Applying AI to improve the operations controller's job

Laszlo Kovacs, Senior Product Owner — AI & Data Analytics, Lufthansa Systems shares the story of developing an AI system to improve the operations control process speed and quality

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A lot of people are talking about Artificial Intelligence (AI) and how it will revolutionize so many processes and technologies. This article is about how Lufthansa Systems has leveraged AI capability to bring the Operations Control Center (OCC), and the operations controllers who work there, right up to date with a solution that will help them to work better but will also remove some of the stress from what is a key function for any airline. But before we go any further, I think we need to step back a pace to think about AI itself. AI often gets portrayed in the movies or in headlines as already having superhuman capabilities: however, the reality is that we are still in an evolutionary phase of AI development and are very far from having a superhuman generic AI that can act like a human. That is because most of the current AI systems, including our Smart Assistant, are designed to tackle some specific tasks and operate more like an intelligent assistant or agent.

What really is exciting, is how AI is evolving in different industries because we have seen a shift in how we view AI which has gone from seeing it as a tool to seeing it as a service. Think about the self-driving car. One day, in the future, cars will not have drivers at all and that will fundamentally change the concept of a car because the passengers will interact with the car on a higher and abstract level, using the car as a transportation service and not as a tool that they need to use to go from A to B. This evolution translates to the aviation industry as well because, as the role of the users, if we are talking about operations controllers, shifts from operators to managers, the network and the daily operation will need an AI system that is in a highly collaborative state with a clear communication between users and the technology, a conversation but on a more abstract level. You won't need to go into the mechanics of every process, you will just need to manage the network and make sure that it does what you want; but you will not need to operate it. That is a fundamental change in progress today. What is behind all this is that there is an underlying shift which AI is bringing to our relationship with the tools we use.

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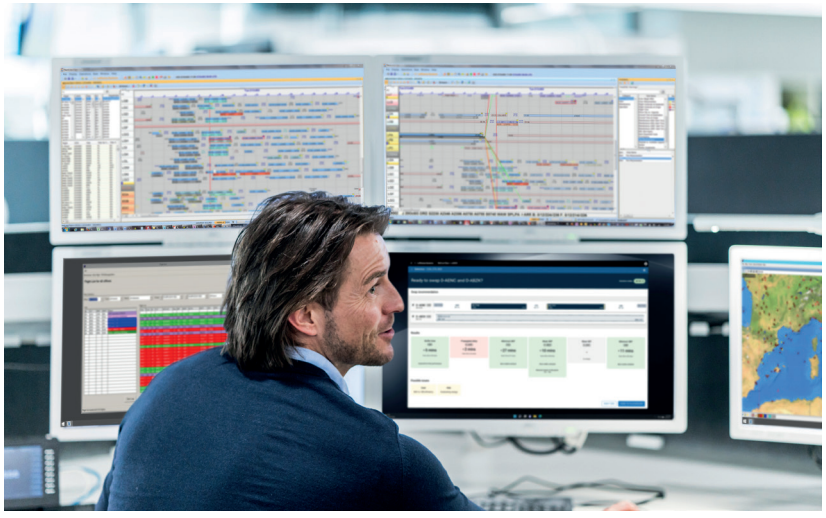
Traditionally, humans have had complete control over not just what the tool does but also how it functions. AI systems are different; they are more like intelligent agents who are capable of making predictions and offering recommendations for actions; they can even make decisions based on the information that they process. It's a different level of autonomy. This is the first time when we have given some control over the whole process to the tool. The important thing here is that, to be able to do this, there is a critical component and that critical component is trust. Like handing over the wheel of the car to an autonomous system, there needs to be confidence in the AI's capabilities. Trust and transparency, in what is behind the processes is very important in the design of an AI tool for operations controllers. The big question is how to establish that trust and, in that, we realized that the most crucial factor is competence. That means that the AI system has to be capable to perform its tasks effectively and can deliver some valuable results. To do this, there has to be explainability and usefulness, to demonstrate that it can solve real problems. It should not be a case of just putting AI somewhere and then leaving it at that. You need to demonstrate that the system can solve some real problems and provide clear benefits for the user as well as being able to clearly communicate the reasons behind its recommendations and decisions. This is the transparency that allows users to understand why a recommendation has been offered or a decision taken and that will give them some confidence in the system.

The other key factor is openness: the system should be sufficiently flexible to be able to accept changes or new inputs and, to reach this state, there needs to be some control with the users; that means empowerment. The system should provide a way for users to keep control, to adjust the actions that the system proposes. The other one is a kind of adaptability to be able to quickly adapt to the user's references. Those are the key components if you want to design an AI product that not only empowers users but fosters trust and collaboration between humans and the AI systems; this is the key to a successful AI product. These are the design principles that we established when we designed the aiOCC; we tried to follow those principles as closely as possible because we learned during the cooperation that those principles are the key points for success.

CHALLENGES AND REASONS FOR A NEW SOLUTION

As I stated above, it should not be a case of just putting AI somewhere and then leaving it at that, there has to be a reason for developing a new software solution and so, before we go into the details of NetLine/Ops ++ aiOCC, what it does, how it works, I would like to briefly outline the challenges that we had identified in the way things were done before and why those challenges warranted a new solution.

The story behind aiOCC began just before Covid because, at that time, we saw that airlines were really suffering from disruptions and, of course, disruptions can cost a lot of money. Disruptions are quite common during operations but if there are a lot of disruptions to flights because of the weather or security or



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other problems, then that will amount to a lot of delay which, in turn, costs a lot with delay-related fees and other costs. That was the situation in 2019; it was a challenging year for airlines and was when we started collaboration with an airline customer to figure out how that situation could be improved. What we realized was that today's systems have the capacity and capability to provide a lot of data for operations controllers about any given situation and the theory is that, if you have more data, you can make better decisions.

However, one problem with that is that operations controllers often have very stressful days, working under a lot of time pressure, especially if it's a day with bad weather or other delay factors. Analyzing huge amounts of data and information can be very time consuming for a human and sometimes it can even be confusing because there is simply too much data for a human to manage; but that is not the case for a machine. That was what we realized. On top of that, while you are trying to figure out this data, determine what is the problem and how can it be solved, other matters might be going unaddressed. That was the other problem at the time and it was then that we decided to create a product to help with the everyday work of the operations controller. It was as an addition to NetLine/Ops ++ from Lufthansa Systems and we called it aiOCC – bringing AI into the Operations Control Center.

HOW NetLine/Ops ++ aiOCC ADDRESSES THE CHALLENGES

As previously discussed, the challenges that we faced were data overload and time pressure. For the first of those, data overload, our mission was to have a smart system that could continuously monitor the data sources in real time. Imagine our solution as an assistant or a helpful colleague, constantly monitoring and analyzing the situation and providing some concrete and actionable insights; concrete actions that would directly target improving the efficiency of daily operations, that was our goal.

Offering these recommendations in aiOCC will significantly speed up the workflow for the operations controllers because they will no longer need to be analyzing those massive amounts of data: the system will analyze the data, highlight all of the potential problems and not just highlight the problems but will also suggest mitigating actions. That was the idea and the vision.

There is one more aspect in the aiOCC in that it goes beyond simply firefighting with daily problems because it can also provide the users with proactive recommendations. The aim is to stabilize the daily schedule and avoid the risk of disruptions later in the day. So, it doesn't just deal with problems as they arise but also, in a proactive way, it can suggest preventive measures to avoid future problems and thus ensure smoother operations.

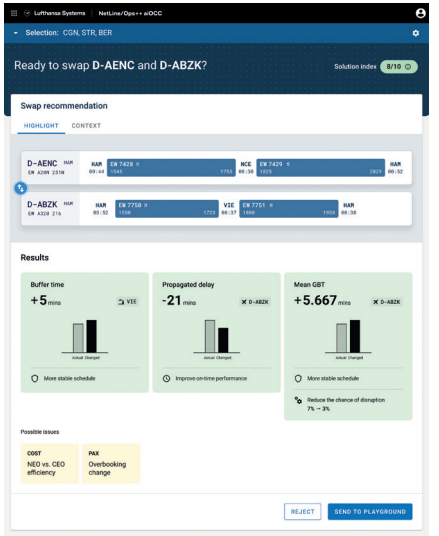

Figure 1

Very helpfully, not only will aiOCC generate suggestions for how to resolve and avoid problems but it will also identify the most important problem, the one that, by implementing the recommendation, can result in the most saving of delays. It prioritizes the different tasks into an order for the user to be most effective. But sometimes, it isn't only about priority but also complexity and other aspects that need to be taken into account when distributing and prioritizing the tasks (figure 1.)

We looked at some alternatives. For instance, traditional optimizer methods were certainly a possibility because they've been used for over twenty years in Operations but these methods have some limitations because they often struggle to deliver results in real-time, which is crucial in this dynamically changing and complex environment, and optimizers can struggle with complex and constantly changing situations. Given those limitations, we felt that AI techniques were a better fit for this challenge because AI has the ability to handle complex data, complex environments and dynamic situations. That aligns perfectly with the needs of an operations controller and was the reason behind our decision to use an AI technique instead of a traditional optimizer method. Furthermore, there are quite a few different AI techniques but we wanted a solution that could not only forecast potential issues but could also recommend actionable steps to address them. That is why we chose deep reinforcement learning, because it has the capability to do this.

DEVELOPMENT HISTORY OF aiOCC

The story of this development started, as mentioned earlier, before Covid in collaboration with an airline and, at that time, together we developed a very promising prototype but, unfortunately, when Covid hit the airline industry, we had to put the project on hold. However, the potential for aiOCC had become clear; so, in 2022, we were able to resume development and we now have the product in the market in a model that is able to be integrated with NetLine/Ops ++ which is the main software solution from Lufthansa Systems for the operations controller; aiOCC is a module on top of that.

That's the current situation but the work does not stop there; we continue to be dedicated to collaborating with our customers in an ongoing partnership that allows us to continually further develop the aiOCC and to support the digital transformation of the airline industry. Our ultimate goal is to revolutionize airline operations implementing not just aiOCC but also other AI products that will help the workflow.

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TECHNOLOGIES USED IN NetLine/Ops ++ aiOCC

We use multiple technologies in the solution, but the core AI agent is based on deep reinforcement learning. That's a technology invented by Google which hit the news when it beat the world's best AlphaGo player. It is the technology

behind our application. You can think of it as an AI agent that is constantly learning from experience the optimal course of action based on a specific goal. As I mentioned earlier, it's not predictive but it's prescriptive so it doesn't just tell you what might happen but it tells you what actions to take to achieve your desired outcome. Prescriptive technology has been used in the gaming environment for some time but real-world applications, as opposed to a game, face some unique challenges. It's more complex and the data might include some unexpected elements plus the data quality can vary. The system is more sophisticated but the core principle is the reinforcement learning method.

The technology is just one piece of the puzzle. At the start of this article, I mentioned some key principles that are crucial for AI based applications and we kept these principles at the forefront of our thinking when designing the user interface which is web-based and is designed to be clear, intuitive and user-friendly, so that operators can not just easily see the recommendation but also can understand the reasoning behind them and can adjust the actions if needs be. aiOCC tells its users what is happening, why it is happening and some ideas for what to do about what is happening as well as why those actions are suggested and what will be the impact if the actions are carried through.

IN SUMMARY

As stated earlier, aiOCC is like having a highly skilled assistant by your side who is constantly working to improve airline operations. Behind the scenes the system learns from historical data. It can learn how to act in different situations and, during the live operation phase, what is important is that it considers a situation in real-time and, if it figures out a recommendation that could improve it, it will generate a recommendation but will not usurp user control. So, when the recommendation is generated, the controller has complete autonomy. They can choose to send it for a final review before implementation, to what is called a dedicated playground, within the operations software from Lufthansa Systems or, alternatively, they can reject the recommendation, in which case, the system will present the next best alternative.

I should reiterate that the system has transparency and will show what is behind the recommendation, what is the reasoning, why this is recommended. Furthermore, the system can highlight any potential issues created with the recommendation. It is prompting the human controller to consider these factors for making a decision because sometimes it is not totally clear or black and white.

This is where we are today but we believe that this is just the beginning of our transformational journey when we will consult with our customers to further develop aiOCC and unlock its full potential.

AUTHOR

Laszlo Kovacs is a Ph.D. holder in electrical engineering and informatics with an extensive research background, including ownership of several patents. With a strong background in AI and Data Analytics he has worked on diverse AI products across various domains. Currently serving as a product owner at Lufthansa Systems. Additionally, he has a master's degree in psychology, which adds a unique perspective to his research and work, particularly in understanding the intricacies of human-AI interactions.

LUFTHANSA SYSTEMS

Lufthansa Systems offers its more than 350 airline customers an extensive range of successful and in many cases market-leading products for the aviation industry. These innovative IT products and services cover all of an airline's business processes and offer customers a wide range of economic benefits while also contributing to improving efficiency and competitiveness. Headquartered in Germany, Lufthansa Systems employs around 2,800 people at its locations in 16 countries.