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Development of an RFID Automated Baggage Counter

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Abstract:

The study of automated baggage counter is a typical example of a conveyor system with radio frequency identification program. An initial structure was designed and built. Automated baggage counter's materials and devices specifications were methodically made for a comprehensive output. Existing energies of dynamic model were observed separately to generate the model of the automated baggage counter. State - space model of baggage counter was developed and radio frequency identification was used as a programming medium according to state-space model. Automated baggage counter system has some keys parameters that are directly engaged with system's performance and response. Parametric studies were done and system responses were observed by variations of key parameters. Observed results from parametric studies were applied into physical model to improve the automated baggage counter performance.

Keywords — **RFID, Baggage Counter, Automated Baggage Counter, Servo Motor**

I. INTRODUCTION

The customer's expectation follows the traditional way of having the best services as possible. In addition to this, the establishment's duty is to give the best services needed by their customers. However, problems are not an exception to this where in fact it can be encounter by the customers having trouble going around the establishment which is necessary for the establishment to offer a storage counter. Then, as the number of reports of stolen items increases from the checked luggage it becomes more prevalent that causes the obvious question to loom: Is your checked luggage safe? (Bite K.E., 2008) Theft in stored baggage is not new in the country, even with a strict protocol it is inevitable that there will be few that still passes through.

There are many transferred baggage that are directed to false destinations or simply getting lost during traveling procedures. Some of these however, get taken away by other passengers by mistake or intentionally stolen. Irrespective of whether the loss can be attributed to a human or computer error, it is causing enormous losses for the establishment. (Polytechnica, 2008) Other than theft, the mishandling of stored baggage is another issue to be foreseen. Not only that the customers want their baggage to be there when they come back but also want their baggage in one piece.

The trust between the establishment and the customer is to be maintained in order to do so, the management offers a guarantee to give the most efficient and secured storage they can offer. The installation of CCTV cameras is the most commonly used countermeasure by some of the establishments around the country. Monitoring the baggage by security personnel, the establishment guarantees that the stored baggage is safe and secured but there are other establishments that do not apply cameras in the storage area due to security and privacy purposes. (D. Elledge, 2007) Furthermore, some counter measures used by the establishments along with having CCTV cameras is the employment of trust worthy personnel who carefully handles the customer's baggage with

utmost care. These personnel are trained by the establishment to provide the best service available however; the consistency of the output of the employee is not definite and just based on mere luck. (Haxton, 2011)

Finally, one of the best possible countermeasures done by the establishment is the strategically placing of the storage area. It is mostly placed near the security personnel to psychologically prevent against bad elements while placing the storage in a well-lighted area is also a must. In fact, having a secure and steady storage area is a requisite to prevent the mishandling. (K. Earle, 2008)

The primary concern of the study is to design, develop and evaluate a micro-controller operated automatic baggage counter system.

The whole system is limited for storing items only excluding the security system. The RFID programming and calibrations are not included in the study. The researchers also provide a specific object as load for the baggage's basket. Thus, the load already have a prescribed shaped or sized and weight. The basket's shape and weight is limited from the capacity of the passage of the conveyor and thus, provided by the researchers. The system is also limited on using only two (2) RFID cards. Furthermore, the conveyor system is a single level floor only with wiper motors attached on each conveyor.

II. METHOD

A. Baggage Counter Design

The baggage on the research that is conducted by the researchers has identified the parts of system that is needed in the study. The researchers had gone through selection of materials with regards to the best of quality. They come up with 12 volts wiper motor, 12 volts servo motor, RFID scanner, and an arduino micro-controller were the materials to be utilized in the designing of the Automated Baggage System. The software application used in the research is Google Sketch Up in designing the automated baggage system. The integrated design of the study is shown below in Fig. 1.

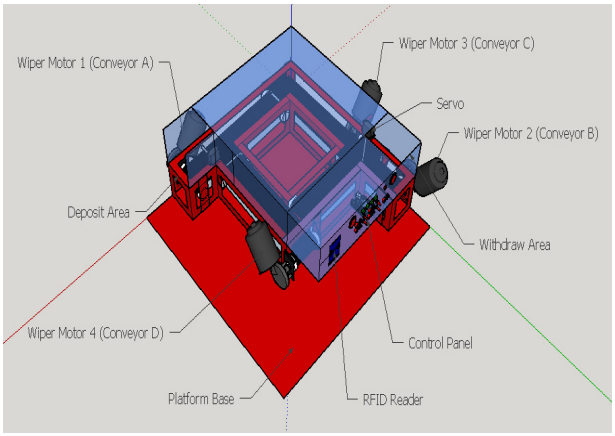

Fig. 1 Perspective View of the Automated Baggage Counter

The conveyor system is composed of four (4) conveyors with different size in length powered by a 12V wiper motor on each conveyor. A rubber material is used as the conveyor's belt. Then, the conveyor system applied engineering plastic as a raw material for rollers.

In addition, the conveyor system also has a couple of servo motors with flippers. Thus, flippers, in the conveyor system, are used to block the basket whenever it is not ready for withdrawal or to travel from a conveyor to the other.

A "basket" is used by the researchers as the container of the load that is being deposited into the automated baggage counter which is being shown at Fig. 2. The container has a specified size or shape and weight which is already provided by the researchers. The basket has an indicator tag that is attached on the outer part of the container to provide identification of the items inside the baggage counter.

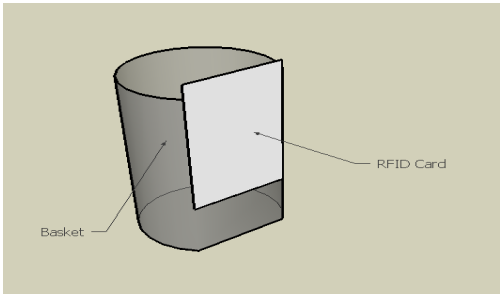

Fig. 2 "Basket"/Container

An RFID is an essential component in this study. The RFID uses electromagnetic fields to automatically identify and track tags attached to

objects. The tags contain electronically stored information. Passing tags collect energy from a nearby RFID reader's interrogating radio waves. Since the main purpose of this study is the tagging and identification of the baggage using RFID is the most logical solution.

III. RESULTS AND DISCUSSION

A. Developed Automated Baggage Counter

On the assembling process, RFID tags were added so that it will not confuse the end users of the different components incorporated on the baggage counter. It was found out to be a vital adds on since wiring the components on the Arduino program and it is a very sensitive activity that may result on an Arduino and components malfunction. The foundation of knowledge with regards to wiring and soldering the components of the Arduino were not enough and effective to comprehend the sensitive doings.

Fig. 3 shows the whole components of the baggage counter which are the following:

- The wiper motor which serves as a driving mechanism of the conveyors.
- The RFID reader is responsible on scanning and indicates each basket of the system.
- The control panel is responsible for the control of the system.
- The servo motor is responsible for stopping the basket at some point on the conveyor system.

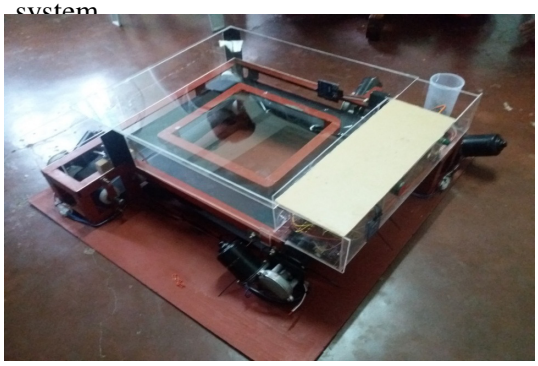

Fig. 3 Actual View of the Automated baggage Counter

IV. CONCLUSIONS AND RECOMMENDATIONS

The test and assessment conducted on the development automated baggage counter reveal that the baggage counter is able to demonstrate the program that is being downloaded in the micro-controller. The unit uses Arduino for the program that is being downloaded.

The evaluation of the developed automated baggage counter design showed that the unit is perceived to have good qualities on the evaluation parameters.

The respondents found that the automated baggage counter have good physical appearance and most especially on the evaluation based on its functionality

The respondents recommend that therefore the prototype's design workmanship is suitable for enhancements. The respondents also recommend the prototype to be used as part of the educational facilities in University of Science and Technology of Southern Philippines for the students to utilize and heighten the expertise in relations to Mechatronics.

The respondents therefore recommend that the following:

a) The thorough canvassing of the whole materials must be observed from the very beginning.

b) The fabrication of the body and its structure must be improved as well to increase the overall physical appearance of the prototype.

c) It is suggested to utilize a power that can supply high voltage and also can last longer during the operation.

d) The harnessing of wire must be improved.

e) It is suggested to improve and utilize a design for the basket to be controllable when it is already inside the prototype.

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