Turbulent Skies of AI

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INTRODUCTION

From the first Airplane, which was made by the Wright Brothers in 1903, to today's world aircraft has transformed immensely. Aircrafts went from being powered by gasoline engines, to piston engines, to now even electric motors. Today's airplanes are performing feats that 80 years ago would have been unimaginable. This is because of the development of technology, which allows for such great growth in such short periods of time. Though it may seem completely out of reach at this moment, it may even be possible that soon there is no need for a pilot to fly a plane. Imagine a world where every vehicle in the world does need a driver to drive a car, is what people used to say less than 10 years ago. Today, the electric self-driving car known as Tesla is in the top 10 cars bought in the United States. As freaky and sci-fi as this might sound, it is starting to become our reality. Self-driving cars and Autopilot plane systems are being used today. Today every commercial flight we take has autopilot, but it can only be used in certain conditions and still has to be monitored. However, with such advanced technology, questions about its functionality and, more importantly, safety are still raised. Though extremely fascinating, without an actual person there to control a plane, if something were to spiral out of control and technology could not quickly detect and fix the issue, several passengers' lives could be at stake. Though AI can greatly improve and smoothen out plan journeys, there is still so much more precaution and research that needs to be done to insure safety, and even with those precautions, there is still so much room for potential danger.

Fatal Code Errors

Since humans make many AI algorithms, there can be bugs that could lead to improper executions. Ben Schneiderman, the author of "The Dangers of Faulty, Biased, or Malicious

Algorithms Requires Independent Oversight," explains how humans can make errors in developing specific algorithms. "There is a long history of analysis of how poor design, unintentional bias, and malicious interventions can cause algorithms to trigger huge financial losses, promote unfair decisions, violate laws, and even cause death"(Shneiderman 1). Since these algorithm deficits are hard to depict, it might take years for solutions. While this deficit has yet to be solved, other aircraft can still be in the air and run into the same malfunctions at any time. The need for logging and monitoring must be detailed to ensure more safety in aircraft and autopilot systems. A more specific example of this happened on June 1st, 2009, when Air France flight AF447 took off from Rio de Janeiro, Brazil, to its destination of Paris, France. The flight unfortunately never made it to Paris and crash-landed into the Atlantic Ocean instead. No one on the flight survived. The problem the plane had, according to Haitham Baomar and Peter J Bentley in their article "An Intelligent Autopilot System That Learns Piloting Skills from Human Pilots by Imitation," had to do with the root of Automatic Flight Control Systems (AFCS). The AFCS is a basic autopilot system that keeps the aircraft en route to the destination path. "[T]he aircraft entered a severe turbulence zone forcing it to climb steeply and stall. Shortly after that, the [AFCS] disengaged, causing the aircraft to lose altitude dramatically. Unfortunately, it was too late for the flight crew to rectify the situation " (Baomar and Bentley). Douglas L. Kettler initially invented and patented the "Aircraft Autopilot System" to have an "apparatus for cooperative interaction with an aircraft autopilot for interrupting automatic operation and manually commanding the autopilot to couple the glide slope during approach for landing" (Kettler). However, the autopilot system of this aircraft in 2009 had"poor design[s]" or "unintentional bias" (Shneiderman 1). It wasn't secure enough to handle severe turbulence systems. Also, when it did disengage, it wasn't notifying crew members early enough, causing a great catastrophe. Although the main problem with aircraft was the failure in the AI systems, many believed the problem was with the crew members. There were many hypotheses in which people believed that crew members were not quick enough to handle the situation and caused this situation to become worse than it was. According to the research study, “What We Can Learn from Pilots for Handovers and (De)Skilling in Semi-Autonomous Driving: An Interview Study” there is evidence that supports that human error was not the main cause of the accident. The text explains that “the accident and concluded that it was the sociotechnical system that compromised aircrew and cockpit, as well as, airplane systems that lost situation awareness; it was not the fault of the aircrew” (Trösterer et al.). This clears the human error and explains the AI caused the main reason for AirFrance Flight 447.

The AirFrance flight is not the only case in airplanes to have caused an accident due to AI. In 1994 American Eagle Flight 4184 missed their landing at Raliegh-Durham and crashed, killing 13 passengers and the two pilots. It “encountered in-flight icing which lead to loss of control and a failed handover situation, as the automation system failed to provide adequate information to the pilots concerning previously known effects of freezing precipitation on the plane” (Trösterer et al.). The AI on this American Eagle flight failed again with human and AI interaction. If the systems were able to give the previous records of freezings of the airplane, the pilots would have been more attentive to the problem without putting passenger safety and security at risk. We see another case where there handover response for AI and human interaction to fail. “CHATGPT and Software Development” by Issac Sacolick explains why this interaction has failed. “Since the technology is based on data and not human intelligence, sometimes the program can sound coherent, but it does not provide any critically informed responses”(Sacolick). If AI cannot give accurate information about different airplane conditions or the flight's path, it could lead to mishaps and compromise the security of the Aircraft and provide the crew members with a disadvantage in keeping passengers safe. This is why the American Eagle flight was a disaster and a failure towards AI in the aircraft industry.

Very similar to the American Eagle flight, another flight had a miscommunication between AI and pilots. In 1991 Scandinavian had a failure in both engines just after take off. Fortunately, all the passengers and crew members survived, and the crash was called the Miracle at Gottröra. It still does not suffice as it puts all those in the flight at risk. "The accident was caused by inadequate instructions and inspection routines. One routine was to ensure that clear ice is removed from the wings of an aircraft prior to takeoff. In this case, the ice broke off and was ingested by the engines, leading to engine surging" (Trösterer et al.). The display information on the airplane's AI systems failed this time. The pilots had a hard time comprehending the information about the plane's condition. This led to another compromise for the safety of passengers on the airplane. AI is not as powerful as it should be for Airplanes. It should be stronger and used for the same purposes humans have. As Sacolic notes,

> Shanea Leven, cofounder and CEO of CodeSee, says, 'Engineering requires a lot that AI can't replace, like context, making it near impossible for AI to load into a single model, train that model, and incorporate the predictive capability of humans who understand what's going to be necessary in five years. There are a lot of big picture decisions unique to different businesses that AI will simply never be able to handle' (**Sacolick).**

AI can not put situations into the bigger picture: saving humans. It might just look out for the Aircraft structures' integrity, but not enough context to look out for the safety of passengers and crew members. In contrast, a pilot's priority is to save his passengers, even if it means sacrificing his own life. AI is yet to make these big decisions in these life-or-death situations.

Remote Control Hacking

Since aircraft autopilot system does use Artificial Intelligence, these things could be hacked. Cesar Cerrudo and Lucas Apa report on an experimental study. Their article "Hacking Robots before Skynet1" discusses how robotic AI can be hacked.

> It's vital to keep a robot secure by using cryptographically strong communications. Otherwise, attackers can easily intercept communications and steal confidential information, compromise key components of the robot ecosystem, hack the robot, etc. Unfortunately, most robots evaluated were using insecure communications. Mobile and software applications connected with the robots through the Internet, Bluetooth, Wi-Fi, etc., without properly securing the communication channel. They're sending critical information in clear text or with weak encryption. Some robots connect to the Internet by sending data to vendor services or the cloud in cleartext without any protection (Apa and Curredo 7).

These days, almost every flight in the world has Wi-Fi. These robotic features on aircrafts could be connected to the inflight Wi-Fi without a stable communication channel. A passenger can easily intercept this without good AI and user communication security. They could start controlling different aircraft functions if this is easily intercepted. "As many of these 'smart' machines are self-propelled, it is important that they're secure, well protected, and not easy to hack. If not, instead of helpful resources they could quickly become dangerous tools capable of wreaking havoc and causing substantive harm to their surroundings and the humans they're designed to serve" (Apa and Curredo 4). For aircraft AI, these robotic technologies, as described in the article, must be secure. Otherwise, hackers could bring fatality to all those on the flight if hacked. This weakness also relates to why many airlines require passengers to stow away their devices during takeoff and landing. Especially if there are " poor design[s or] unintentional bias [that may] cause [these] algorithms" to be fatal, these practices of stowing away devices are a safety measure to ensure no passengers are compromising the most vulnerable parts of aerial travel (Sniederman 1).

An example of this case can be said about the Spanair Flight 5022 plane crash. In the news article "How To Hack An Aircraft" by Kate O'Flaherty it states the plane's "central computer system used to monitor technical problems in the aircraft was infected with malware. An internal report by the airline revealed the infected computer failed to find three technical problems with the aircraft which, if detected, might have stopped the plane from taking off in the first place" (O'Flaherty). The aircraft was not able to detect weak encryption. The plane's "[h]uman safety protections and collision avoidance/detection mechanisms can be disabled by hacking the robot's control services" (Apa and Curredo 10). Similarly, Sniederman explains these algorithms will "trigger huge financial losses, promote unfair decisions, violate laws, and even cause death" (Shneiderman 1). This puts many passengers, flight attendants, and even pilots in danger. Strict security and encryption must be placed, especially on safety functions on aircraft.

Another very significant mystery related to insecurity in airplanes is the very famous missing Malaysia Airlines Flight MH 370. Stephan A. Kaiser, from the article "Legal Considerations about the Missing Malaysia Airlines Flight MH 370" states the flight was one the biggest "technical myster[ies]" and a demonstration of "weaknesses of the current technical, regulatory and organizational infrastructure of international civil aviation" (Kaiser). What had happened, according to *Britannica's* editors in the article "Malaysia Airlines flight 370 disappearance summary," was that "[t]he plane's transponder was switched off just as the plane was about to enter Vietnamese airspace" (*Britannica*). Although it is not clear what happened to the after, many experts believe the plane's transponder was insecure. The transponder should never turn off for a commercial flight taking more than 200 passengers. This could be another example of the "malicious interventions [that] can cause [these] algorithms to trigger death"(Shneiderman 1). Since it is still a mystery, the option of the aircraft being hacked cannot be disregarded. It could answer to how the plane became “capable of wreaking havoc and causing substantive harm” (Apa and Curredo 4). A lot is unknown about this Malaisya Airline flight, but many theories link to the failure of AI in the plane and the planes demise.

Solution?

AI helps with the automation of consistent activities, but for generative AI, it does not understand human context and experiences. For now, generative and narrow AI can help fill gaps and accelerate implementing solutions within the software development life cycle, but we will still need developers to drive appropriate experiences. “ChatGPT misses the ability to understand the human context of computing to do programming well’”(Sacolick). In challenging situations, AI does not provide data about human instinct and past experience from pilots. AI might give solutions to simple problems but lack the complexity to solve complex problems that sometimes require emotion to make the best decision. On the contrary, Baomar and Bentley have proposed a solution to improve airplane AI: The Intelligence Autopilot System (IAS). IAS is an AI that understands and imitates decisions by pilots to enhance aircraft performance better. They describe it as a learning system like how “an apprentice observes the demonstration of a new task by the experienced teacher, and then performs the same task autonomously” (Baomar and Bentley). This is a significant problem because even with a great amount of experience, anything could happen in any situation. Also, with the rise of technology and the lack of general knowledge, there is so much possibility for situations no one knows how to deal with. The instructor for the program must be highly experienced and good at analyzing situations, which comes from several years of experience; even then, anything could happen. If the IAS can imitate everything the instructor does, what makes it not imitate the possibility of bad decisions? Even an extremely experienced pilot can make mistakes. Humans are never perfect, and being copied doesn't give the perfect result. This can be related to Schnieder's theory as well. Humans are known to make mistakes and are full of imperfections. Even when humans make algorithms, they are "less visible than transportation crashes, so logging and monitoring techniques will have to be improved and widely applied" (Shneiderman 2). Whether making the intelligence or copying the intelligence of an experienced pilot, there is always a chance of failure. Every chance of failure must be scrutinized in the aircraft industry because most failures lead to hundreds of fatalities.

The IAS could also have other problems with its data collection. In the article "Artificial Intelligence: Overhyped and Underdeveloped," Alex Yang addresses another important piece of information that relates to IAS. "After a neural network has been trained, it will only know how to handle cases it has been exposed to before" (Yang). This means that even after countless hours of training, the IAS can only access data similar to that event. There is no guarantee that system will encounter a solution to every type of aircraft problem that could occur. There could also be countless new problems that we might not even know that could happen in the future. If a problem is not dealt with as much, the IAS can get confused and again show an "unintentional bias" that can later cause so many fatalities (Shneiderman 1). Even though IAS has a great cause, it will only open the possibilities to additional problems in the future.

Conclusion

As artificial intelligence is used to help humans, there are a lot of problems that arise from it still. It is still underdeveloped and has a long way to go. In the aircraft industry, AI is generally is used on most flights. Every time an accident occurs because of AI, problems are fixed and solved. But most AI-related problems in aircraft lead to huge fatalities and accidents, making the solutions less celebrated than the deaths the problem has caused. For example, as of today, it is getting closer to a decade after the Malaysia Airlines incident, and yet it feels like the investigation has never ended. It remains a mystery as to what exactly happened to all the passengers. It is assumed there were no survivors of the plane, but some exact evidence has still not been discovered.

AI is becoming our future, and we all must embrace it whether we like it or not. Problems will still occur, but the way to automation shows human advancement. AI will one day run this world. It can already drive planes and cars, make coffee, and even turn the lights on and off. We have to make sure there are good standards for these algorithms. Algorithms must be logged and verified so we can prevent disasters from happening if there are such problems present, just like how Schneiderman explains.

There are still so many unknowns on the capabilities of AI. It might cause human life to be more efficient. However, it might lead human life to destruction. AI could become its own identity and run this world. Then at that point, our problems will not be just about the AI in aircraft but AI around the world.

Just like the unknown of AI, the future is still unknown. Maybe one day, AI might be the most helpful technology to ever exist to human kind. We must leave the future of not only aviation in good hands but also the future of those always engaged with AI. We must ensure it does this for the survival of the future generations. Who knows, one day AI might even help us make flying to different planets commercial. It might make it safer. Only time will tell what us humans are capable of doing with this technology.

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