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ARDUINO-BASED SMART SUITCASE DEVELOPMENT

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ABSTRACT

Security factors are the main thing to watch out for the number of cases of luggage theft in the luggage of airline passengers that continues to increase. MCU nodes are used to help find out the existence of the position of the suitcase so that the ownership of personal items can be known the status of its existence. The use of load cells is used as the main tool for improvisation in the development of smart suitcases to become automatic. This sensor works as a heavy sensor on a scale that will be used as a weighing of a suitcase that is in the filling of clothing. The author came up with the idea to create Arduino-based smart suitcase development. The tool uses Arduino Uno microcontroller coupled with a 20 Kg Load Cell weight sensor and GPS by using NODE MCU V.1.0 ESP8266 as a tracker for the presence of luggage position with other supporting components.

1. INTRODUCING

Passenger numbers increase, safety and security factors continue to take precedence. Security factors at airports are the main thing to watch out for given the number of cases of luggage theft in passenger luggage that continues to increase. On February 9, 2014, exclusively Cakrawala Telisik Antv aired the results of the investment at Soekarno-Hatta airport. In 2013 Soekarno-Hatta Airport recorded 9 cases of theft of luggage bags in passenger luggage. For baggage, each airline provides a free baggage allowance policy provided that the weight of each item included in this type of baggage does not exceed 32 kg. So, even if you have a baggage allowance of ≥ 33 kg, you must divide the item so that each item / pcs / pack / Koli does not exceed the maximum required weight.

The more advanced the development of various innovations, it is expected that security systems can be carried out. One of them is that with the monitoring system of the position of the suitcase if the suitcase is far from its owner such as forgetting or left in one place, then the suitcase can be found by utilizing GPS technology and knowing the weight of the suitcase automatically using the Load Cell[1]–[3]. With such comfort, owners of personal items of expensive value no longer need to worry about losing a suitcase while traveling, negligence from the owner. Also do not be afraid of the capacity of the suitcase exceeds the size limit when traveling by plane because it can know the weight of the suitcase automatically[4]–[6]. From these problems, the author designed a tool that can help and overcome security issues and know the capacity of the suitcase automatically, in hopes of helping to know the existence of the position of the suitcase so that the ownership of an item that is personal can be known the status of its existence and the weight of the suitcase automatically through maps on android[7]–[9].

Arduino Uno is a microcontroller board based on the Atmel AT mega 328 chip. This microcontroller has 14 digital I/O (6 pins can be used as PWM output) and 6 analog inputs, 16 MHz crystal oscillators, USB connections, power jacks, ICSP headers, and reset buttons. This microcontroller operates at a voltage of 5V. Arduino Uno uses the MAX232 IC which is used as a USB-to-serial converter for serial communication to the computer via a USB port.

The buzzer is an electronic component that serves to convert electrical vibrations into sound vibrations. Basically, the principle of buzzer work is almost the same as a loudspeaker, so the buzzer also consists of a coil attached to the diaphragm and then the coil is fed current so that it becomes an electromagnet[10]–[12]. The coil will be pulled inward or out, depending on the direction of the current and the polarity of the magnet, because the coil is mounted on the diaphragm then any movement of the coil will move the diaphragm back and forth to make the air vibrate which will produce sound. Buzzers are commonly used as an indicator that a process has been completed or an error has occurred in a device (alarm) [13]–[15].

2. RESEARCH METHODS

The flowchart diagram below explains how the tool works and processes: In the flowchart below described starting from the moment the power supply is connected with the microcontroller, then starts an initialization that is on the definition of LCD, load cell, module hx711, GPS, Buzzer and variables used, after that, it will appear LCD with the inscription "Smart Suitcase Anita Sari" after performing then the next is the load cell will detect whether there is a load on the koper if there is then the weight of the suitcase will be displayed and when the weight of the suitcase exceeds the max limit of 15 kg then the suitcase will send a HIGH signal on the buzzer that will make the buzzer sound, at the same time node MCU will ask the GPS Module to read the current location and after getting the current location it will be directly sent to the firebase server and then android will read the location sent to the firebase[16], [17].

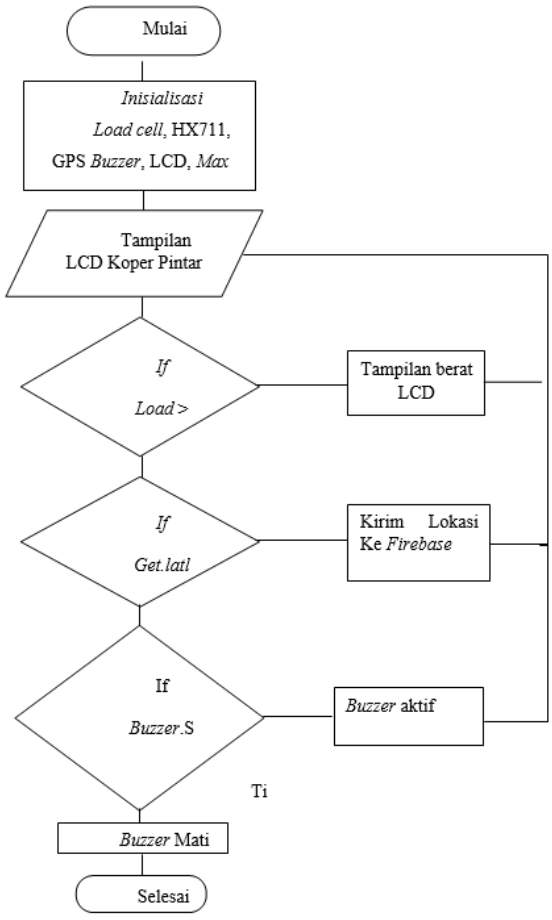

Figure 1. Flowchart Diagam

3. RESULTS AND ANALYSIS

This smart luggage tool is useful to make it easier for people to travel where the suitcase will know the automatic weight using the Load Cell and know the position of the suitcase if the suitcase is lost with GPS. The way the system works is that when the Arduino program has been

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activated it is sent to the microcontroller and then instructs the hx711 module on the Load Cell to calculate the weight with pressure and if it has exceeded the maximum limit then the buzzer is active and appears on the LCD. Then the way android works to detect the position of the suitcase is when the program on the MCU node is active and connected to the internet then the GPS will immediately find the current location and will send the location to the firebase[18]–[20].

3.1. System Planning

The design of this tool uses a SketchUp application that appears images from the front, side, bottom, and top that can be seen from the following images

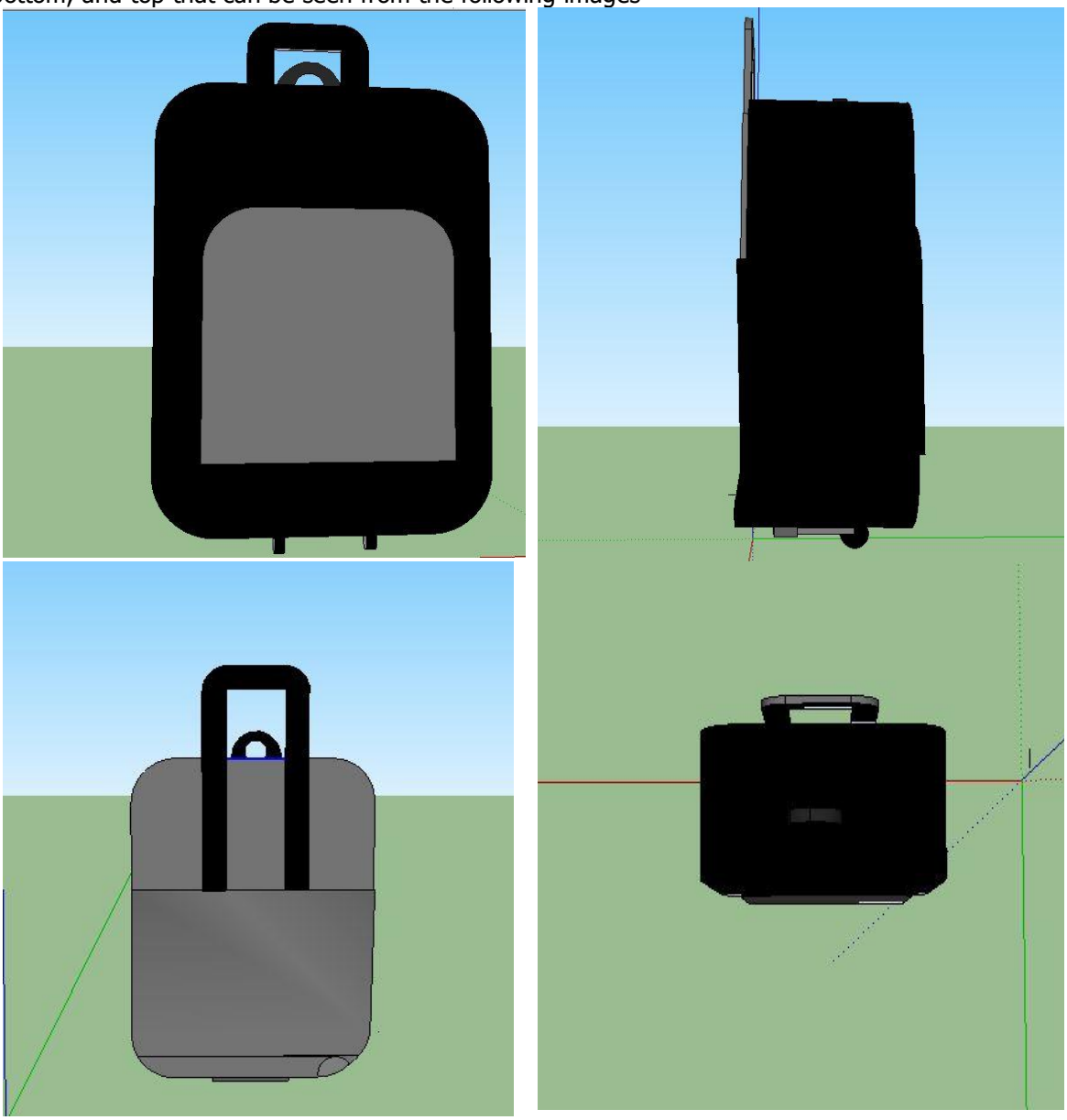

Figure 2. System Design

3.2. System Testing

The purpose of this test is to prove whether the system made meets the planned specifications. Tester results will be utilized to improve system performance and at the same time be used in further development. This system testing consists of several stages, ranging from testing each supporting part of the system to the system tester as a whole. From the test results, it can be analyzed the performance of each part of the system that is inter-contracted so that an automatic heavy luggage system is formed and the existence of a suitcase position in Arduino-based Smart Suitcase Development. Testing the entire system is useful for knowing how the performance and success rate of the system.

This stage of power supply testing is to measure the voltage from the power supply that goes into gnd and vin from the adapter. This test aims to ascertain whether the power generated by the adapter can be used in this test i.e. Tester meter connected to the power bank battery and MCU node. And this test is done to make sure the power bank battery lasts how many hours on 100% charging. This power test is carried out starting at 09.00 WIB and the battery runs out at 22.10 WIB on Sunday 4. The conclusion of this power bank voltage power test can last up to 13 hours. It can be seen in figure 4.2 of the paint testing image on the power bank and the power supply test on the MCU node below.

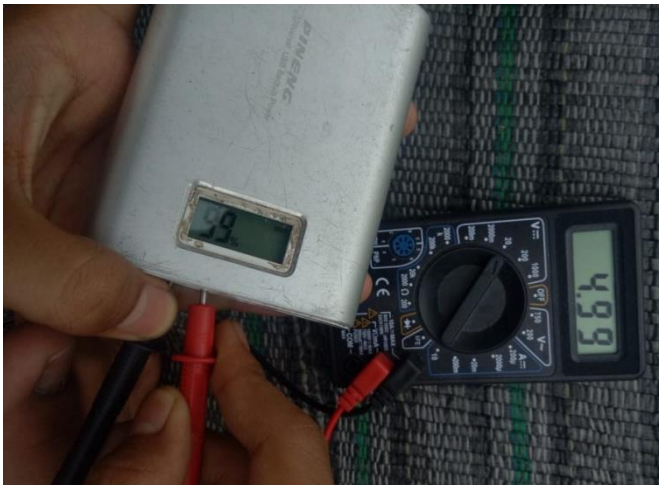

Figure 3. Power Supply Voltage Testing on Power Bank Batteries

Load Cell testing is the first step to get the results and data obtained to get the weight of the contents of the suitcase. Measurements are made to determine the weight automatically when there is a load placed on the suitcase and the measurement results can be seen on the LCD. This test is done to determine the calibration of the weight of the suitcase and the maximum weight, the weight of the suitcase is 1.7 kg while the maximum weight of the suitcase for simulation is 5 kg. The calibration calculation tools are: Maximum Weight – Suitcase Weight = 5 kg – 1.7 kg = 3.3 kg.

Figure 4. Load Cell Testing

The overall testing of this tool is done microcontroller testing can be uploaded by receiving the program code well on some of the components used to create the tool. The circuit below can be seen that Arduino which is a microcontroller to process all the activities of the tool serves as the brain of a tool, in the circuit, there is an LCD connected to I2C where I2C minimizes the use of ports on Arduino into SDA and SCL where the LCD will display text according to Arduino commands, then HX711 connected to the Arduino pin as a module calculates the weight of the load on the Load Cell and then the buzzer as a trigger when the weight exceeds the maximum that has been set in Arduino, then in the MCU Node where here is a connection test whether the MCU node can connect with the surrounding wifi and can process GPS location data.

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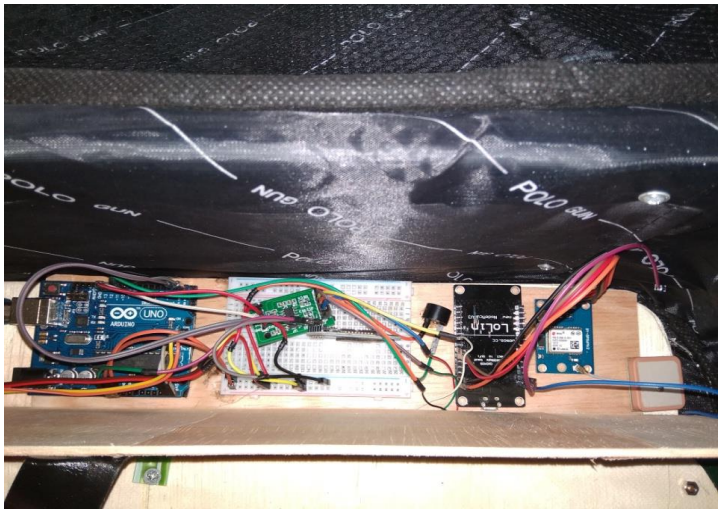

Figure 5. Overall Suite of Tool Mechanics

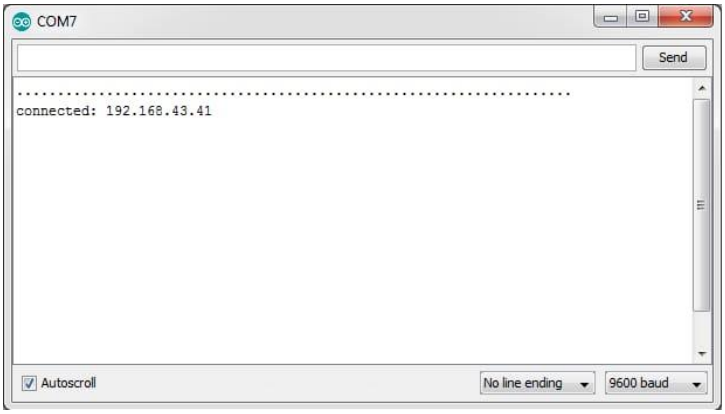

Figure 6. Test Connections on MCU Nodes

This test was conducted to test the connection between 4G and 3G networks using 3 different sim cards namely Telkomsel, 3, and M3. This test was carried out in The Way of Doctor Susilo, Gang Pusri 2, Teluk Betung Utara, Bandar Lampung.

SIM Card	**Location Time Found**	
	Network 3G	**Network 4G**
Telkomsel	4 second	36 second
3	28 second	83 second
M3	10 second	14 second

4. CONCLUSION

Smart suitcase development that has been made by the author can work well by being able to know the weight of the suitcase and the position of the suitcase accurately, can be applied in general, especially referring to people who travel. So that the ownership of an item that is personal can be known the status of its existence and the weight of the suitcase automatically. The weight sensor or Load Chell works well with calibration of an accuracy difference of less than 5% with a perpendicular position weighting measurement. GPS (Global Positioning System) on MCU nodes provides the correct location position with an accuracy of +- 90-100% of the actual position.

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