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Aircraft Personal Safety Compartment (APSC)

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ABSTRACT

There are four different types of cabin class in aircraft passenger seat, which is first class, business, premium economy, and economy class. For the economy class passenger seats, they have the least security onboard which leads to the thievery activities and compromise the comfort level of the passenger. This is a major issue that will have a significant influence on the industry and the community. Therefore, Aircraft Personal Safety Compartment (APSC), a revolutionary method of protecting personal goods and belongings in economy class seats while flying has been successfully designed and developed. The APSC's major goal is to provide an armrest with a compartment equipped with locking device and mechanism for securing passenger personal items onboard. APSC is made from various recycle materials which is lightweight and equipped with the solenoid lock which is programmed by Arduino Uno circuitry board. The solenoid lock will be controlled using RFID technology and will unlock when the access card is tapped and will remain locked if the access card is incorrect. Therefore, the APSC will be able to lower the numbers for in-flight thief cases in economy class while introducing a new degree of protection and enhance flying experience to the passengers.

Keywords: recycle materials, economy class, aircraft seat, ergonomic design, Arduino UNO

1. INTRODUCTION

Most of the economy class armrest is very simple and doesn't come up with a specific function. It only designed to reduce weight and for the passenger comfort. Following the development of low-cost carriers, majority of people flying economy, such conveniences and indulgences were a pipe dream. Flying became an unpleasant experience that had to be endured for those passengers. Overcrowding, unavoidable delays, extensive security procedures, noisy cabins, and few freebies characterized the air travel (Elvis, P., 2020).

In addition to that, even though we were high in the air, an in-flight thievery occurred especially on economy class cabin, reported 43 instances were recorded in 2012 and 35 cases were reported in the first six months of 2013. Lately, in-flight theft happened on American Airlines and causes the loss nearly 10,000 US Dollars on the victim as reported by Insider (July 2022). This highlight the lacking of security system or mechanism practised in the economy class cabin and therefore contribute to the insecurity and uncomfortable feeling among the passengers during flight.

2. LITERATURE REVIEW

According to Dorhmann Consulting (2021), ergonomics is the study of how to build or arrange workplaces, products, and systems so that they are comfortable for the people who use them. Comfort is one of the most important aspects of ergonomics science, as it focuses on the user's experience and emotional behavior. Overall, ergonomics can be defined as the study of how a product and its design process interact with the human body and the environment. The end

users' experience and degree of happiness should be taken into account during the design process, particularly when it comes to aspects like size, materials, forms, and other factors that contribute to design comfortability.

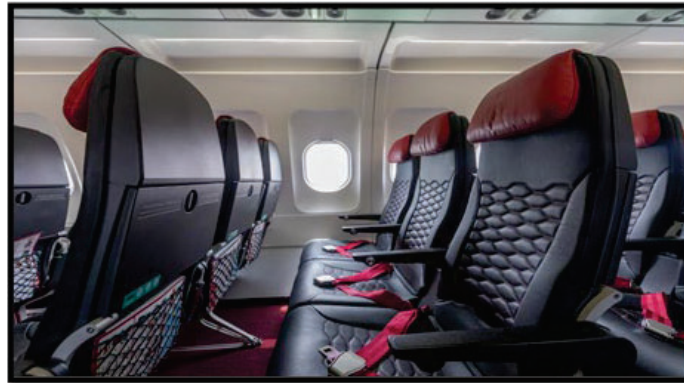


Figure 1: Modern Aircraft Passenger Seat Taken from AirAsia Airlines (AirAsia, 2018).

In current trends, the economy class, certain airlines are introducing new "slimline" seats. Seat pitch and width have also decreased in economy class; in 1985, none of the major US carriers had a seat that was less than 19 inches broad. Slimline seats are reported to be lighter than full-size seats, allowing airlines to expand capacity without sacrificing passenger comfort as stated by Shaw. K. (2020, January 5).

In contrast, Figure 1 shows modern aircraft passenger seat in latest economy class cabin of Boeing 737-800 which called "slimline" design. This is anything but a characterized term, slimline seats have less cushioning toward the back (SAE International). As stated by Airlines.Net (2018), since the start of the 21st Century, normal seat width diminished from 18.5 to 17 inches, and once in a while as low as 16.1 inches. This in turn could possibly jeopardize the comfort level due to the less-ergonomic design of the passenger seat. Furthermore, most of the economy class cabin doesn't provide compartment with lock mechanism and it easy for flight attendant or someone else to excess. In short, most passenger seats are very simple and do not have space to place their items safely.

3. METHODOLOGY

The prototype of the APSC will be based on the standard economy class passenger seat. The product structure and chasis dimension will be based on the Department of Civil Aviation of Malaysia: Airworthiness Notice 61 (AN61), complying with the standard dimension of an aeroplane seat. The ergonomic design will then be addressed while creating the APSC for passenger comfort, based on a DOSH (Department of Occupational Safety and Health) standard design.

Furthermore, this device also has an electrical/ electronic component that can help APSC strengthen its security system. All of APSC's components work together to build a flawless security system. The first component is Radio Frequency Identification (RFID), which has the role of granting access to the programme only to cards or tags that have registered a Unique Identification Number (UID) code as stated by TechTarget Contributor (2017). Any card or tag with an incorrect UID code will be denied entry.

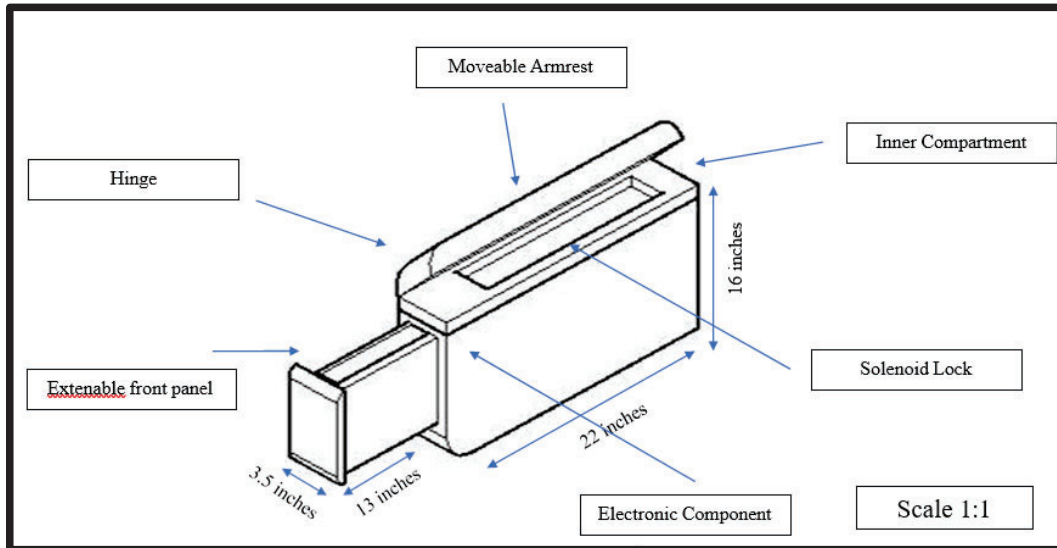


Figure 2: Isometric View of APSC in Three Dimension with Specific Parts.

Next, LEDs are used to alert passengers by employing two separate colours: green for unlocking and red for locking. The solenoid lock, which is an electrical locking device that locks and unlocks the compartment with the mechanism of temporary electromagnetism induced by the DC power source (Takigen, 2021). Furthermore, the Arduino Uno R3 is a critical component for electrical/ electronic mechanisms since it is the logic board used to programme using the Arduino IDE and it is also responsible for ensuring that other electrical/electronic components perform as expected. Furthermore, the relay module is a component that acts as an electromagnet-operated electrical switch. A separate low-power signal from a microcontroller activates the electromagnet. The electromagnet pulls to open or close an electrical circuit when energized.

4. RESULTS & DISCUSSION

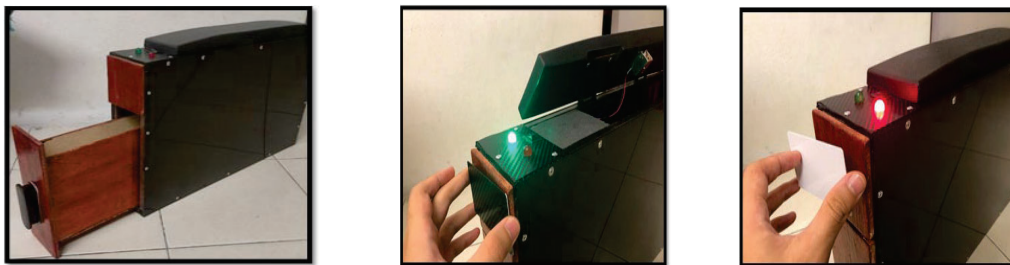


Figure 3 (From Left): APSC Prototype, Access Granted & Access Denied.

Figure 3 shows the front panel is fully extended. The extendable front panel is a drawer that connects with a slider. The drawer has a self-designed rail and gripper as an extension and retraction mechanism. The mating piece acts as a gripper, attaching the drawer to the rail, and the rail has been welded together with the main structure. One type of grip is used as a stopper, and the other is made to prevent the drawer from deviating from its track. Plastic handles are used to make it easier for passengers to pull and push the drawer.

Operation of the product for electrical/electronic mechanism, it is start from Arduino UNO board which act as a brain for electrical/electronic mechanism. Arduino UNO board store all

the coding program to command all electrical/electronic component (Tarun A., 2017). Firstly, “Access granted” card touch to the RFID sensor and send the signal to solenoid lock to unlock the safety compartment at the same time green LED will light up as indicator for access granted. Next is for “Access denied”, when access denied touch the RFID sensor the solenoid lock will stay locked and at the same time the red LED will light up together with buzzer sound as access denied indicator.

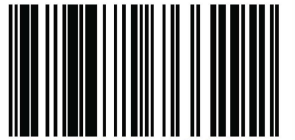
5. CONCLUSION

The contribution of the project to our society is to provide economy class flight passenger a high security level experience by adding and integrating the APSC in the aircraft seat. Meanwhile, the contribution of the project in industry is to increase their security rating of the company that apply APSC in their aircraft passenger seat. The impact of the APSC towards society is to decrease the chart for in-flight thief case in economy class flight and the opening on a new path for economy class flight security level.

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