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Design and Development of Bird Detection and Deflection System in Aircrafts

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ABSTRACT: Involving air traffic controllers and pilots into the bird strike prevention process is considered an essential step to increase aviation and avian safety. Prior to implementing operational measures such as real-time warning systems, it is vital to evaluate their feasibility. This paper studies the efficacy of a bird strike advisory system for air traffic control. In addition to the potential safety benefit, the possible impact on airport operations is analyzed. To this end, a previously developed collision avoidance algorithm underlying the system was tested in fast-time Monte Carlo simulations involving various air traffic and bird densities to obtain representative conclusions for different operational conditions. The results demonstrate the strong safety potential of operational bird strike prevention in case of precise bird movement prediction. Unless airports operate close to their capacity limits while bird abundance is high, the induced delays remain tolerable. Prioritization of hazardous strikes involving large individuals as well as flocks of birds are expected to support operational feasibility in all conditions.

KEYWORDS- Air traffic controllers, bird strike prevention, traffic control, airplanes damage.

INTRODUCTION

Birds cause a lot of trouble in airports especially during take-off and landing of aircrafts. Incidence of the bird hitting the aircraft is called bird strike. A small bird, if gets struck inside the engine can cause serious consequences like losing the entire aircraft, passengers and its crew. It can sometimes damage the aircraft to major extent as shown in the figure below. Hence it is very important to detect any presence of birds within the range specified. If birds are detected, they have to be deflected so that they will not come into the path of the aircraft. One can use water jet as a deflector system since it is a harmless way to deflect the birds. The detection system will scan the range specified and will send a signal if any object is present within the region. Upon detection, the detector system will raise an alarm in the form of a signal. Once the signal is raised from the detector system, the location estimation system will estimate the position of the object relative to the aircraft. This is done so that the water jet can be turned on to reach the location of the object to deflect it away. This project aims to prevent the airplanes from the damages caused by the winged birds during the take-off and landing. The rate of the fledgling of winged creatures hitting on the airship is called winged creature strike. Normally the Bird strikes happen during take-off or landing, or during low altitude flight. Yet, the bird strikes have also been stated at high elevations up to 9,000 m (30,000 feet) above the ground level. According to the International Civil Aviation Organization (ICAO) report, 90% of bird collisions occur near or on airports. Often, accidents are occurring during a collision of bird (or birds) with a windscreen or a bird (or birds) is sucked into the engines of mechanical airplane. Thus, it is critical to distinguish any proximity of the flying creatures nearby the aircraft.

An attempt is made to sense the flying birds near by the airplane using IR sensors. A stream of water is sprayed and divert the birds away from the aircraft. Thereby, it reduces the accidents caused by collision of birds. It safeguards the passengers' life and propellers in the aircraft. A bird shall cause serious damages to airplane during take-off and landing. By the way of hitting the airplane or getting struck inside the motor.

II. LITERATURE SURVEY

INTEGRATED BIRD-AIRCRAFT STRIKE PREVENTION SYSTEM – IBSPS

AUTHOR— Danny Ace

YEAR— 2010

An airborne apparatus that employs an advanced computer to analyze bird and aircraft positioning data, programmed to issue a warning about an impending strike, thereby creating the ultimate Bird-Aircraft Strike Prevention System. This system will constantly process the bird positioning data gathered by the Radar/Infrared sensors. In case of a bird-aircraft strike danger the system will immediately alert the pilot as well as Air Traffic Control, and, compute the necessary course correction required to avoid the collision. The advantages of the system include the ability to prevent bird strikes and instantaneously compute an alternative course or action necessary to avoid the bird-aircraft impact. Additionally, because the IBSPS is capable of being airborne, the aircraft will be protected from bird-strikes throughout the entire flight, even in absence of ground systems.

DEVELOPMENT, ANALYSES AND VERIFICATION TESTING OF A HYBRID FIBER OPTIC SYSTEM FOR DEFLECTION AND DAMAGE DETECTION OF MORPHING WING STRUCTURES

AUTHOR—Zoran Djinovic

YEAR— 2015

Within the EC Clean Sky-Smart Fixed Wing Aircraft initiative concepts for actuating morphing wing structures are under development. In order for developing a complete integrated system including the actuation, the structure to be actuated and the closed loop control unit a hybrid deflection and damage monitoring system is required. The aim of the project "FOS3D" is to develop and validate a fiber optic sensing system based on low-coherence interferometry for simultaneous deflection and damage monitoring. The proposed system uses several distributed and multiplexed fiber optic Michelson interferometers to monitor the strain distribution over the actuated part. In addition the same sensor principle will be used to acquire and locate the acoustic emission signals originated from the onset and growth of defects like impact damages, cracks and delamination's. Within this paper the authors present the concept, analyses and verification results of the mentioned system.

DEVELOPMENT OF BIRD DETECTION AND DEFLECTION SYSTEM IN AIRCRAFT

AUTHOR— Dickson Mick

YEAR— 2016

Birds cause a lot of trouble in airports especially during take-off and landing of aircrafts. Incidence of the bird hitting the aircraft is called bird strike. A small bird, if gets struck inside the engine can cause serious consequences like losing the entire aircraft, passengers and its crew. It can sometimes damage the aircraft to major extent as shown in the figure below. Hence it is very important to detect any presence of birds within the range specified. If birds are detected, they have to be deflected so that they will not come into the path of the aircraft. One can use water jet as a deflector system since it is a harmless way to deflect the birds. The detection system will scan the range specified and will send a signal if any object is present within the region. Upon detection, the detector system will raise an alarm in the form of a signal. Once the signal is raised from the detector system, the location estimation system will estimate the position of the object relative to the aircraft. This is done so that the water jet can be turned on to reach the location of the object to deflect it away.

III. EXISTING SYSTEM

The problem of bird strikes is multifaceted and can be approached from the point of view of sustainable development, economy, law, and technology.

Non-Technological Approaches

The non-technological aspect of the presented solution could be analyzed from the perspective of bird presence near the airports, as well as the legal and financial consequences of potential bird strikes.

Increasing volumes of air traffic and the adaptation of some bird species to the living conditions in the vicinity of urban areas, which also increases their activity around airports, are the main causes of the increase in bird collisions. Birds have modified their behaviour and learned to tolerate the presence of both humans and man-made structures including air traffic and accompanying noises. Therefore, it is getting more difficult to control or limit their presence in the airport's vicinity.

The problem with the increasing bird strike rate was noted by national and international organizations including the ICAO, the World Bird strike Association (WBA), and states' aviation authorities. These organizations are responsible for sharing information and experiences, as well as for the development of the best practices regarding collision prevention. Currently, environmental monitoring of airports is regulated by the EASA and the ICAO. There are also national civil and military authorities and organizations responsible for aviation safety, like the Civil Aviation Authority in Poland or the Swedish Civil Aviation Administration (Luftfartsverket) in Sweden, who are responsible for wildlife risk management.

The data analysis performed by the ICAO and the EASA shows the critical areas where most of the accidents occur:

Ninety percent of collisions are below an altitude of 150 m;

Sixty-one percent of events are at heights of less than 30 m;

Eight percent of collisions are at an altitude above 900 m and are outside the aerodrome area;

IV. PROPOSED SYSTEM

As the survey of related works shows, there is a need for a reliable and cost-effective system mitigating the collision of avifauna with airplanes around airport runways. The biggest drawback of existing solutions, mostly based on stereovision, is their basically horizontally oriented Field of View (FoV), limiting the observation area and therefore requiring multiplied installations, which are heavy and costly.

The main objective of the paper is to determine the hardware and software structures of a stereovision based detection system for monitoring space over the airport runway to identify, localize, and classify moving objects. Such a highly reliable real-time system has to assure a wide range observation area without compromising its size and price, whilst also providing a wide range of customizability.

The proposed hardware configuration is composed of two cameras coupled in stereovision mode, wherein the first and second cameras are oriented with their optical axes of an angle α to the base line, wherein α is a substantially non-right angle. The cameras could be equally rotated to any direction to cover the selected observation area, which can be horizontal, vertical, or even oblique. The system software configuration is based on IoT technology, the distributed computing concept, and deep learning algorithms to ensure real-time operation mode.

V. CONCLUSION

Birds cause a lot of trouble in airports especially during take-off and landing of aircrafts. Incidence of the bird hitting the aircraft is called bird strike. A small bird, if gets struck inside the engine can cause serious consequences like losing the entire aircraft, passengers and its crew. It can sometimes damage the aircraft to major extent as shown in the figure below. Hence it is very important to detect any presence of birds within the range specified. If birds are detected, they have to be deflected so that they will not come into the path of the aircraft. One can use water jet as a deflector system since it is a harmless way to deflect the birds. The detection system will scan the range specified and will send a signal if any object is present within the region. Upon detection, the detector system will raise an alarm in the form of a signal. Once the signal is raised from the detector system, the location estimation system will estimate the position of the object relative to the aircraft. This is done so that the water jet can be turned on to reach the location of the object to deflect it away.

Bird strikes are always a measure accident in aviation industry. These cause measure damage to the aircraft where human life can be lost due to these accidents. This a measure threat to air safety. By using above methods these accidents can be avoided. But it is not possible to avoid all 100 percentage of bird strike. It was observed that over 800 ft altitude, strikes and damage are dominated by heavier birds, whereas at lower altitude the damages are from lighter bird but percentages of accidents are more at lower altitude, that is at time of take of landing, climbing and gliding.

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