

# Fod Detection And Fire Extinguisher

Sreelakshmi. R<sup>1</sup>, Revathy. M. Nair<sup>2</sup>, Parvathy. E. I<sup>3</sup>, Parvathy. E. I<sup>4</sup>, Prajeesh. P. A<sup>5</sup>  
<sup>1,2,3,4</sup>UG Scholar, <sup>5</sup>Assistant Professor

Department of Electronics and Communication Engineering  
AdiShankara Institute of Engineering and Technology

**Abstract**—Foreign Objects Debris (FOD) at Airports can be considered as a main cause of accidents that includes aircrafts damage, infrastructure and human lives loss. Therefore, Foreign Objects Debris (FOD) is the topmost intimidation for the security of aviation, airports, aircrafts and passengers. It is very complex to identify the Foreign Objects Debris (FOD) due to its diversification in size and volume. For the security of aviation and passengers, robust Foreign Objects Debris (FOD) identification system is needed. One of the common scenarios that are taking place in an airport is the fire sparks from the wheel when a flight arrives. In that situation it will take one to two minutes to set up the fire engine. But this time is very crucial as far the safety of so many passengers and airport workers are concerned. This project deals with setting up a fire extinguisher system in the runway track. We should also be able to control the direction of extinguisher. The temperature sensors are used for detecting the temperature of the wheels and a pump for pumping the water.

**Keywords**—Foreign Object Debris(FOD), Extinguisher

\*\*\*\*\*

## I. INTRODUCTION

Foreign object debris (FOD) has been a major cause of plane crashes at the surface of the runway [1]. The mini objects and wreckages can critically harm the aircrafts, passengers, airline employees and other infrastructure loss [1]. The Debris found on the surface of the airport runways must be reported, cleaned and eliminated rapidly for the security of machinery and human lives[2]. Currently various researches are being done for the concrete estimation of the debris[3]. There is a need of vigor and robust Foreign Object Debris (FOD) detection system that may compute the debris accurately and precisely for the protection of aircrafts and personnel [3].

An annual loss of 3 to 4 billion US dollar has been recorded due to the incompetent Foreign Object Debris (FOD) detection systems[3]. Usually Debris are very small in size therefore it is very difficult and challenging task to identify and estimate it [3]. Most of the Foreign objects are made of metals like nut and bolts having size generally 2.5 by 2.5 cm [3][4].

## II. EXISTING SYSTEM

### FOD System

Common sources of debris currently found on the runway include: parts of airport infrastructure that has deteriorated; miscellaneous items fallen off from the aircraft, such as luggage tags; and random objects, such as plastic and polyethylene materials that have landed on the runway via wind or environmental conditions. Debris can vary in size and type, from a small golf ball to a piece of aircraft as shown in Fig 1.

It is estimated that FOD on the runway results in approximately \$4 billion a year in damage costs[2]. To repair a single damaged engine can range anywhere from \$250 thousand to \$10 million, depending on the type of engine[4]. The result of FOD damaging aircraft levies heavy tolls on the

airlines that must repair their aircraft. FOD on the runway also imposes high costs to airports that make revenue from the operations run per day. In 2000 the historical Air France Concorde crash killed all 109 people on board and 4 on the ground as a result of foreign object debris on a runway[1]. Following this tragic event, airport officials worldwide have strived to improve debris detection and removal systems to avoid similar future runway occurrences.



Fig1: FOD-Razor airport runway sweeper, single mat version

### B Fire Extinguishing System

When an aircraft lands during dry conditions, huge sparks are released to Earth as soon as the aircraft touches down. These discharge sparks to Earth substantiate the potency of the charge on the aircraft. Sometimes these sparks become uncontrollable. In that situation it will take some time to set up the fire engine. The fuel tank of an aircraft is situated at its wings. So, when the spark gets uncontrollable, then there is a great probability of catching fire to the fuel tank. This situation can cause great disaster. Hence the spark must be controlled. There are no precautions for controlling spark due to friction. If fire is developed due to over sparking, fire engine used to extinguish the fire. Nowadays usually fire trucks are used in order to prevent the catching of fire from the airplane.



Fig 2: Airport Fire Truck

### III. PROPOSED SYSTEM

The main disadvantage of the current system is that, when the area of runway becomes large, it will take long time to sweep the entire runway. There are also chances for missing out a particular section due to human error. Thus, by implementing our project, we can easily detect foreign objects on the runway and we need to clear that particular area only. This method saves so much time when compared to conventional method.

The microcontroller used is Atmega32. The power supply consists of 230V step down transformer, coupling capacitors, voltage regulator, bridge rectifier and LED. The transformer converts 230V to 12V. Input coupling capacitor is used for coupling and output capacitor for removing ripples. 7805 voltage regulator converts 230V to 5V. LED is used for indication of power supply. LCD display is used for displaying different status of the circuit. Crystal oscillator is used for providing external clock. A push button mechanism is used for resetting microcontroller. The temperature sensor is used for measuring threshold value and fire sensor for detecting fire. Pump motor is connected to microcontroller through L293(driver IC). Two relay is used to controlling on-off of extinguisher system through solenoid valves. Two HC-SR04(Ultrasonic sensor) is used for object detection.

### IV. RESULTS AND DISCUSSION

FOD is a perennial problem for aviation related operations and if left unchecked could cause a disastrous accident. Through FOD prevention, training and detection systems, FOD can be identified and eliminated so that potential hazardous situations will not materialize. By using our product, there will be no need to scan the whole runway mechanically. Only the detected areas have to be cleaned. This also helps to increase the safety of aircrafts on the runway, as the fire is immediately extinguished before it spreads to adjacent parts of aircraft.

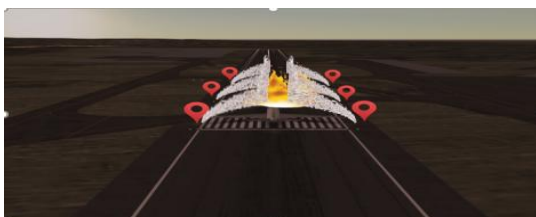


Fig 3: Proposed Fire Extinguisher System

### IV. CONCLUSION

Foreign object debris (FOD) has been a major cause of plane crashes at the surface of the runway. The main disadvantage of the current system is that, when the area of runway becomes large, it will take long time to sweep the entire runway. This project was able to set up a fire extinguisher system in the runway track. We should also be able to control the direction of extinguisher. The temperature sensors are used for detecting the temperature of the wheels and a pump for pumping the water.

### V. FUTURE EXPANSION

This project can be expanded in future by including a mechanism for controlling the direction of pumping mechanism according to the direction of movement of exploded aircraft. The efficiency of FOD detection system can be further increased by placing thermal imaging cameras and also a mechanism for picking up the debris can be incorporated along with the proposed FOD detection system.

### REFERENCES

- [1] [1] Z. Kang and T. Hong, "A new SAR imaging scheme in foreign object debris detection," 2012 5th International Congress on Image and Signal Processing, Chongqing, 2012, pp. 952-956. doi:10.1109/CISP.2012.646996
- [2] [2] Donnell, M. J., Airport Foreign Object Debris Damage (FOD) Detection Equipment, Advisory Circular of U.S. Department of Transportation, Federal Aviation Administration, 2009.
- [3] [3] E.E. Herricks, E. Woodworth, and I. Patterson Jr, "Performance assessment of a hybrid radar and electro-optical foreign object debris detection system," No. DOT/FAA/ITC-12/22, 2012.
- [4] [4] Y. Li, and G. Xiao, "Study and design on FOD detection and surveillance system for airport runway," J. Name Laser and Infrared, vol. 41, pp. 909-915, 2011.
- [5] [5] M.J. Fan, "The Study of FOD Detection on Airport Runway," Master Thesis of Beijing Jiaotong University, Beijing, China, 2011.
- [6] [6] X. Cao, G. Gong, M. Liu and J. Qi, "Foreign Object Debris Detection on Airfield Pavement Using Region Based Convolution Neural Network," 2016 International Conference on Digital Image Computing: Techniques and Applications (DICTA), Gold Coast, QLD, 2016, pp. 1-6. doi: 10.1109/DICTA.2016.7797045
- [7] [7] F. Nsengiyumva, C. Pichot, I. Aliferis, J. Lanteri, C. Migliaccio, "Millimeter-wave imaging of foreign object debris (FOD) based on two-dimensional approach", 2015 IEEE Conference on Antenna Measurements & Applications (CAMA), pp. 1-4, 2015.
- [8] [8] W. Wang, S. Liu, Y. He, Z. Chen, "A real-time target detection algorithm based on combination of intensity edge of infrared search system", MIP15-MIP301, 2015.