Design of Conveyor Scale Control and Monitoring Systems using HX711 Module Based On Arduino uno

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ABSTRACT

The weighing and load control system on conveyor scales is a system that has a crucial role in ensuring the efficiency and safety of operations, especially in the aviation industry. In this context, this study aims to design and implement a control system and monitor the overload threshold on conveyor scales using the Arduino Uno-based HX711 module. The efficiency of using this tool can assist in the check-in process. Using this tool can help and speed up airport employees in the process of weighing baggage. This tool can process baggage weighing in less than 1 minute. In this study, using a scale equipped with a conveyor system. The design of the tool in this study for the maximum load that is set on the weighing system is 200 grams with a fine for every increase of 1 gram multiplied by IDR 1,000. If the weight of the load that is weighed exceeds the predetermined load limit, it will be integrated through the print out results that print from the weighing results. The print out contains the results of the weighing and fines that must be paid according to the excess weight. The results of testing the tool with a load weight of 117.7 grams did not experience an overload on the scales, while for a test with a load weight of 229.0 grams it experienced an overload of 29 grams with a fine of IDR 29,000.

Keywords: *Monitoring, Conveyor, Print Out, Overload*

1. INTRODUCTION

The surge in airplane passengers during the 2023 Christmas and New Year holidays can also cause several problems, such as flight delays or cancellations, overbooking, long queues at the airport. To overcome this problem, the Ministry of Transportation often issues several policies, such as increasing supervision of flight security and safety, speeding up the check-in and boarding process, and optimizing the use of technology to increase the efficiency and comfort of air travel during the Nataru holiday season.

Therefore, a reliable technology system is needed to overcome the increase in airplane passengers in order to overcome this problem. Especially when passengers are checking-in, many passengers are queuing due to the lack of airport employees at the check-in area so that the queue for passengers is getting longer. Not only that, weighing passenger luggage which is still done manually and simultaneously during the check-in process can hamper and take approximately 5 minutes for the check-in process. If there is an overload of passenger baggage, the time needed will be longer because the passengers have to pay for the excess baggage.

From these problems, a more reliable and effective passenger baggage weighing device is needed. A tool in the form of a weighing conveyor that can transport and weigh goods simultaneously without the need to stop it. Weighing on the weighing conveyor is carried out by a load cell sensor, which is processed on the Arduino Uno microcontroller component.

If there is an overload of baggage with a weight exceeding the baggage limit set by the airline, passengers can also see the fines that must be paid which are written on the print out. The benefits of this research are that it makes it easier to weigh baggage with weight provisions according to each airline and speeds up the time when airplane passengers go through the check-in process.

From previous research entitled Design and Build of a Weighing Conveyor System by Arda Pandu (2022) there is a difference in the output of the device. The tool designed from existing research uses a buzzer alarm as an information tool when there is an overload when weighing. Whereas in this study, to detect the existence of a weight that exceeds the limit it will be displayed on

the LCD screen and also use a thermal printer as a conversion tool for weighing results. Comparison of previous studies with the title "Design of 5 kg Load Sensor-Based Digital Scales Using the Atmega32 Microcontroller" by Edwar Frendi Yandra, Boni Pahlanop Lapanporo, Muhammad Ishak Jumarang (2016),

The difference between the proposed research and existing research is that this research is equipped with a

conveyor system with the help of a proximity sensor to detect loads passing through the conveyor before entering the weighing process. Whereas the existing research only makes a digital scales system design.

Comparison of the research of previous studies with the title "Design of Microcontroller-Based Digital Fruit Scales with a Thermal Printer Connection" by M. Irmansyah, Junaldi (2021) has differences in this research with existing research

2. METHODS

2.1 Research Design

The research method used in this research is to use research and development tools or Research and Development (R&D). The research method for tool development or Research and Development (R&D) includes several stages as suggested by Sugiyono (2015): Potentials and problems: Research and Development (R&D) starts with a potential problem. Data on potentials and problems do not have to be sought independently, but can be based on other people's research reports or documentation of activity reports from individuals, data collection, product design, design validation, design revision, product trial, product revision, product revision, product validation, revision final product, limited production.

2.2 Tool Design

2.2.1 Hardware Components

1. Adapter

In designing this tool, an adapter with an output of 9 volts is used to supply power to the conveyor and thermal printer.

2. Load Cell Sensors

The load cell sensor functions to measure the weight of an object by converting the pressure or force applied to it into an electrical signal that can be measured.

3. Proximity Sensors

The proximity sensor in the design of this tool is used to detect the presence of a load to be weighed.

4.LCD screen

In the design of this tool, the LCD screen functions to display the weight of the results of weighing the load being weighed.

5.DC motors

The DC motor in the design of this tool is used to rotate the belt on the conveyor.

6.MG90S Servo Motors

The MG90S servo motor is a type of motor used to drive its shaft to a specified position with a high degree of accuracy.

7.Push Button

Push button or push button is a simple type of switch that works by pressing the surface of the button. This button is used to produce a certain action or response in an electronic or mechanical system when pressed.

8. Thermal Printers

Thermal printers are used to print the results of the weighing process.

2.2.2 Software Components

1.Arduino IDE

Arduino IDE (Integrated Development Environment) is software specifically designed to develop, program and upload code to Arduino microcontroller boards. The Arduino IDE provides a user-friendly environment for writing code, testing, and controlling various components and devices via an Arduino board.

2.2.3 Tool Design

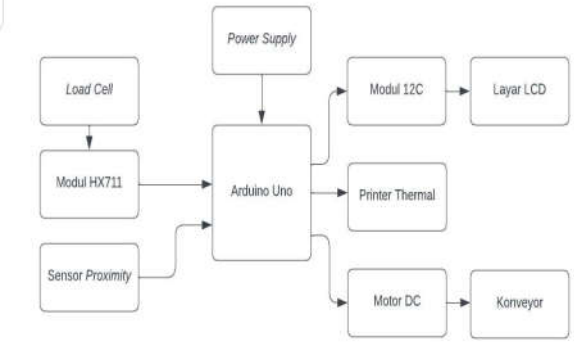

Figure 1. Tool Design

It was explained that the conveyor works when the load has been placed on the conveyor, then the goods will move towards the weighing device which is equipped with a Load Cell component with the weighing distance regulated and limited using a proximity sensor. Furthermore, this component provides input to the HX711 module then the data generated from the scales is forwarded to the Arduino uno component with the output

being issued in the form of numbers which will be displayed on the LCD layer.

If the results of the scales do not exceed a predetermined limit of 200 grams, then the goods will proceed to the next process. If the goods being weighed have a load more than the specified limit, the data system that has been processed on the Arduino uno component will work so that it sends a signal to the thermal printer component to print out the results from the luggage scales.

2.2.4 How the Tool Works

The way this tool works is when the goods are on the conveyor, the goods will be detected by the proximity sensor as input to the Arduino Uno Microcontroller to send commands to run the conveyor. The conveyor moves the goods to the cross-section of the scales. When the goods are on the cross-section of the scales, the weight of the goods will be detected by the load cell sensor which is a weight sensor. Furthermore, the detection of the weight of goods will be forwarded to the HX711 Module as input to the Arduino Uno. The result of weighing will be displayed on the LCD screen along with a display if the object's weight exceeds the capacity of the scale.

Then, print out the results from the weighing will come out of the thermal printer. In the print out display the weighing results will inform the weight of the item being weighed, the fine to be paid, and the maximum weight of the scale. After the print out of the weighing results comes out, the goods will be pushed for further processing on the conveyor which is after the cross section of the scales.

The components used in the design of the control system and monitoring the overload threshold for conveyor scales are Arduino Uno Hardware, Adapters, Buck Converter Modules, HX711 Modules are scales modules, Inductive Proximity Sensors, conveyors, DC Motors, drivers L298N type dc motor, MG90S type servo motor, Load Cell, LCD screen, 12C module, Thermal printer. As for the Arduino IDE software.

3. RESULT AND DISCUSSION

In this study the hardware used for the control and monitoring system is the Arduino Uno Microcontroller, LCD screen and Buck Converter, other hardware is used to manufacture miniature conveyor scales. The software in the design of this tool is used to build a control system that plays an important role in this research. According to the Ministry of Transportation (Kemenhub) the number of passengers every year always increases in air transportation, in 2023 passengers jumped by 3.88 million passengers, this increase was accompanied by the problem of piling up goods weighing because it was still done manually. This weighing conveyor can simultaneously transport and weigh goods without stopping them. Weighing on the weighing conveyor is carried out by a load cell sensor, which is processed on the Arduino Uno microcontroller component.

The data obtained from each airline is used as a reference in compiling this tool so that it can simplify and shorten the time when weighing baggage.

Table 1. 1 Maximum Baggage Weight

NO	Maskapai	Berat Max Bagasi (Kg)
1	Garuda Indonesia	Kelas *First* (40 Kg) Kelas *Bussines* (30 Kg) Kelas Ekonomi (20 Kg)
2	Lion Air	20 Kg
3	Citilink	Kelas *Bussines* (30 Kg) Kelas Ekonomi (20 Kg)

In designing this tool, the Arduino Uno Microcontroller is used as the brain of the tool program. This Arduino Uno microcontroller gets input from several sensors connected to these components. The sensors in the tool design include proximity sensors and load cell sensors. Then, Arduino Uno sends commands to display the weight of the scales on the LCD screen.

In the design of the tool made there is an electronic component in the form of an alarm buzzer. This component functions as a marker when the item being weighed has a weight that exceeds the capacity of the scales that has been set in the Arduino Uno program. At the design validation stage it was generated from the validator that the control and monitoring tool for the conveyor scale overload threshold has been evaluated by a validator named Drs. Hartono, S.T.,M.Pd.,M.M.

Product trials were carried out starting from adapter testing which is important hardware to provide voltage supply to the desired device, buck converter testing to reduce voltage, testing on miniature conveyors aims to determine the work of the conveyor, testing of scales aims to determine the accuracy of weighing system the results of the goods are displayed on the LCD screen. Testing the print out display program aims to display information from the results of weighing the goods carried out. The weighing results will be written on paper printed using a thermal printer. Thermal printers work according to programs that have been made in the Arduino IDE software. In the design of this tool there is some information displayed on the print out results of weighing results.

4. CONCLUSION

Based on the results of testing and analyzing data of the research entitled "Design of Conveyor Scale Control and Monitoring Systems Using HX711 Module Based On Arduino Uno" the following conclusions were obtained the following:

1. This conveyor scale system can speed up the check-in process.
2. This conveyor scale system can help airplane passengers in weighing baggage and passengers can find out the weight of the baggage and fines if the weight of the luggage is overloaded.
3. This conveyor weighing system can be set for the maximum weight of the load being weighed and fines paid for each excess weight.
4. In the design and construction of the control system and monitoring of the overload threshold threshold, this conveyor scale only requires a short time in the work process, which is less than 1 minute.
5. The design of this conveyor weighing system can work properly when weighing with load samples weighing 117.7 grams, 229.0 grams and 243.9 grams.

Advice

In making this final project of course, there are shortcomings so that further development is needed further. Constructive suggestions ar needed to perfect this final project among others as follows:

1. Improve accuracy in the weighing process in order to obtain good accuracy during the weighing process.
2. Using a walking conveyor as a substitute for a cross section of scales.
3. Using additional IoT components to store weighing data.
4. Added display of print out results of scales using QRIS for payment of fines.

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