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Automated Airport Check-In System

Ashwini Naik[1], Sujith Nair[2], Jayesh Mhatre[3], Akshay Nair[4], Prajwal More[5]

Department of Electronics and Telecommunication, Ramrao Adik Institute of Technology, DY Patil Deemed to be University, Navi Mumbai, India.
ashwini.naik@rait.ac.in

Article Info
Volume 83
Page Number: 108- 113
Publication Issue:
November/December 2020

Article History
Article Received*: 25 October 2020*
Revised*: 22 November 2020*
Accepted*: 10 December 2020*
Publication*: 31 December 2020*

Abstract

Airports are one of the busiest places where a large number of people assemble. Effective crowd management, therefore, becomes inevitable. Airline check-in is one process that is mostly done manually, leading to long queues and a slower work rate. Also, it is one of the processes where human contact has been necessary until now. Therefore, an automated system would reduce human contact and would help in saving precious seconds, thereby leading to efficient time management. Also, the human error involved in this process could be eliminated. The process of printing boarding passes also requires a lot of paper. A technological alternative to this could help reduce the burden on the environment. This paper proposes to demonstrate a version of an automated check-in process, using Radio Frequency Identification, Arduino, Java, Structured Query Language, Hypertext Markup Language, and Cascading Style Sheets. The proposition ultimately aims to integrate hardware as well as software mechanisms required in check-ins ad in the issuance of boarding passes into one seamless package.

Introduction

Airplanes have been the fastest mode of transport commercially available to people around the world. First invented and flown by the visionary brothers Orville and Wilbur Wright, airplanes have come a long way. Initially, used to demonstrate flight, then used in World Wars, and to fly general passengers, airplanes have been around for quite a while. It has been flying goods, people, weapons for years and this have required the help of people, thereby giving them an occupation in the process. Years passed by, and airplanes gave rise to a full-fledged industry of its own.

DELAG, in 1909, from Germany, was the first 'airline' to provide its services. Its airplanes, mainly used for flying passengers were also used in the First World War. Soon, their flights rose up higher and higher, breaking several records and circumnavigating the wholeglobe. One airline led to another, and 'the another' led to more, and by 1920 there were several airlines providing their air services.

The airline industry has seen several changes over the years. The industry we see around us today, in the form of various airlines and airports, is because of the development it has undergone all these years. Initially, when it came to passenger flights, these were considered to be a rich man's luxury. But, today, it is very much accessible, even to the not-so-rich. The overall cost of air- travel has gone down and as a result, it is one of the most sought-after modes of transport today. Airports, today, are one of the busiest places where a large number of people assemble. This is because of the increase in the number of airline companies, and of course, a direct result of the number of increased flight services. These developments have resulted in increased pressure on the airline industry. Not to mention the direct pressure on the environment for the resources required to run the industry. The addition of technologies has lessened the pressure, but there is always 'room for more'.

One such field which could get some help

from technology is the check-in process and the corresponding processes around it. Airline check-in processes have been long-drawn-out processes that require a lot of time. It being mostly manual, leads to an unnecessary reduction in the overall pace of user travel experience. They also end up creating long queues for the passengers. Not to mention the amount of paper it requires while printing the boarding passes. Also, it includes a component of human contact. In these times of COVID-19, this is quite an ask.

According to statista.com, around 4.5 billion people traveled through airplanes in the year 2019. And this number will only increase once the pandemic subsides. This alone shows how the airline industry would need to cater to humongous amounts of people every day. And therefore, their work efficiency needs to be supremely high. Also, the paper wastage this would lead to is just saddening.
Therefore, an automated check-in system with a user-check system instead of boarding passes, will help immensely to reduce the efficiency problems faced by airlines and airport management teams. This, would also help to reduce the paper costs, and the overall requirement of the paper. The airlines, as a result of the time saved due to this, could then squeeze in extra air- services. Also, a fully automated system would not require any kind of printing of documents. Extra air services would help more and more passengers to travel, reducing air-travel costs and zero-paper would mean serving the environment better. Also, the human contact is drastically reduced and the human error component is nullified.

Hence, we aim to propose a system in order to improve and enhance the working efficiency of airlines and airports alike, while lessening the burden on the environment and the extent of human contact that would be required

1 Internet of Things

The Internet of things (IoT) is a web of objects connected to each other to carry out a specific task. The objects create a network of themselves to work in harmony, thereby carrying out a task assigned to them successfully. IoT systems have helped in designing applications meant for people from all walks of life.
The concept of IoT devices began early in the 1980s. A modified Coca-Cola vending device was the first device to connect and work using the Internet. It could report its inventory and the temperature of the loaded beverages. Reza Raji explained, in the 1994 IEEE Spectrum magazine, the idea of IoT as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories". Kevin Ashton of Procter & Gamble coined the term internet of Things'.

In 2000, electronics corporate Lucky Goldstar (LG) announced a refrigerator that could decide on its own, if the food items in it were restored. In 2003, RFID was used on a huge scale in the United States Army's Savi program. In 2005, International Telecommunication Union (ITU) released the report 'ITU Internet Reports 2005: Internet of Things. The report predicted that an era of the "Internet of things" was on the horizon. The smallest t of objects around us could be used to work on their own using IoT.

IBM took the freedom to spread awareness around Io T by using a lot of initiatives, educational as well as commercial. The launch of IPv6 proved to be a boon as it embarked a massive interest around this. The IPSO Alliance was made to improve awareness around the Internet of Things.
Some of the main components of the Internet of Things are actuators, sensors, and storage. An actuator is a component that converts electrical energy into energy that can be used. Actuators are used to process the data collected by Sensors. Based on this data, actuators decide the action be performed. Sensors are the frontend of IoT. Its access to data is the event of stimulation for performing IoT tasks. Every sensor writes and executes a detailed program for the accurate collection of data. Sensors are used almost everywhere, to collect different kinds of information like temperature, atmospheric

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pressure, proximity, acceleration, gravity, etc.

IoT is a hub of different devices and the services that these devices provide. As a result, this generates a lot of data, and this data is used for various needs and therefore is very important. The data generated needs to be stored, for further analysis and use. The general modes of data storage are not enough for IoT. Hence, cloud storage is required for the best functioning of IoT devices.

2 Research Methodology

The research work for this paper included referring to various research papers relating to IoT and airport management & security to understand the present status of study in this field. The work also included understanding various concepts of the Internet of Things and how they can be implemented. Far-field RFID tags issued within boarding tags and creating a cellular network of RFID receivers can be used to improve airport efficiency and security [1]. An information system created in tandem for automation can help increase efficiency exponentially [2]. Usage of self-serving kiosks for check-in can make the overall process of boarding faster [4] [5].

This research then prompted the idea to propose and implement a different version of pre-existing research by using tools like RFID, Arduino, HTML, CSS, Java, Structured Query Language, etc. The idea was to implement a superfast channel, to help reduce the workload on airline officials and to help passengers to complete the check-in process faster, in the process, helping the environment, reducing human contact, and the hassles of carrying printed boarding pass.

3 Project Proposition

The Proposed Project is a Web Application based on the Internet of Things concept. The project makes use of RFID, Arduino, Load Cell, Java, Structured Query Language, Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and serial Comm library. HTML and CSS work on the frontend, SQL Database works on the backend with Java being the bridge between the two, running the logic. The load cell is used in the weight scale to measure the luggage weight, with Arduino connecting the hardware to the software. Serial comm helps in serial port communication.

The overall project is divided into three processes viz. Ticket Reservation, Check-In, and User Seat Check.

Fig. 1. Process Diagram

4 Implementation

RFID Cards would be issued to uniquely identify each passenger. The passenger could use the card credentials to book an airplane ticket of a specific Class (Economy, Business, or First Class), online.

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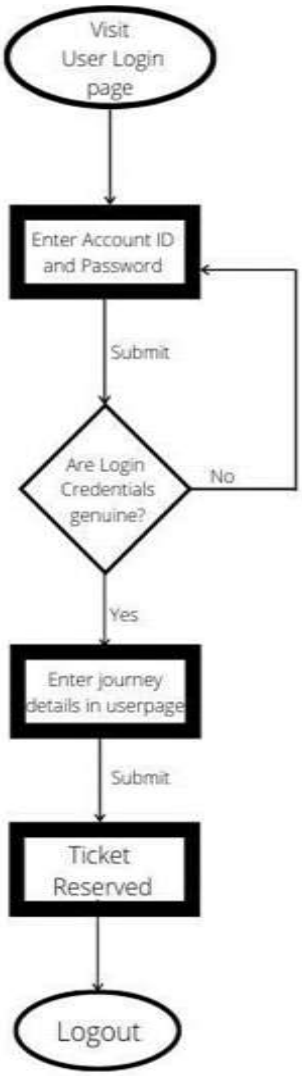

Fig. 2. Ticket Reservation Process

The passenger could then use a check-in kiosk at the airport for a faster check-in process. The luggage is to beplaced on the weight scale and the card is to be scanned using the scanner at the kiosk.

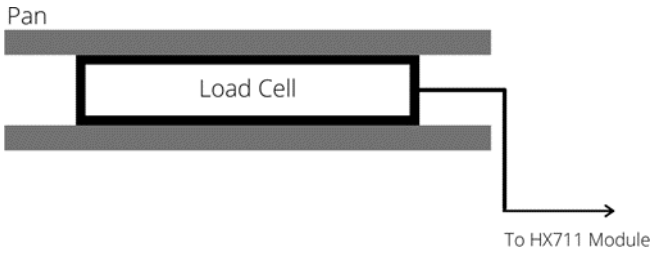

Fig. 3. Weight Scale

The weight scale consists of a load cell that is connected to the HX711 Module. The load cell used for this prototype is of 7kg capacity. For actual purposes, the load cell can be replaced with one of the required capacities. The HX711 Module is connected to the Arduino Uno microcontroller, which instead connects to the kiosk computer through a COM Port in the CPU. Theweight scale gives the measured weight to an intermediary database table.

The system checks for the credentials in the corresponding database table. If found to be genuine, the system then moves onto the weight check section, where the measured weight is checked according to the allowance as per the class of the ticket. If the luggage is overweight, the system blocks the check-in and intimates the user about it. If the luggage weight is found to be lessthan or equal to the allowed weight, the check-in is successfully completed and the database is updated. After completion of this process, the luggage can be left at the nearby luggage counter.

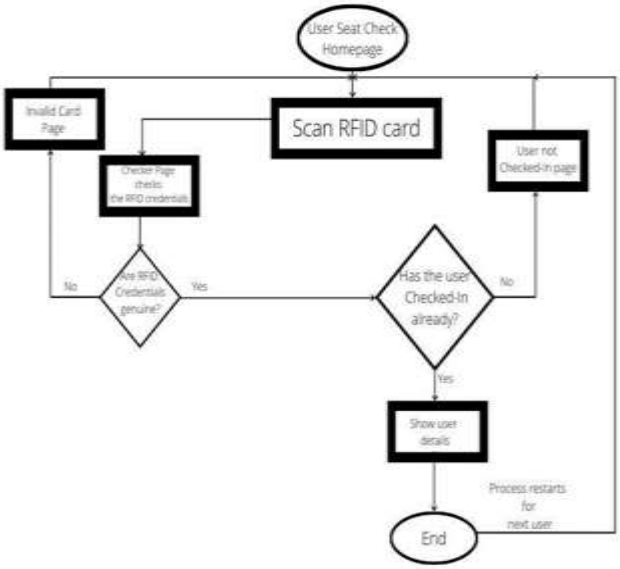

Fig. 4. Check-In Process

This same RFID card could then be used to scan and identify the specific details of the user including their seats. This can be done either by the user themselves, or another airline/airport authority. This could help in eliminating the process of printing boarding passes. If the card is not genuine, the system notifies that through the screen. Also, if the

person has not checked in and has reached security checks, the system notifies that while the card is scanned by the authorities.

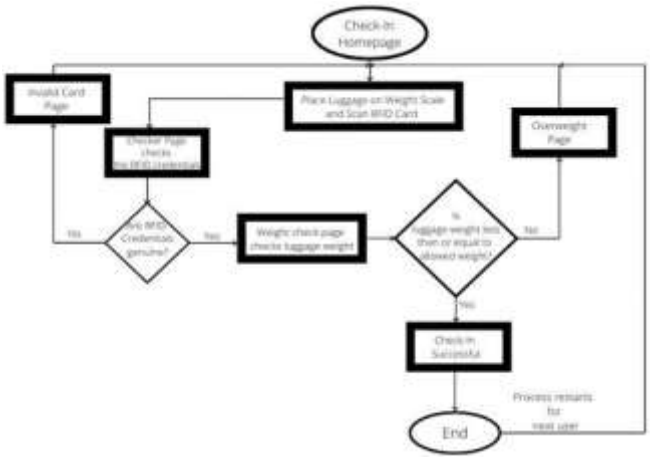

Fig. 5. User Seat Check Process

If all validations and processes are successful, the user can smoothly complete the process of checking -in and boarding.

In this way, this system aims to minimize the time taken in the overall check-in process, thereby helping in better and more efficient management for airlines and airports. The elimination of paper helps in the protection of our environment. It also minimizes the human effort required, thereby reducing human errors. The system also reduces the contact between people to a great extent.

Conclusion

The result of this project was a system that helps book tickets, minimizes the time taken in the overall check-in process, and replaces printed boarding passes. This will help in better and more efficient management within airlines and airports. It also minimizes the human effort required, thereby reducing human errors in the overall check-in process. The proposed system also reduces the amount of paper required and reduces the contact between people to a great extent.

An efficient automated check-in system would go a long way in helping airlines to reduce the immense workload on their officials by automating tasks that currently require high concentration. The system would also help in improving the speed of the overall airline experience, thereby making it a much more attractive option for passengers. The increase in speed means gaining precious time, which would help the airlines to increase the frequency of their airplane services. Implementation of this service would mean lesser human contact, which certainly, is a boon during a pandemic-like situation. Lastly, it would help in reducing the overall paper consumption, thereby helping the environment and providing a sustainable future for our coming generations.

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