# ARTIFICIAL INTELLIGENT AIR TRANSPORTATION SAFETY SYSTEM

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***Abstract*:**

An escape crew capsule is an escape capsule that allows one or more occupants of an aircraft to escape from the craft while it is subjected to extreme conditions, such as mechanical error, firing etc. The contribution is dealing with the issue of air transportation safety in view of the potential causes resulting in air accidents and their prevention.

## 1. INTRODUCTION :

Artificial Intelligence (AI) is a commonly employed appellation to refer to the field of science aimed at providing machines with the capacity of performing functions such as logic, reasoning, planning, learning, and perception. Despite the reference to "machines" in this definition, the latter could be applied to "any type of living intelligence". Likewise, the meaning of intelligence, as it is found in primates and other exceptional animals for example, it can be extended to include an interleaved set of capacities, including creativity, emotional knowledge, and self-awareness. The term AI was closely associated with the field of "symbolic AI", which was popular until the end of the 1980s. In order to overcome some of the limitations of symbolic AI, sub symbolic methodologies such as neural networks, fuzzy systems, evolutionary computation and other computational models started gaining popularity, leading to the term "computational intelligence" emerging as a subfield of AI. Nowadays, the term AI encompasses the whole conceptualization of a machine that is intelligent in terms of both operational and social consequences. A practical definition used is one proposed by Russell and Nerving: "Artificial Intelligence is the study of human intelligence and actions replicated artificially, such that the resultant bears to its design a reasonable level of rationality" [1]. This definition can be further refined by stipulating that the level of rationality may even supersede humans, for specific and well-defined tasks.

Current AI technologies are used in online advertising, driving, aviation, medicine and personal assistance image recognition. The recent success of AI has captured the imagination of both the scientific community and the public. An example of this is vehicles equipped with an automatic Steering system, also known as autonomous cars. Each vehicle is equipped with a series of liar sensors and cameras which enable recognition of its three-dimensional environment and provides the ability to make intelligent decisions on maneuvers in variable, real-traffic road conditions. Another example is the Alpha-Go, developed by Google Deep mind, to play the board game Go. Last year, Alpha-Go defeated the Korean grandmaster Lee Sedum, becoming the first machine to beat a professional player and recently it went on to win against the current world number one, Ke Jie, in China. The number of possible games in Go is estimated to be 10761 and given the extreme complexity of the game, most AI researchers believed it would be years before this could happen. This has led to both the excitement and fear in many that AI will surpass humans in all the fields it marches into.

## 2. APPLICATIONS OF AI IN TRANSPORT:

In many cases, it is hard to fully understand the relationships between the characteristics of the transportation system; therefore, AI methods can be presented as a smart solution for such complex systems that can't be managed using traditional methods. Many researchers have demonstrated the advantages of AI in transport. An example of that includes transforming the traffic sensors on the road into a smart agent that detects accidents automatically and predicts future traffic conditions . Also, there are many AI methods used in transport such as ANNs. ANNs can be used for road planning public transport Traffic Incident Detection and predicting traffic conditions. It is classified into supervised and unsupervised learning methods. Supervised methods include Support Vector Machine , Probabilistic Neural Network , Radial Basis Network , K-Nearest Neighbors and Decision Tree, etc. while unsupervised NNs include greedy layer-wise and cluster analysis. Many transportation problems lead to an optimization problem that needs bespoke algorithms to make computational analytics easy to solve. They are highly advanced computational algorithms referred to as raster algorithms. The Genetic Algorithm (GA) is an example of those algorithms. It is based on the evolutionary biological concept.

Ant Colony Optimizer (ACO) is also an AI algorithm developed based on the behavior of a group of real ants following their path from the nest to food source . An artificial Immune system (AIS) which is modeled based on the human immune system. Bee Colony Optimization (BCO) which solves a hybrid complex optimization problem . ACO and BCO are part of swarm intelligence systems . Swarm intelligence is an AI system which is inspired by ants and bees working together as a group to reach to an optimized solution. The intelligent computational analytics of these system are able to represent uncertainty, imprecision and vague concepts, hence these techniques are used for route optimization problems in transport . Another optimization technique is Fuzzy Logic Model (FLM). The objective of planning is to identify the community needs and decide on the best approach to meet this demand while utilizing the impact of social, environmental and economic in transportation. Designing an optimal road method for transport planning is part of the Network Design Problem (NDP) . It can be a Continuous problem when the capacity of existing infrastructure changes (extend lane width, median and shoulder area), a Discrete problem is identified when adding more infrastructure and a Mixed of Continuous and Discrete problems. Previous researches in the 90s focused on NNs for road planning, designing and modeling.

## 3. ECONOMIC ANALYSIS OF AVIATION SAFETY:

As might be expected, much of the literature on aviation safety has its roots in engineering and technology. Much of the economic analyses of airline safety in the 1980s and early 1990s focused on the potential safety effects of deregulation and liberalization, and the comparative safety performance of industry segments, especially new entrant carriers. Although the conclusions were mixed, Savage shows that safety records for new entrant airlines in the early 1990s were worse than for established carriers . In the past decade though, there has been little variation in safety among the major airlines in the developed world. Efforts to analyze comparative safety performance in the developing world have been hampered by problems of data availability and inconsistency.

### 3.1. Reactive versus proactive approaches to the analysis of aviation safety:

Lying accidents, investigating their causes, and recommending corrective action. More recently, in addition to this reactive approach to improving aviation safety, increased emphasis has been placed on taking a proactive approach. This approach involves identifying emerging risk factors, characterizing these risks through modeling exposure and consequences, prioritizing this risk, and making recommendations with regard to necessary improvements and what factors contributed to the accident. This approach places more emphasis on organizational and systematic risk factors.

### 3.2. Economic (reactive) analyses of safety:

While the worldwide aviation safety record has improved dramatically over time, these safety advances have not been evenly distributed across all segments of commercial aviation nor among all countries and regions of the world. A handful of researchers, in addition to those identified above, have tried to identify what causes these variations in accident rates among air carriers.

The effect of profitability on an airline's safety record is one area that has received a fair amount of attention, with mixed results. Research performed in 1986 by Globe found no significant relationship between airline profitability and safety. Rose (1990) found a significant relationship between profitability and lower accident rates. Upon a closer analysis of the data, it was determined that this correlation between profitability and safety was present for medium and small airlines but was not statistically significant for larger airlines. A 1997 analysis of the Canadian airline industry by Dionne, Gagné, Gagnon, and Vanasse (1997) identified a negative relationship between profitability and safety for the smallest airlines analyzed. While on the surface this result might seem counterintuitive, the investigators discovered that those small airlines that spent more on maintenance, which would negatively impact the bottom line, experienced lower rates of accidents.

### 3.3. Proactive approaches to safety analysis:

As the safety record of the aviation industry improves it has become increasingly evident that the probability of an accident, especially a fatal accident, is extremely low. This makes it ever more apparent that reliance on analyses of accidents after they have occurred provides only a partial picture of aviation safety. The result has been increased attention being paid to identifying ways to proactively determine how changes in the aviation system affect the risk of accidents. This argument is based on work by Reason on modeling of organizational accidents. Reason favors an integration of reactive and proactive approaches to the analysis of safety e what he refers to as the interactive phase of system operations, where safety, operational, and management systems interact. This conceptual framework has become the basis for “Swiss cheese” models of safety management, in which most accidents are seen as the result of multiple failures in a system. In Reason's work, for an accident to occur, all of the holes (failures in safety defenses) in multiple slices of Swiss cheese need to line up for an accident to occur. This perspective is the basis for much of the development and emphasis on Safety Management Systems. For example, the Federal Aviation Administration (FAA) is placing more emphasis on a proactive approach through its use of Safety Management Systems in an attempt to identify and reduce risks.

Clearly a more comprehensive approach to the analysis of aviation safety, along the lines of what Reason and Loquats suggest, can be very useful in developing safety practices and oversight. However, more traditional reactive analytical approaches remain useful in helping to identify segments of the aviation industry where safety performance is problematic relative to the rest of the industry. In this vein, there are important research opportunities in the development of firm level behavioral data concerning safety investments, more disaggregation of incident data, and improving data availability and quality about safety performance in specific regions and segments of aviation.

## 4. ARTIFICIAL INTELLIGENCE METHODS:

At the present time, AI methods can be divided into two broad categories: (a) symbolic AI, which focuses on the development of knowledge-based systems (KBS); and (b) computational intelligence, which includes such methods as neural networks (NN), fuzzy systems (FS), and evolutionary computing. A very brief introduction to these AI methods is given below, and each method is discussed in more detail in the different sections of this circular.

### 4.1. Knowledge-Based Systems:

A KBS can be defined as a computer system capable of giving advice in a particular domain, utilizing knowledge provided by a human expert. A distinguishing feature of KBS lies in the separation behind the knowledge, which can be represented in a number of ways such as rules, frames, or cases, and the inference engine or algorithm which uses the knowledge base to arrive at a conclusion.

### 4.2. Neural Networks:

NNs are biologically inspired systems consisting of a massively connected network of computational "neurons," organized in layers . By adjusting the weights of the network, NNs can be "trained" to approximate virtually any nonlinear function to a required degree of accuracy. NNs typically are provided with a set of input and output exemplars. A learning algorithm (such as back propagation) would then be used to adjust the weights in the network so that the network would give the desired output, in a type of learning commonly called supervised learning.

### 4.3. Fuzzy Systems:

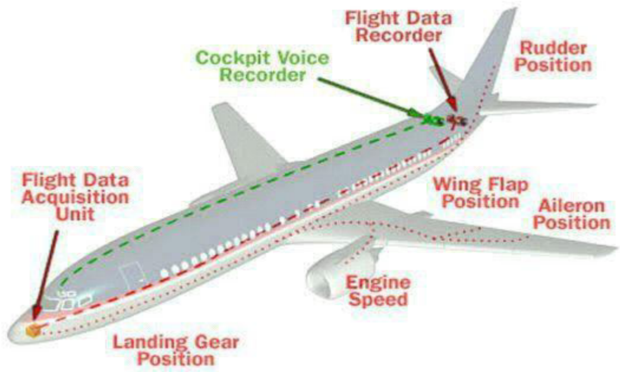
Fuzzy set theory was proposed by Zadeh (1965) as a way to deal with the ambiguity associated with almost all real-world problems. Fuzzy set membership functions provide a way to show that an object can partially belong to a group. Classic set theory defines sharp boundaries between sets, which mean that an object can only be a member or a nonmember of a given set. Fuzzy membership functions allow for gradual transitions between sets and varying degrees of membership for objects within sets. Complete membership in a fuzzy function is indicated by a value of +1, while complete non-membership is shown by a value of 0. Partial membership is represented by a value between 0 and +1.

### 4.4. Genetic Algorithms:

Genetic algorithms (GAs) are stochastic algorithms whose search methods are based on the principle of survival of the fittest. In recent years, Gas have been applied to a wide range of difficult optimization problems for which classical mathematical programming solution approaches were not appropriate. The basic idea behind GAs is quite simple. The procedure starts with a randomly generated initial population of individuals, where each individual or chromosome represents a potential solution to the problem under consideration. Each solution is evaluated to give some measure of its "fitness." A new population is then formed by selecting the more fit individuals. Some members of this new population undergo alterations by means of genetic operations (typically referred to as crossover and mutation operations) to form new solutions. This process of evaluation, selection, and alteration is repeated for a number of iterations (generations in GA terminology). After some number of generations, it is expected that the algorithm "converges" to a near-optimum solution.

## 5.EXISTING SYSTEM:

The differentiating factor of an AI system from a standard software system is the characteristic ability to learn, improve, and predict. Through training, an AI system is able to generate knowledge and apply it to novel situations not encountered before. While computing powers were a barrier to adoption previously, advancements and greater availability of data has propelled AI applications across industries. Today, AI capabilities are proliferating across the transport sector through AI-enabled autonomous vehicles. Faced with the challenges of growing traffic, resource demands, increasing uncertainties, and operational complexity can exploit the power of AI to empower current operators and boost productivity through the capability of decision making under uncertainties and provision of optimized situational strategies that procedures or simple algorithms cannot provide. This would assist operations in managing varied air traffic scenarios with high efficiency and safety.



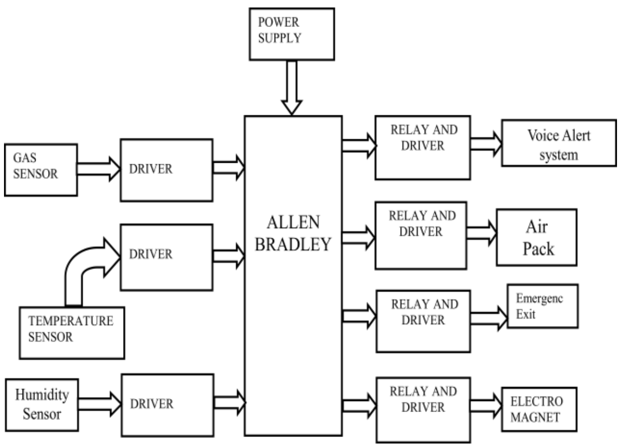

Large commercial aircraft and some smaller commercial, corporate, and private aircraft are required by the FAA to be equipped with two "black boxes" that record information about a flight. Both recorders are installed to help reconstruct the events leading to an aircraft accident. One of these, the **Cockpit Voice Recorder (CVR)**, records radio transmissions and sounds in the cockpit, such as the pilot's voices and engine noises. The other, the **Flight Data Recorder (FDR)**, monitors parameters such as altitude, airspeed and heading. The older analog units use one-quarter inch magnetic tape as a storage medium and the newer ones use digital technology and memory chips. Both recorders are installed in the most crash survivable part of the aircraft, usually the tail section.

The FDR onboard the aircraft records many different operating conditions of the flight. By regulation, newly manufactured aircraft must monitor at least eighty-eight important parameters such as time, altitude, airspeed, heading, and aircraft attitude. In addition, some FDRs can record the status of more than 1,000 other in-flight characteristics that can aid in the investigation. The items monitored can be anything from flap position to auto-pilot mode or even smoke alarms.

With the data retrieved from the FDR, the Safety Board can generate a computer animated video reconstruction of the flight. The investigator can then visualize the airplane's attitude, instrument readings, power settings and other characteristics of the flight. This animation enables the investigating team to visualize the last moments of the flight before the accident.

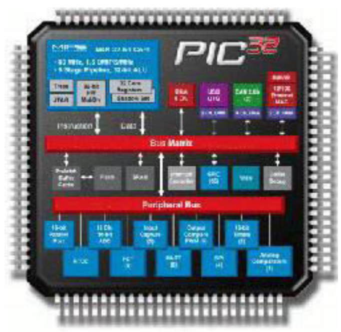
Both the Flight Data Recorder and the Cockpit Voice Recorder have proven to be valuable tools in the accident investigation process. They can provide information that may be difficult or impossible to obtain by other means. When used in conjunction with other information gained in the investigation, the recorders are playing an ever increasing role in determining the Probable Cause of an aircraft accident.

## 6.BLOCK DIAGRAM:




## 6.1.ALLEN BRADLEY:

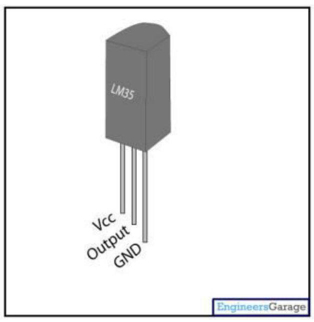
PIC microcontroller was developed in the year 1993 by microchip technology. The term PIC stands for Peripheral Interface Controller. Initially this was developed for supporting PDP computers to control its peripheral devices, and therefore, named as a peripheral interface device. These microcontrollers are very fast and easy to execute a program compared with other microcontrollers. PIC Microcontroller architecture is based on Harvard architecture. PIC microcontrollers are very popular due to their ease of programming, wide availability, easy to interfacing with other peripherals, low cost, large user base and serial programming capability (reprogramming with flash memory), etc.



## 6.2.TEMPERATURE SENSOR:

Temperature sensors are vital to a variety of everyday products. For example, household ovens, refrigerators, and thermostats all rely on temperature maintenance and control in order to function properly. Temperature control also has applications in chemical engineering. Examples of this include maintaining the temperature of a chemical reactor at the ideal set-point, monitoring the temperature of a possible runaway reaction to ensure the safety of employees, and maintaining the temperature of streams released to the environment to minimize harmful environmental impact.

Temperature sensors are devices used to measure the temperature of a medium. There are 2 kinds on temperature sensors: 1) contact sensors and 2) noncontact sensors. However, the 3 main types are thermometers, resistance temperature detectors, and thermocouples. All three of these sensors measure a physical property (i.e. volume of a liquid, current through a wire), which changes as a function of temperature. In addition to the 3 main types of temperature sensors, there are numerous other temperature sensors available for use.

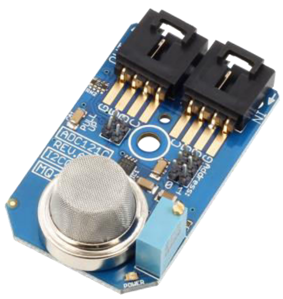



The familiar liquid thermometer consists of a liquid enclosed in a tube. The volume of the fluid changes as a function of temperature. Increased molecular movement with increasing temperature causes the fluid to expand and move along calibrated markings on the side of the tube.

## 6.3.GAS SENSOR:

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. **Gas sensors** are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

**Gas sensors** are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a **methane gas sensor** that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element.



## 6.4.RELAY AND DRIVER:

The advantage of relays is that it takes a relatively small amount of power to operate the relay coil, but the relay itself can be used to control motors, heaters, lamps or AC circuits which themselves can draw a lot more electrical power.

The electro-mechanical relay is an output device (actuator) which come in a whole host of shapes, sizes and designs, and have many uses and applications in electronic circuits. But while electrical relays can be used to allow low power electronic or computer type circuits to switch relatively high currents or voltages both "ON" or "OFF", some form of **relay switch circuit** is required to control it.

The design and types of relay switching circuits is huge, but many small electronic projects use transistors and MOSFETs as their main switching device as the transistor can provide fast DC switching (ON-OFF) control of the relay coil from a variety of input sources so here is a small collection of some of the more common ways of switching relays.

## 7.PROPOSED SYSTEM:

In this system, if a plane detects any errors like

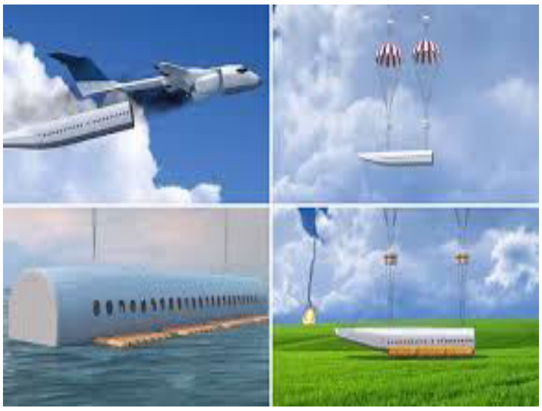
- Mechanical error
- Firing
- Pilot error
- Weather etc.
- Then the capsule automatically detachable from front of the fuselage.

## 7.1.Mechanical error:

An accident may result from one or any combination of a vast number of factors. It is suggested that 90% of all fatal accidents in US civil aviation involve factors other than the aircraft. As mechanical reliability improves. an incur. Proportion of accidents are attributable to human failure or 'Pilot Error'. Pilot error is the commonest causative factor in civil aviation accidents. [I] However, it is the extent of the pilot error and the interaction with other variables, that are being examined here. Pilot error should be defined as an accident that has not been caused by weather, mechanical failure, ATC or biomedical factors but only by pilot's failure to fly the aircraft appropriately due to diversion of attention over trivia. Pilot error is no longer an acceptable label.

## 7.2.Pilot error:

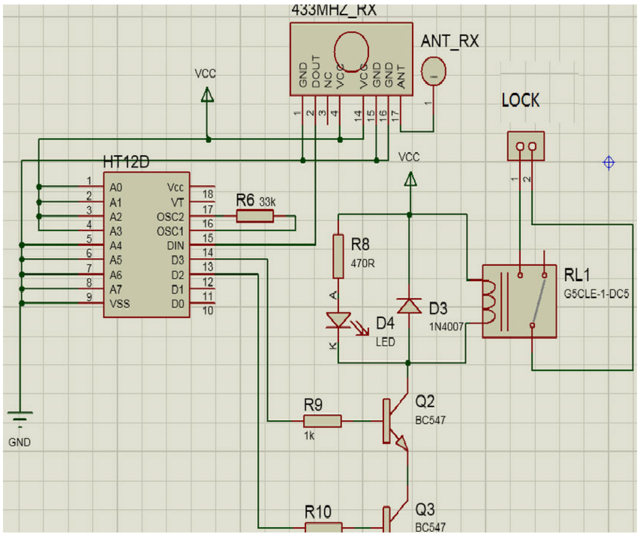
T he importance of human factors, particularly pilot error, in aviation crashes has long been recognized . Overall, about 80% of aviation crashes and 50% of aviation incidents are attributed to pilot error . As aviation hardware becomes more reliable due to advanced technology, the relative importance of human factors in aviation safety is likely to further increase . Empirical research on pilot error has been limited primarily to describing the detailed operational and behavioral acts that contribute to aviation mishaps and to classifying those deviant acts according to various taxonomies . Although these studies have helped to delineate the profiles and patterns of pilot error, they are descriptive in essence and provide little information about the etiology of pilot error. The lack of epidemiologic data on etiological factors underlying pilot error has made it difficult, if not impossible, to develop effective interventions. In this study, we examined the prevalence and correlates of pilot error in a large sample of aviation crashes, using multiple data files compiled by the National Transportation Safety Board (NTSB) over an extended period. The results indicate that the likelihood of pilot error in a given crash is a function of both endogenous and exogenous factors. In contrast to the widely accepted notion that pilot error is entirely an intrinsic phenomenon of human behavior, this study reveals that extrinsic attributes, such as weather condition, are important determinants of pilot error as well.



The effects of pilot characteristics on the likelihood of pilot error was primarily limited to general aviation crashes. The odds of pilot error in general aviation crashes decreased as pilots' total flight time and certificate rating increased. The interaction effect of total flight time and basic weather condition on pilot error was assessed during the modeling and was not included in the final model because of statistical insignificance. With regard to pilot age, a significantly elevated odds ratio existed only among pilots younger than 20 yr in general aviation crashes. There was not an independent gender effect on pilot error.

## 8.CIRCUIT DIAGRAM:

Suppose that a composite solution is eventually proposed and tested. If it is found to work it is returned as the answer, but often the proposal has a bug. A bug may manifest by a contradiction among the constraints of the modules which are the solutions to the sub problems. The composite solution is also analyzed to see if it actually achieves the goal. If there is a bug the next step is to localize the cause of the failure. Since the solution is a composite of correct solutions to sub problems, the bug must be the result of some unanticipated interaction between the parts of the proposed solution. In any case the problem solver must construct a sub problem whose solution would fix the bug. This problem is then solved (by a recursive call to the problem solver) and the resulting patch is installed in the proposed solution. The corrected solution must then be retested against the original criteria.




While the findings of this study are strengthened by the large sample size, the inclusion of three major categories of aviation, and the multivariate statistical technique, there is a limitation with the research design that warrants special attention. The analysis of pilot error was conditional to the occurrence of a crash. The factors associated with pilot error identified in this study are correlates in essence, and thus do not necessarily represent risk factors. Aviation crashes are rare events. Presumably, the overwhelming majority of pilot errors and encounters with adverse weather and other hazardous conditions do not result in an incident or a crash and thus are unreported. Unless surveillance data on pilot error and exposures to hazardous conditions, regardless of the flight outcome, become available, risk factors of pilot error cannot be adequately assessed. Nevertheless, this study provides valuable data for understanding the etiology of pilot error and for formulating prevention strategies. It provides evidence that pilot error is not merely a function of human nature. Rather, it is determined by both endogenous and exogenous variables in ways that are understandable and predictable. Environmental stressors that increase performance demand often play an important role in the causation of pilot error and aviation mishaps. To minimize pilot error, enhancing performance ability through safety training may be beneficial but has its limits. Developing and applying technologies that reduce pilot performance demand in dangerous situations appear to be more effective, and may have contributed to the significant decline in the prevalence of pilot error in major airline crashes over the past four decades. We also see that we have conveniently forgotten about K, which was deferred for later because it is not a constraint. We know that it is always easy to make a scalar if the problem specification does not require that the result be passive. Next, we recursively attempt to instantiate the sub problems. In this case, we have (at least) two matches in the answer library.

## 9.ADVANTAGE:

- By using this type airplane safety system, we can save people through accident.
- The analysis of 80% accidents can be reduced with help of air plane safety system.
- Air transport is the most risky form of transport because a minor accident may put a substantial loss to the goods, passengers and the crew. The chances of accidents are greater in comparison to other modes of transport.

## 10.CONCLUSION:

In this application more comprehensively, primarily by formulating an AI based transportation policy and secondary by making mandatory for urban area. The aim of this study is to raise some fundamental questions in the debate on the future evolution of aviation. This paper presents an overview of the applications of AI to a variety of transport-related problems. The range of applications is expected to increase as our cities and transport systems become more instrumented providing much-needed data for AI application development. The review focused on a number of application areas which are expected to have more influence in future cities including autonomous vehicles, public transport, disruptive urban mobility, automated incident detection, future traffic status prediction, and traffic management and control. It shows that AI can be used to solve the challenge of increasing travel demand, CO2 emissions, safety concerns, and wasted fuels. The literature abounds with case studies that show how AI is effective in designing and developing an optimal network for the community, finding an optimal schedule plans for public transport authorities, enhancing timing plans for traffic signals, and optimizing routes for individual drivers. It is also applied for automated incident detection, detecting anomalies during flights and in image processors/video sequences for data collected from the roads. Moreover, in recent years, AI has been developed to use in traffic demand prediction, weather condition prediction, and future traffic state for management and control purposes and to alleviate congestion and fast decision making during hazardous situation i.e., road accidents.

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