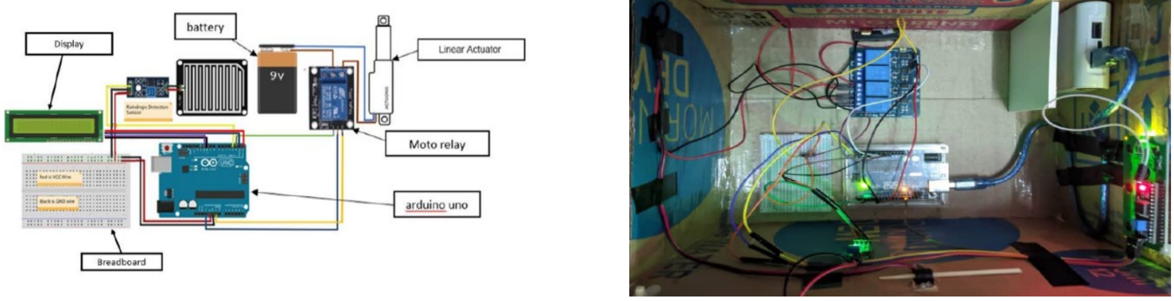

Figure 2: Components Connections

After the components have been maintained, all hardware components are connected and functioning properly, and all are placed correctly in the frame. The system was checked again to make sure there were no problems. Users can send system commands via message to move the system out or in to a residential area. The system has been completely developed and adapted to the prototype (Refer **Figure 3**). Finally, to know that the system was successfully developed, the detector must be able to automatically detect the roof when raindrops fall on it.

Figure 3: Protype of Fish Drying Electronic Roof

3.2 Verification process

Finally, to know that this system was successfully produced, the detector must be able to detect automated roofing of the roof when it starts to rain, and the user must be able to send the system instructions through message to move the system into or out of the roof area after system finish developed. Individual software units or components are tested as part of the software testing process known as unit testing. The test results are shown in the following table:

Table 1: Unit Testing Plan

Unit Testing Plan					
Test Case Name	Text Procedure	Precondition	Expected Result	Tester	Result
Sensor	The rain detector requires Arduino software to function properly.	Ensure rain sensors can detect rain	Rain sensor successful detect rain	User	Pass
LCD Display (Refer to **Figure 4**)	The LCD display requires Arduino software to function properly.	Ensure LCD display works perfectly	Output will show by system	User	Pass

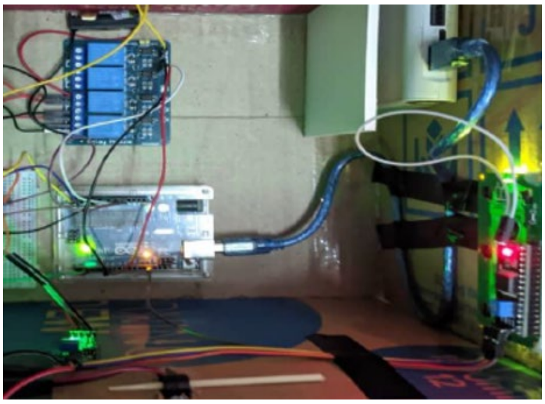

Figure 4: LCD Display

Table 2: Integration Testing Plan

Unit Testing Plan				
Text Procedure	Precondition	Expected Result	Tester	Result
The rain detectors require Arduino software to function effectively.	None	Users can command the system from a remote control	User	Pass

Table 3: User Acceptance Testing

Unit Testing Plan				
	Results			
Acceptance Requirement	Pass	Fail	Tester	Remark
This system can provide extra roof	/		User	This system is very useful for dried fish operators to manage drying activities due to unpredictable weather and its sensors help the movement of the roof to go in and out according to weather conditions. Thus, it can prevent the drying of fish from getting wet and damaged due to rain.

4. Recommendation and Conclusion

The fishing industry contributes significantly to the national economy. This is because the contributions made have resulted in an increase in Gross Domestic Product (GDP) at the moment. However, the fishing industry must increase production and sales in order for the contribution to be multiplied. Given Malaysia's hot and rainy climate all year, fish-based production has presented significant challenges, particularly during the monsoon season or prolonged heavy rains. The main goal of this project is to overcome the challenges that fish industry operators face during the drying process in Malaysia during the monsoon season. The creation of this product will ensure that the manufacturing process and the production of fish-based products can be improved.

This project, known as the Fish Drying Electronic Roof, can aid in the drying of fish in spite of heat and rain. This is due to the fact that the resulting project includes a fish drying machine that can be pulled in when it rains and removed when it is hot. The project also reassures the operators that they do not need to be concerned about the problems they are experiencing even when they are not near the machine. Similar projects have been implemented successfully in developed countries, and they can also be implemented in developing countries such as Malaysia. Proposals have been made to turn this project into a real product that can be used by operators of fish-based products. Further improvements in the future are needed to make this project better in the future by involving the design of hot temperatures inside the machine.

Overall, the main goal of this project is to help Malaysian fish-based product operators produce more products for market sale. Besides that, this project can assist fish product entrepreneurs in continuing the product production process despite rainy or hot weather. This project has produced creativity and innovation that can be contributed to the parties involved, such as fish product operators and the Department of Fisheries Malaysia (DOF), in order to highlight more efficient machines. Indeed, the presence of this machine is certain to alleviate the problems encountered during the rainy season. As a result, this project can help Malaysian fish product operators overcome the constraints they have faced.

Acknowledgement

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Appendix A

AKTA HAK CIPTA 1987

PERATURAN-PERATURAN HAK CIPTA (PEMBERITAHUAN SUKARELA) 2012

SIJIL PEMBERITAHUAN HAK CIPTA
[Subperaturan 8(2)]

No. Pemberitahuan : CRLY2022C01255
Tajuk Karya : S.M.A.R.T AUTOMATED CLOTHESLINE

Jenis Karya : SASTERA
Tarikh Permohonan : 30 MAC 2022

Saya dengan ini mengesahkan di bawah Akta Hak Cipta 1987 [Akta 332] dan Peraturan-Peraturan Hak Cipta (Pemberitahuan Sukarela) 2012 bahawa karya hak cipta dengan No. Pemberitahuan seperti di atas bagi pemohon **UNIVERSITI MALAYSIA KELANTAN** sebagai **PEMUNYA** dan **NURUL ASHYKIN BINTI ABD AZIZ (880106105256), MOHD NASRULDDIN ABD LATIF (891215065293), MOHAMAD ROHIESZAN BIN RAMDAN (920506016109), NOR HAFIZA BINTI OTHMAN (860526355106)** sebagai **PENCIPTA** telah didaftarkan ke dalam Daftar Hak Cipta menurut seksyen 26B Akta Hak Cipta 1987 [Akta 332].

ABDUL HARIS BIN HAJI LAKAR
PENGAWAL HAK CIPTA
MALAYSIA

(Agensi di bawah Kementerian Perdagangan Dalam Negeri dan Hal Ehwal Pengguna)

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