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Design of a Rice Weighing Tool with Sound Output Using Arduino Uno

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ABSTRACT

Technological developments are currently growing increasingly widespread. This causes conventional equipment to be replaced with more sophisticated and fully automated equipment. This research aims to implement the design of a rice-weighing device with sound output using Arduino Uno. Meanwhile, the benefit you get is knowing the weight of the rice to be weighed and being able to simplify the process of selling rice for traders who sell rice. The research method for this tool uses input, output, and control processes. The load cell functions as an input that calculates the weight, the Arduino functions as a controller for all circuits, and the player and LCD are outputs that display prices. This rice weighing tool is designed in the form of a digital scale which aims to simplify the process of reading the weight of rice on the scale. The test results of this digital scale are that when the weight of rice is above 500 grams, this tool produces a sound output and displays the total price according to the importance of the rice.

INTRODUCTION

Technological developments are currently growing increasingly widespread. This causes traditional equipment to be replaced with more sophisticated and fully automated equipment. 3 The impact of technological developments can develop the level of human creativity in designing and making tools to make it easier for humans to carry out daily activities. One area of technology that is developing rapidly is in the world of electronics. With technological advances, humans can utilize technology to support their needs and mobility. An example of developments in electronic technology that can be applied in the field of commerce is weight measurement. Weight measurement is a problem that can hinder the trading process because it is still done using traditional methods which are still manual and less efficient.

The application of digital scales can be used/utilized in traditional markets, where in traditional markets they are generally only used in light load capacities. Digital scales have many functions because they can be used according to the maximum load capacity of the scale. Accurate measurement results, a more attractive display, and a reading display that is easier to read are the advantages of this digital scale. With these digital scales, traders can have a positive impact because they can simplify the weighing process. The way digital scales work is very easy. The rice is placed in the place provided previously, then the load cell sensor will process the weight of the rice and the LCD information about the weight and price of the rice. However, this is not yet capable of having a significant impact on the sales process, because traders still need time to accumulate prices for the amount of rice sold.

To make the process of weighing rice easier, a tool is needed that works automatically or that works more than the digital scales on the market in general and can replace conventional rice scales. The tool that will be designed is a tool that works using Arduino as a controller for the entire circuit and as a The program storage container is input to the Arduino board, but another supporting tool for knowing the weight of the rice being weighed is the load cell which will be connected directly to the Arduino. This automatic rice scale can display the importance of the rice using an LCD as well as sound output from the weight. The rice uses an MP3 player module. From the description above, the working principle of the tool to be designed is that if rice is weighed on a loadcell scale, the loadcell will send weight data to the Arduino for processing and display on the LCD how much the rice weighs, and then the weight of the rice will also be processed by the MP3 player. is the sound output of the importance of rice being weighed.

Based on the background above, the author is interested in researching "Designing a Rice Weighing Tool with Sound Output Using Arduino Uno".

BASIC THEORY

Arduino Uno

Arduino Uno is a microcontroller-based board on the ATmega328. This board has 14 digital input/output pins (of which 6 pins can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, reset button power jack. These pins contain everything and are used to support the microcontroller, just connect it to a computer with a USB cable or a voltage source that can be obtained from an AC-DC adapter or battery to use it.

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Load cell sensors

It is a sensor designed to detect the pressure or weight of a load, the load cell sensor is used as the main component in a digital weighing system and can be applied to a weighing bridge which functions to weigh the weight of trucks carrying raw materials, measurements carried out by the Load Cell use the principle of pressure.

Hx711 Module

The HX711 is a weighing module, that has a working principle of converting the measured changes into changes in resistance and converting them into voltage quantities through the existing circuit. The module communicates with the computer/microcontroller via TTL232.

LCD

LCD (Liquid Crystal Display) is a device that functions as a display medium by utilizing liquid crystals as the main display object. Of course, LCDs have been widely used for various purposes, such as electronic media, televisions, calculators or even computer screens.

Df Player

DF Player mini is a sound module that can support several files, one of which is an mp3 file which is used as a sound file format. This mini DFPlayer has 16 interface pins, namely standard DIP pins and header pins on both sides.

Speakers

Speakers are output hardware that functions to produce processing results by the CPU in the form of audio/sound. Speakers can also be called tools to output sound produced by music devices such as MP3 players, DVD players, and so on.

METHOD

The tools and materials needed to design a rice weigher with sound output using Arduino Uno consist of hardware and software, including:

Hardware

The hardware used in designing a rice weigher with sound output using Arduino Uno includes:

1. Samsung Intel Core I3 Laptop
2. Arduino Uno R3
3. Jumper Cables
4. Load Cell/Weight Sensor 5 Kg
5. LCD 12c
6. Df Player
7. Speakers

Software

The software used in designing a rice weigher with sound output using Arduino Uno is:

1. Frizing 0.9.0b.32.Pc
2. Arduino Ide Software
3. Vision

Tool Chart

The following is a series of tool charts for designing a digital rice scale.

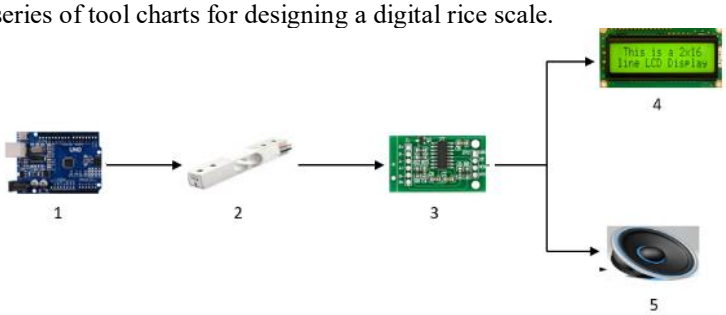

Figure 1. Tool Chart

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Information
1. Arduino Uno as component controller
2. Load cells to detect the weight of objects
3. Hx711 functions as a place to calibrate the scale values
4. LCD as a results display
5. Speaker as a sound player

Research Stages

1. Preparation phase
   At this stage, prepare the tools and materials needed to make this final project, such as PC / Laptop, Arduino Uno, Jumper Cables, Load cell, DFplayer, and LCD I2c.
2. Design stages
   At this stage, what must be done is to connect one tool to another tool so that it becomes a unit.
3. Program Writing Stage
   This step is to write the program syntax into the Arduino IDE software.
4. Testing Phase
   After the previous stages have been carried out correctly, what must be done at this stage is to connect the laptop to the device that has been assembled, and upload the program.
5. Testing Phase
   If the load cell measures the weight of rice reaching 500 grams and 1 kg, the price of the rice is displayed on the LCD and makes a sound.

Tool Design Schematic

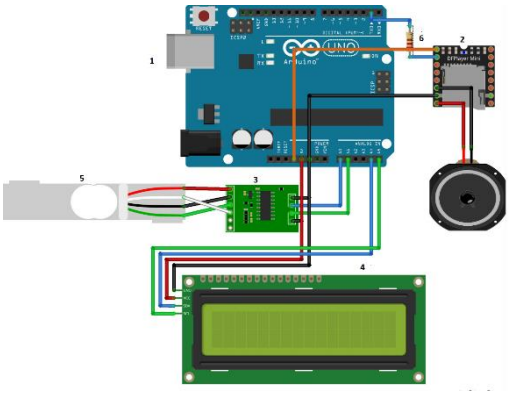

Figure 2. Schematic of tool design

Information
1. Arduino Uno
2. Dfplayer
3. Hx711
4. I2c LCD
5. Load Cells
6. Resistors

Research Workflow

When the tool starts running, the Arduino will control all connected components and the loadcell will detect the weight of rice placed on the loadcell scales. When the weight of the rice is 500 grams to 5 kg, the price of the rice will appear on the LCD and sound.

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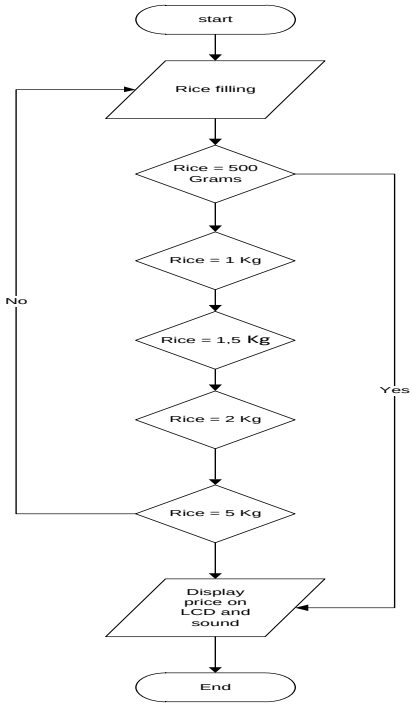

Figure 3. Flowchart

RESULT AND DISCUSSION

After the system has been created, it is necessary to test the system. When a load is placed on the scale, the hx711 sensor will detect the weight of the rice. If the weight of the rice is above 500 grams, the sound and price will be issued from the Dfpleyer module in three languages, namely Indonesian, Jameese, and Acehnese. The weighted price can be set in the Arduino Idea program and will be displayed on the LCD. This test was carried out 10 times to determine the performance of the tool that had been designed.

The way to calculate the Mean Squared Error (MSE) is to subtract the actual data value from the forecast data and the results are squared, then added together as a whole and divided by the amount of existing data.
The Mean Squared Error (MSE) formula is as follows:

$$MSE = \frac{\sum_{t=1}^{n}(At - Ft)^2}{n}$$

Table 1. Testing of weighing equipment

No	Pengujian	Perbandingan Alat		Harga	Nilai MSE	
		Timbangan load cell gram	Timbangan konvesional gram		Selisih	Selisih Kuadrad
1	Pertama	505,40	500	Rp. 19,754	0,54	2,919
2	Kedua	1402,0	1400	Rp 39,589	0,2	0,4
3	Ketiga	701,66	700	Rp 19,995	0,166	0,27556
4	Keempat	1504,69	1500	Rp 42,000	0,469	2,19961
5	Kelima	1000,5	1000	Rp 28,162	0,05	0,025
6	Keenam	1603,90	1600	Rp 45,747	0,39	1,521
7	Ketujuh	1400,8	1400	Rp 43,331	0,08	0,054
8	Kedelapan	1300,40	1300	Rp 36,908	0,04	0,016
9	Kesembilan	500,67	5000	Rp 15,726	0,067	0,04489
10	Kesepuluh	1600,11	1600	Rp 41,436	0,011	0,00121
				Total	2,013	7,46327/
				n	10	10
				MSE	0,2013	0,746327

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The research on the automatic rice weighing device was carried out 10 times, each time the weight is placed on the scale, the weight and price will be issued by producing a sound output and will be displayed on the LCD. And uses voice output in 3 languages, namely Indonesian, Acehnese, and Japanese. After testing the comparison of the two tools, there is an MSE (mean squared error) value with a total difference of 2.013 and a total squared difference of 7.46327 which has been divided by 10 tests and gets a difference value of 0.2013 and a total squared difference value of 0.746327.

This rice weighing test tool is designed in the form of a digital scale to make it easier to read the weight of the rice on the scale. This digital scale will produce a sound output when the weight of the rice is above 500 grams and will issue a total price according to the weight of the rice. The sound of the scales can be used in 3 different languages, namely Indonesian, Japanese, and Acehnese. The price per kg scale is set at IDR 28,000 and can be changed according to your wishes.

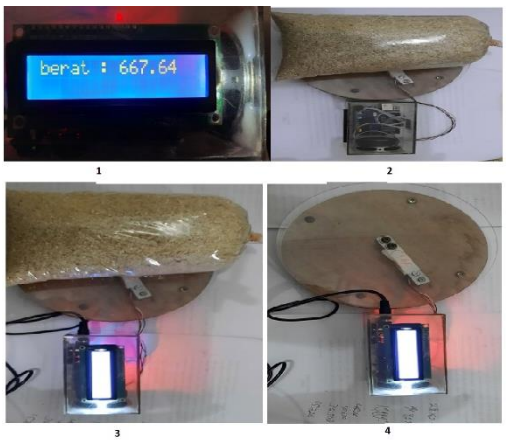

Figure 4. Tool Test Results

CONCLUSION

After designing and testing the rice weighing device with sound output using Arduino Uno and then testing the tool, both testing each circuit and the overall sensor reading. So it can be concluded:

1. When the scale weighs above 500 grams it will make a sound and a price
2. Use a 5 kg HX711 load cell to measure the weight of rice on a scale.
3. The rice scale can determine the price automatically and the price per kg can be set according to the market price.
4. The reading level of the MSE value from loadcell scales with conventional scales is around 0.74632.

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