Airport Security Luggage Scanning System with Conveyor Belt

G. Lavanya[1], R. Alekh[2], U. Chandini[3], S. Ramu[4] (students)

Mr. U. Pradeep Kumar[5] (professor)

[1,2,3,4,5]Department of Electronics and Communication Engineering,

Sanketika Institute of Technology and Management

---***---

Abstract - Airports handle large passenger volumes daily, making security a primary concern. Traditional manual luggage checking is slow, labor-intensive, and prone to human error. This paper presents an automated luggage scanning system utilizing a conveyor belt and sensor integration. The system automatically moves luggage through a scanning section where sensors detect suspicious or metallic objects without requiring the bag to be opened. Upon detection of a threat, the system activates a buzzer and halts the conveyor for further inspection. Results demonstrate improved security levels, increased checking speed, and reduced human effort

Key Words: Airport security, luggage scanner, conveyor belt, automated baggage inspection, real-time detection, sensor-based detection

INTRODUCTION

Air travel growth has made airport security a critical operational component. Every bag must be inspected to prevent the entry of weapons, explosives, and harmful materials into secure areas. Early manual inspection methods were unreliable and time-consuming, leading to the need for automation. Modern systems use advanced sensors and conveyor belts to ensure a continuous flow of bags and better detection of hidden items. This project aims to reduce human workload and increase screening accuracy through a fully automated hardware and software setup.

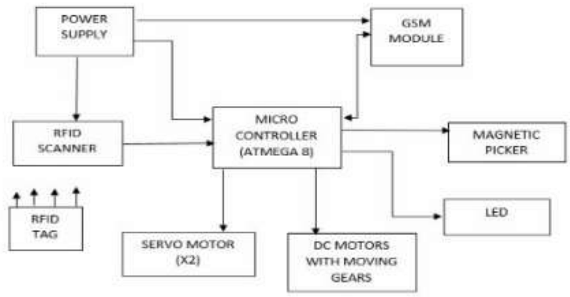

Fig-1: Block Diagram of RFID Airport Luggage Scanning System

SYSTEM ARCHITECTURE AND WORKING

The proposed system is an integrated automation solution consisting of a conveyor belt, scanning sensors, and a control unit.

WORKING PRINCIPLE

1. **Placement:** Luggage is placed on the belt where an IR proximity sensor detects its presence.
2. **Identification:** An RFID reader identifies the luggage for sorting and tracking purposes.
3. **Scanning:** As the belt moves the bag through the scanning area, sensors analyze the contents.
4. **Response:** If a suspicious object (such as metal) is detected, the microcontroller triggers an alarm and stops the motor. If clear, the luggage proceeds normally.

HARDWARE COMPONENTS

- **Microcontroller (Arduino):** Acts as the central brain, processing sensor data and controlling the motor and alarm.
- **Conveyor Subsystem:** A speed-controlled belt tracked by encoders for reliable movement
- **Sensor Suite:** Includes IR sensors for detection and RFID modules for luggage data storage

- **Output Unit:** Comprises a buzzer and LED for alerts, and a display unit for operator monitoring

Fig-2: Circuit Board

RESULTS AND DISCUSSION

The system was tested with various objects to evaluate performance. Testing showed that normal luggage passed without alerts, while metallic objects consistently triggered the security protocol

Feature	Old System	Proposed System
Speed	Slow	Fast
Accuracy	Medium	High
Automation	Low	High
Human Effort	High	Low

Table -1: Comparison of Security Systems

The hardware responded instantly to threats, demonstrating a significant reduction in the time required for baggage inspection compared to manual methods

CONCLUSIONS

This project successfully implemented an automated luggage scanning system that improves airport security efficiency. By reducing manual labor and increasing the speed of checking, the system provides a reliable solution for high-traffic environments like airports, railway stations, and malls. Future work involves integrating AI-based object classification and X-ray imaging for even more detailed internal inspections

ACKNOWLEDGEMENT

The authors express deep gratitude to their guide, **Mr. U. Pradeep Kumar**, M.Tech, and the Head of Department, **Dr. R. Suneetha**, for their valuable advice and inspiration throughout this project

REFERENCES

[1] Alvarez, R. E., and Macovski, A. (1976). Energy-selective reconstructions in X-ray computerized tomography. Physics in Medicine and Biology, 21(5), 733-744.

[2] Akcay, S., Kundegorski, M. E., Devereux, M., and Breckon, T. P. (2016). Transfer learning using convolutional neural networks for object classification within X-ray baggage security imagery. IEEE International Conference on Image Processing (ICIP), 1057-1061.

[3] Mery, D., Riffo, V., Zscherpel, U., Mondragón, G., Lillo, I., Zuccar, I., Lobel, H., and Carrasco, M. (2015). GDXray: The database of X-ray images for nondestructive testing. Journal of Nondestructive Evaluation, 34(4), 1-12.

[4] Li, C., Liang, S., Hu, Z., Zhang, D., and Tian, Q. (2020). SIXray: A large-scale security inspection X-ray benchmark for prohibited item discovery in overlapping images. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2119-2128.

[5] Rutherford, R. A., Pullan, B. R., and Isherwood, I. (1999). Measurement of effective atomic number and electron density using an EMI scanner. Neuroradiology, 11(1), 15-21.

[6] Mery, D., and Filbert, D. (2002). Automated flaw detection in aluminum castings based on the tracking of potential defects in a radioscopic image sequence. IEEE Transactions on Robotics and Automation, 18(6), 890-901.