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DESIGN OF FISH WEIGHT MEASURING INSTRUMENT USING CONVEYOR FOR COASTAL FISHERMEN WITH ARDUINO INTEGRATION

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ABSTRACT

Indonesia is a country rich in natural resources including marine wealth when viewed from the geographical structure of Indonesia consists of thousands of islands spread from sabang to merauke. From natural conditions like this, the majority of Indonesian people's livelihoods are fishermen after farmers. But the technology used by our fishermen is still lagging behind so that fishermen cannot maximize the potential of Indonesian fisheries. So that applicative development is needed to make it easier for fishermen. In this study, the design of a tool to automatically count the number and weight of fish using an arduino-based load cell sensor was carried out. This automatic counter uses arduino uno as a processor of the data received and uses a load cell sensor as a detector of the number and weight of fish then the resulting output to the LCD. In this design, an hx711 module is also added which functions as a load cell data converter from analog to digital. The test data, the fish is placed on the conveyor belt that runs and is brought into the counter then the sensor will start to detect then give the command to the Arduino then output the results of the data to the LCD.

INTRODUCTION

Fisheries is one of the most important sectors in the economy, especially for coastal communities. In Indonesia, the fisheries sector contributes significantly to community income, employment, and food security. According to the Central Statistics Agency (BPS), the fisheries sector contributes around 3.5% to the national Gross Domestic Product (GDP) and absorbs millions of workers across Indonesia (BPS, 2022).

Price Determination: Fish weight is often a major factor in determining the selling price. Fishers need to know the weight of their fish to get a fair price in the market (Sari et al., 2021). Resource Management: Fish weight data can help in fisheries resource management. This information is important for research and decision-making related to fisheries sustainability (Ministry of Marine Affairs and Fisheries, 2020). Quality and Standardization: In the fisheries industry, the quality and size of fish have a significant impact on market demand. Proper measurement helps in maintaining quality standards (Hassan et al., 2019). Operational Efficiency: With an efficient weighing device, fishermen can save time and effort in the weighing process, so they can focus more on fishing and fish processing activities (Prasetyo et al., 2020).

However, many traditional fishers still use manual methods that are inefficient and less accurate. This method often involves the use of manual scales that require more time and effort, and can result in errors in measurement. In addition, scales on the market are often expensive and unaffordable for small-scale fishers (Sari et al., 2021). In this context, this research aims to design and develop a more efficient and affordable fish weight measuring device, using existing technologies, such as Arduino and load cell sensors. By utilizing a conveyor system, this tool will not only simplify the weighing process, but also improve the accuracy of fish weight measurement. Research Objectives Developing a Tool Prototype: To create a prototype of a fish weight measuring device that utilizes a conveyor system and a load cell sensor integrated with Arduino. Improving Measurement Accuracy: Using the right technology to improve the accuracy of fish weight measurement compared to the manual method. Providing Affordable Solutions: Designing a tool that can be manufactured at low cost making it accessible to small-scale fishermen. Improving Operational Efficiency: Reducing the time and effort required to weigh fish, so that fishermen can focus more on their core activities. Research Significance. This research is expected to make a positive contribution to coastal fishermen by providing an efficient and

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accurate tool for measuring fish weight. With this tool, it is expected that fishermen can increase their income through fairer and more accurate fish sales. In addition, the data generated from this tool can be used for further research in sustainable fisheries resource management. Thus, this research focuses not only on the technical aspects, but also on the social and economic impacts that can result from the application of technology in the fisheries sector.

LITERATURE REVIEW

Importance of Fish Weight Measurement in the Fisheries Sector, Measuring the weight of fish is a crucial aspect of the fishing industry. According to Sari et al. (2021), the weight of fish not only affects the selling price but also plays a significant role in the management of fishery resources. Accurate weight data helps fishermen determine their catching strategies and manage fish stocks effectively. The Ministry of Marine Affairs and Fisheries (2020) emphasizes that good management requires precise and accurate data, including information about the weight of captured fish. Methods of Fish Weight Measurement raditionally, fish weight measurement has been conducted using manual scales. This method is often inefficient and can lead to errors in measurement. Prasetyo et al. (2020) state that using manual scales can result in variations in measurement outcomes, which impacts pricing and resource management. Therefore, there is a need for more efficient and accurate methods. Technology in Fish Weight Measurement With advancements in technology, various tools and systems have been developed to enhance accuracy and efficiency in measuring fish weight. One widely used technology is the load cell sensor integrated with microcontrollers such as Arduino. According to Hassan et al. (2019), the use of load cell sensors allows for more accurate and reliable weight measurements compared to manual methods. Additionally, Arduino-based systems provide flexibility in developing tools that can be tailored to user needs. Conveyor Systems in Weight Measurement Conveyor systems have also been adopted in various industrial applications, including fish weight measurement. This system allows for the automatic transport of fish to the weighing area, reducing the time and effort required for the weighing process. Research by Prasetyo et al. (2020) indicates that using conveyor systems in fish weight measurement tools can enhance operational efficiency and reduce human error in the weighing process. Implementation and Development of Fish Weight Measurement Tools Several studies have been conducted to develop efficient and affordable fish weight measurement tools. Sari et al. (2021) developed a prototype fish weight measurement tool using Arduino and load cell sensors, which showed satisfactory results in terms of accuracy and ease of use. This research demonstrates that affordable tools can assist small-scale fishermen in increasing their income through more accurate weight measurements. This literature review highlights that measuring fish weight is an important aspect of the fisheries sector that requires more attention. By leveraging modern technologies such as load cell sensors and conveyor systems, fish weight measurement tools can be developed to improve accuracy and efficiency. Further research is needed to optimize the design and implementation of these tools to ensure accessibility for small-scale fishermen.

METHOD

The tools and materials needed in designing a tool to automatically count the number and weight of objects using an Arduino-based load cell sensor consist of hardware and software, among others:

Table 1. Hardware Requirement

No	Name	Function
1	Laptop *windows 10 ultimate*	A place to run an application to automatically count the number and weight of objects using an Arduino-based load cell sensor.
2	Arduino uno R3	As a controller for the components in the design.
3	Sensor *Load Cell*	Sensors used to detect the number and weight of objects.
4	Modul HX711	To convert from analog to digital input in hexadecimal form.
5	LDC I2C	To display the output/result of the number and weight of objects.
6	*Belt Conveyor*	As a means of carrying objects to the top of the Load Cell sensor
7	*Jumper cable*	Connecting one component with another.

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8	Akrilik	Counter structure design and as a base for placing objects.

The software used in the automatic number and weight counter using an Arduino-based load cell sensor is:

Table 2. Hardware Requirement

No	Name	Function
1	Arduino IDE Versi 1.8.3	Used for programming and initializing a pin and determining whether it will be used as an input or output.
2	Fritzing	For the design of hardware (electronics) intended to support designers, artists or hobbyists to work creatively with interactive electronic devices.

Tool design includes work related to block diagrams, hardware design. Before making a circuit and system, a block diagram is first planned which will have a purpose so that the planned circuit leads to the desired goal, Before designing a tool, to facilitate the process of work we must make a working diagram of the entire system. In addition, by making a block diagram we can more easily explain the working system of the device being made. This block diagram can be seen in Figure 1 below:

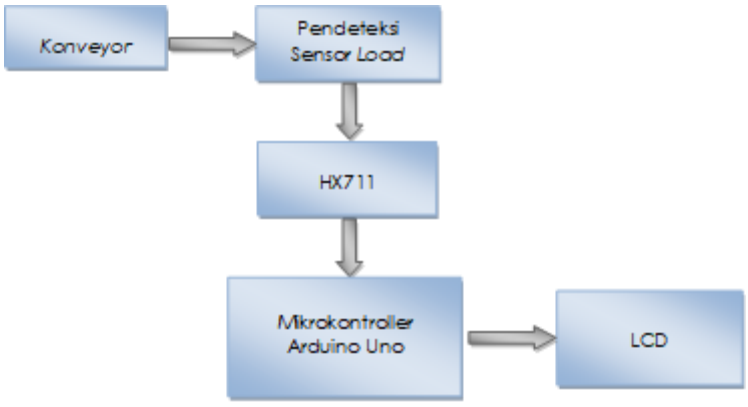

Figure 1. System Design Diagram

Figure 1 is a system for designing a tool to automatically count the number and weight of objects using an Arduino-based load cell sensor. In designing this tool, the system is implemented using Arduino and hardware. The data in this program is detected by the load cell sensor and hx711 module and then processed using Arduino through the interface. While Arduino functions as input for the design program and output for the Load Cell sensor which provides the required set time and then gives output to the LCD. So in this tool we can see the results of the sensor depending on the number and how much weight the object is on it.

In the tool, a micro sensor is planted in the form of a load cell sensor and an hx711 module to calculate the weight of the fish placed in the ataanya. But even though it only calculates the weight of this tool can create an algorithm that not only calculates weight but can even calculate the number of objects one by one. So that the perspective is getting wider, then the sensor is connected to the arduino as the regulator of all programs. The point is that with this automatic counting device for the number and weight of objects, each user will have time effectiveness. The reason is, this tool will cut time faster.

The following is a flowchart of the design of the number and weight of objects automatically using an Arduino-based load cell sensor that will be made. As in Figure 2

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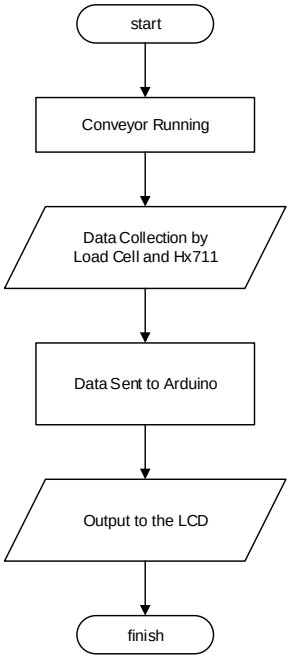

Figure 3. Flowchart of the tool design

From the design of Figure 2 above, it explains that the work of the tool starts by placing objects on the conveyor belt that is running then the object data is detected and calculated starting from the number and weight of objects by the Load Cell sensor, after the data is sent to the Arduino via the Hx711 module to be displayed on the LCD.

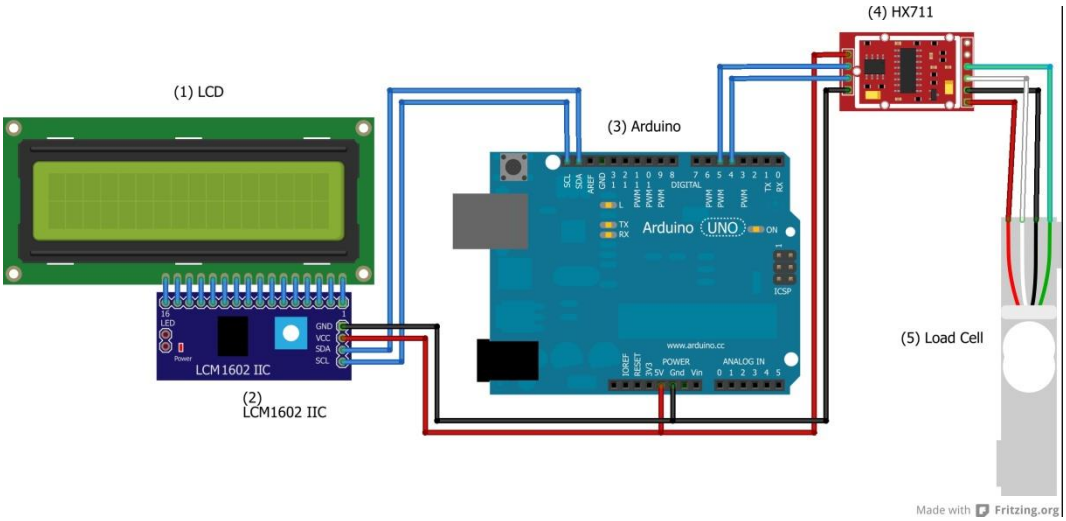

Figure 3. Circuit Schematics

In Figure 3. above explains that this circuit is a description of the system of calculating the number and weight of objects as a whole, the explanation of the picture above is:

1. LCD connected to the I2C pin serves to display the results / output.
2. This I2C converter module functions to control the LCD and reduce the number of pins used on the Arduino in serial synchronization with the I2C protocol.
3. Arduino which is an input tool to process data from a series of counters for the number and weight of objects in the design.

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4. The HX711 module connected to the arduino pin and load cell functions to convert from analog to digital load cell input so that the data in the load cell can be read and processed by the arduino.
5. The load cell sensor connected to the hx711 module functions to calculate the number and weight of objects from this design.

RESULT

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The tool made has several input outputs according to the process and work. The main input is the Load Cell sensor, Hx711 and Arduino, while the resulting output is to the LCD, Belt Conveyor brings fish into the Counter. All connected devices will perform the process according to their respective tasks.sensor.

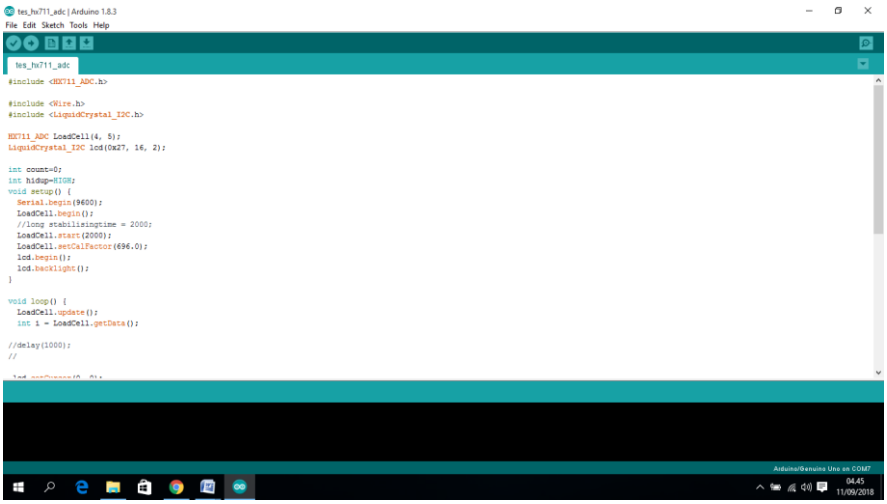
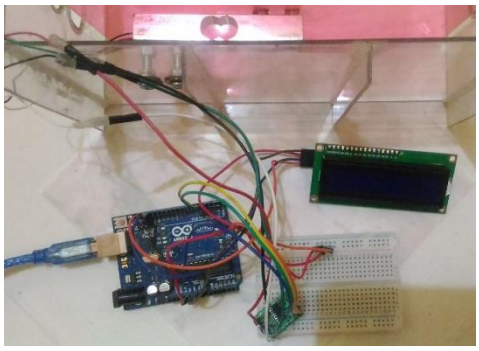
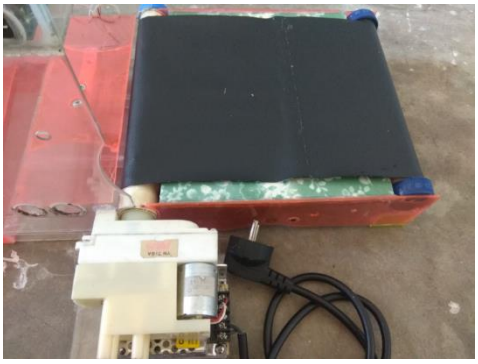


Figure 4. Sketch View of Arduino IDE

In designing this automatic arduino-based fish counting device can be done in several stages, namely:
In Figure 5(a) explains that the Load Cell sensor is connected to the Hx711 module then from the Hx711 module pin itself connected to the Arduino and the pin from the LCD is also connected to the pin on the Arduino as a display tool from the results of the data received.



(a)



(b)

Figure 5. (a) Ardunio Connected to Hx711 Module, Load Cell and LCD, (b) Belt Conveyor

In Figure 5(b) shows the shape of a conveyor made of a DC motor as a means of driving the conveyor belt, while the power supply functions to maintain the stability of the current voltage from the electricity to the DC motor.

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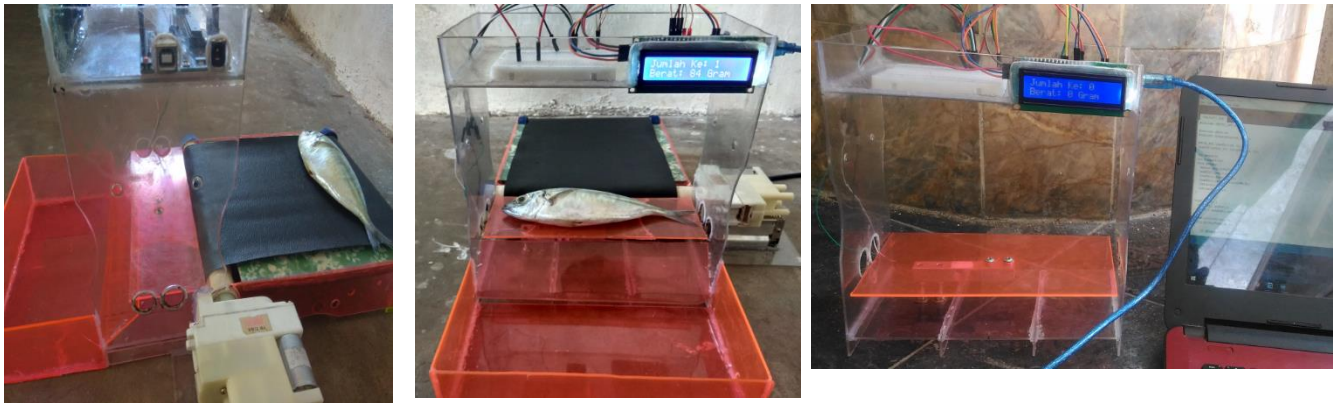
Partial testing of the device has stated that the device is successfully used properly. The device is ready to be combined into one system to carry out commands in accordance with the objectives of this study. The next test is testing the device as a whole.



(a) (b) (c)

Figure 6. Testing the Number and Weight of Fish Counters Automatically

Figure 6 shows that testing the tool starts by entering the program into the Arduino via USB downloader, after which the LCD will start with the display Weight "0", Total "0" and Total Weight "0". In Figure 6 (a) and (b) The first fish is placed on the conveyor belt that is running towards the counter, after the fish enters the counter the load cell sensor will calculate the weight, number and total weight of the fish, then the results will be displayed on the LCD display Weight, Number and Total Weight of the fish. After the weight of the first fish has been calculated, the second fish is placed on the same conveyor belt to go to the same counter. Seen in Figure 7 below

Figure 7. Second Fish into the Counter

Figure 7 The load cell will calculate the Weight, Total and Total Weight of the second fish, where the results of the fish that has been passed first will be added to the second fish that is passed and the weight only calculates the weight of the second fish after the first fish process has been passed, but the Total and Total Weight of the whole fish will be calculated from the first fish then added to the weight of the second fish that has been passed, and so on.
After the system is finished, it is necessary to test the system. This system test aims to determine the extent to which the system can meet user needs and the extent of the accuracy of execution carried out by the system. Counting the number and weight of fish automatically after being tried will get a comparison between input and output. The test results can be seen in the following table:

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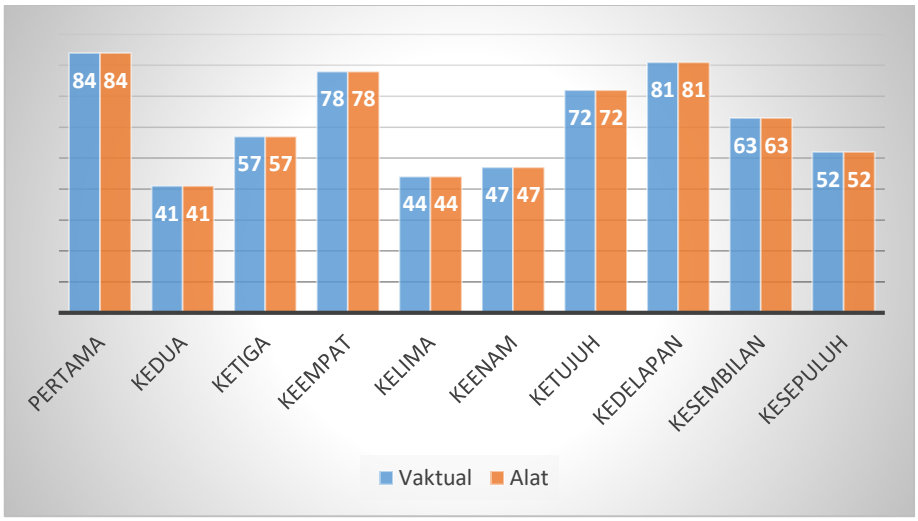

Figure 8. Graph of Tool Accuracy Testing Results

The results of reading the number and weight of fish automatically as shown in Figure 8 Testing was also carried out 10 times. after calculating with the tool, it was concluded that each fish passing over the sensor, the sensor will detect the number and weight of fish one by one by moving the previous fish to the next fish, the first fish data will be calculated by weight and number then after obtaining the results of the first fish data, the status of the number and total weight of the fish will be added to the second fish data and so on. The results of testing the accuracy of the tool as in Table 4.2 Testing was carried out 10 times. After testing, it was found that the comparison of the weight of the fish on the Vaktual scales with the scales in the design of the tool had no difference in weight and stated that the results of both were the same, so it can be concluded that the accuracy of the weight in the design of this tool reached 100% accurate, more details can be seen in the comparison line in the graph below.

Table 3. Accuracy Testing Results

Testing	**Comparison Results of Fish Weight on Vaktual Scales with Fish Weight in Tool Design**			
	Fish Data	Actual Fish Weight	Weight of Fish in Design	Difference
1	First	84 Gram	84 Gram	0
2	Second	41 Gram	41 Gram	0
3	Third	57 Gram	57 Gram	0
4	Fourth	78 Gram	78 Gram	0
5	Fifth	44 Gram	44 Gram	0
6	Sixth	47 Gram	47 Gram	0
7	Seventh	72 Gram	72 Gram	0
8	Eighth	81 Gram	81 Gram	0
9	Ninth	63 Gram	63 Gram	0
10	Kesepuluh	52 Gram	52 Gram	0

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accuracy	**100%**

DISCUSSION

Based on the explanation of the Arduino-based Automatic Fish Counting Tool Design that has been made, a suggestion can be given, namely:

1. Hopefully the prototype of this tool design can be made at a larger size and can be developed in the needs of the community, especially fishermen.
2. Further development of this tool should be able to add a camera for computervision so that it can detect types of fish and add IOT-based monitoring so that it can make it easier for fishermen to count and record details of the catch of fish directly recorded on android.
3. For further development it is recommended to be able to add a total weight program in the design.

The design of a fish weight measuring instrument using a conveyor system integrated with Arduino offers a practical solution for coastal fishermen. The system's key components, including the conveyor, weight measurement module, Arduino microcontroller, and power supply, work together to provide accurate and reliable weight measurements. By considering factors such as accuracy, durability, IoT integration, and cost-effectiveness, the system can be tailored to meet the specific needs of coastal fishermen, enhancing their efficiency and productivity.

CONCLUSION

Based on the results of the design and testing of the automatic fish counting device using an Arduino-based load cell sensor, the following conclusions are obtained:

1. A prototype of a tool to automatically count the number and weight of fish using an Arduino-based load cell sensor has been built.
2. Utilizing load cell sensor technology for counting the number and weight of fish can be done and works well.
3. The result of the calculation accuracy in the tool design is 100%.

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