

Pilot health and safety management tool

Author - Sudipta Nandy



Content:

- Introduction/Overview
- Business Case
- Problem Statement
- Proposed Solution(s)
- Introduction of Solution(s)
- Application of Solution(s)
- Future/Long-Term Focus
- Conclusion

Introduction

Mental health has been a taboo subject in our society. Our society is quite reluctant to talk about it openly and accept this fact that mental health monitoring is as important as physical health.

From the last few decades, there is substantial increase in the number of air passengers and air cargo worldwide. According to data from the international air traffic association (IATA) and international civil aviation organization (ICAO), global air passenger traffic has grown at an average of around 5.5% over the past 20 years and the global air cargo traffic increased by an average rate of around 4.1% between 2009 and 2019. Which has again increased the chances of air accidents and crashes.

There have been various reasons for airplane crashes around the world, but some of the top reasons includes Human error, technical faults, weather conditions, air traffic control errors. According to the surveys done by AOPA (aircraft owner and pilot association), 75% of the accidents are because of pilot error mental health issues and due to the pandemic, it has increased in a highest degree. 12% of airplane pilots have reported symptoms of depressive disorder and these pilots have flown the commercial flights in the 2 weeks. Out of which 4% have reported suicidal feeling while flying. In 2022, 56% of pilots have avoided mental health care in the fear of not able to fly again. 58% of the pilots are lying about their medical condition in the health sheets.

According to the survey executed by FAA (Federal aviation administration) anonymously, 47% of the pilots are in anti-depressant. 97% believes that FAA is not handling mental health issue correctly.

The goal of this system is to ensure that pilots receive the necessary support and treatment to maintain good mental health and prevent incidents related to mental health issues. By detecting potential problems early, the system could help prevent accidents and reduce the risk of harm to passengers, crew members, and the public. Additionally, it could help reduce the stigma surrounding mental health in the aviation industry and promote a culture of openness and support.

Business Case

Pilot mental health monitoring can have several benefits for businesses in the aviation industry, including improved safety, increased productivity, and reduced costs.

1. Improved safety: By monitoring pilot mental health, businesses can identify potential problems early on and take appropriate action to prevent accidents and ensure safe operations.
2. Increased productivity: By monitoring pilot mental health and providing appropriate support, businesses can help pilots to perform at their best, leading to increased productivity and improved performance.
3. Reduced costs: By monitoring pilot mental health and providing support when needed, businesses can reduce absenteeism and turnover rates, leading to cost savings.

Federal aviation administration (FAA) in the United States requires airline to have programs in place to monitor and address pilot mental health.

Problem statement

The problem statement of pilot mental health monitoring is that pilots, like other professionals in high-stress occupations, are at risk of experiencing mental health issues such as depression, anxiety, and post-traumatic stress disorder (PTSD). These mental health issues can impact their job performance, decision-making abilities, and ultimately, the safety of the aircraft and passengers.

To address this problem, a comprehensive and confidential mental health monitoring system can be put in a place to regularly assess the mental health of pilots and provide appropriate support when needed. By using the power of advance analytics, we can create a comprehensive system which will analyse all the available data and give a precise view in the forms of graphs and charts.

Proposed Solution(s)

Computer vision technology can be used in advanced analytics to analyse the pilot's behaviour during the recent flights including their head and eye movement, gesture, and body posture. These insights can help us to identify the pilot's fatigue level, decision making abilities, instrument reading skills, focus level and response to emergency. By collecting the behavioural data of the pilot, predicted data of the weather condition that the pilot may encounter during the flight duration (Long and short distance), medical report of the pilot (physical and mental fitness level) and flight duration from last 2 weeks, we can generate a predictive model to check whether the pilot is fit for the upcoming flights. Furthermore, Computer vision can be used in cognitive behavioural therapy to analyse a patient's facial expressions, body language and vocal tone during the therapy sessions for scanning the mental health condition of the pilot during the initial screening.

Introduction of Solution(s)

The solution is divided into multiple parts that includes:

1. Behavioural data of the pilots.
2. Predicted data of the weather condition.
3. Medical reports of the pilot.
4. Flight duration.

1. Behavioural data of the pilots

The behavioural data of a pilot can be collected from the cockpit can be done using a variety of techniques and technologies. One of the simplest and most effective ways to capture the behaviour of a pilot in the cockpit is through video recording. Video cameras can be installed in the cockpit to record the pilot's behaviour and actions during the flight.

The next step is to create a training dataset which will contain about 20 images each of focus, happy, relaxed, tensed etc. After the training dataset is created, we can use the Viola Jones Face Detection algorithm. This algorithm makes use of Haar features, which when convolved throughout the image, we get high output values only at those regions that match the pattern of the haar features and then using Adaboost algorithm and cascading classifiers, and it can detect face. After the feature set is created, it can be given as an input to the Support Vector Machine is a model that splits the two sets in the best possible way. Example,

Vid eo	Actual -ve	Actual +ve	Actual Emotion State	Predicted -ve	Predicted +ve	Accuracy (%)	First Part Emotion	Second Part Emotion	Third Part Emotion	Predicted Emotion State
I	106	54	High Depression	81	79	64.38	Negative	Positive	Negative	High Depression
II	83	77	Mild Depression	72	88	51.88	Positive	Negative	Positive	Mild Depression
III	41	119	Not Depressed	84	76	55.63	Negative	Negative	Positive	High Depression
IV	88	72	Mild Depression	91	69	54.38	Positive	Negative	Negative	High Depression
V	101	59	High Depression	79	81	42.50	Positive	Positive	Negative	Low Depression

2. Predicted data of the weather condition

Air transport system uses various tools and methods to predict weather conditions to plan and operate their flight safely and efficiently. Some of the common methods and tools used by air transport systems are weather forecasting services, meteorological data, flight planning software etc. The atmospheric parameters such as temperature, pressure, humidity and wind speed are used in mathematical equations to simulate the behaviour of earth's atmosphere.

3. Medical report of the pilot

Pilots undergo a regular medical examination to ensure that they are healthy and fit to fly. Some of the medical examinations are physical exam, electrocardiogram (EKG), Blood tests, vision tests, hearing tests and drug and alcohol screening. All these data are collected regularly to understand the overall health condition of a pilots.

4. Flight duration

In general, an airline pilots fly about 60 to 100 hours in a two-week period. However, this can vary depending on the airline's scheduling practices and the pilot's seniority.

We will consider all these parameters and maintain a database for each pilot. The information that will be obtained during these exams is considered confidential and is only shared on a need-to-know basis. Mental health is a sensitive subject. We need to be vigilant while dealing with all these sensitive data.

Application of Solution(s)

All these data collected from the different sources needs to be stored. The next step is to prepare the data by cleaning it, removing duplicates, and filling in the missing values. This will ensure that the data is ready for analysis.

The next step is to select machine learning model which will help us to train the model with appropriate data. This involves feeding the data into the model and adjusting the model parameters to improve its performance. We need to evaluate the model simultaneously to understand the efficiency of the model. Once the model is trained and evaluated, we can use it predict the data.

For the analytics part, we can use logical model algorithm and decision tree algorithm for now. With which we can evaluate the journey success rate percentage. The journey success rate percentage is the percentage with which will define whether the pilot can fly the aircraft from source to destination considering the journey duration, weather condition, aircraft type etc parameters.

Later these parameters can be added in the visualization tools like amazon quick sight, power BI etc. to get the clear view of the data in the form of graphs and charts.

Future/Long-Term Focus

This tool can be used in the aviation industry and in the defence sector to analyse the efficiency of the pilots. By identifying the early warnings of mental health issues could help individual seek treatment early, before their condition worsens, and improve their chances of recovery.

This will lead to decrease in air accidents and the airlines will gain the confidence and trust of the passengers. This will also help the airline industry to maintain a safe and secure environment for their employees.

Conclusion

This system is an essential tool for ensuring the safety of the air passengers by considering various parameters. This will also help the airline to gain the trust and confidence of the passengers and their employees. Because this will help the airline to manage the wellbeing of their staffs and employees more effectively and efficiently.

About Sogeti

Part of the Capgemini Group, Sogeti operates in more than 100 locations globally. Working closely with clients and partners to take full advantage of the opportunities of technology, Sogeti combines agility and speed of implementation to tailor innovative future-focused solutions in Digital Assurance and Testing, Cloud and Cybersecurity, all fueled by AI and automation. With its hands-on 'value in the making' approach and passion for technology, Sogeti helps organizations implement their digital journeys at speed.

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 325,000 team members more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2021 global revenues of €18 billion. Get The Future You Want | www.capgemini.com

Visit us at www.sogeti.com

This document contains information that may be privileged or confidential and is the property of the Sogeti Group.

Copyright © 2023 Sogeti