A Technique to Predict and Locate the Unit Load Device (ULD) during Aircraft Disaster

(Ref No: RE/2019/UCS1405/PR011)

Dr. Anthony Vincent B and Dr. Cecil Donald A
Department of Computer Science
Kristu Jayanti College (Autonomous), Bengaluru

Abstract:

Unit Load Devices (ULD) are used as containers for baggage and cargo. It holds suitable dimension aircraft which are secured so that they cannot be moved within the hold in flight. ULDs are made with Aluminium (frame) and Lexan (walls) material to safeguard the customer baggage. ULDs carried through cargos in flights like Boeing and also in any personal flights. The Objective of this project is to find out missing ULDs and predict safety measures during the flight disaster. Use of IOT devices and Airbags fixed to the ULDs brings an opportunity to establish this type of precaution measures to safeguard the ULDs before any flight disaster in land or in the ocean. Embedding IoT in ULDs allow us to identify the accurate location of the flights.

Over the years of using the technologies in ULDs, like Bluetooth enabled track-and-trace technology, Smart Business Case, Smart ULDs etc. are used the applications like ERP applications, Smart ULD manager and a tracking application for gallery carts. However, the technologies were used for tracing the containers which were lost in airports or in the cargo bays. But the proposed system speaks about the technology which never existed with not only protecting the ULDs but also significantly predicts the flight's location during the disasters and also overcomes the insurance concern of banks involved in the passenger's baggage in ULDs.

The project tries to address the measures to safeguard the ULDs and also track the location of the flights. A prediction algorithm has been formulated based on the data gathered from the Airport Authority and generated Data. The result of this project can be used to find the ULDs and also find the accurate location of the flight crash. Nevertheless, it will keep the container safe in blowing the air bags just few seconds before the crash through sensors and also keep the tracing signal of GPS/GPRS ready in identifying the ULDs connected to satellites.

Problem Definition:

The primary purpose of ULD is to improve flight safety compared to bulk loading of holds. Whilst a serviceable ULD, properly loaded, will indeed achieve this, a widespread lack of attention / awareness of ULD damage can result in risk arising from the use of containers that are not within their allowable damage limits. The still common attitude that "it doesn't matter as long as the cargo/ baggage makes the flight" and a widespread lack of adequate training for those involved in ULD operations can seriously impact on aircraft safety. Damaged and/or improperly loaded ULD present a hazard to operators, aircraft systems and structure, cargo and baggage and GSE. Used correctly ULD will remain within their safety limits for many years, requiring only minor repairs to wear and tear type damages. Incorrect handling of ULD, particularly the indiscriminate use of forklifts will result in ULD damage rendering them unserviceable for use. Failure to observe rules and a "make it up as we go along "approach to ULD operations will result in safety breaches Arrangement of right ULD dealing with framework, direction for which can be found in the IATA Air terminal Taking care of Manual.

Objective:

The main objective of the project is to **predict** the Unit Load Device (ULD) during the disaster.

Sub-Objectives:

- **Preprocess** the data for noise removal.
- **Analyze** existing techniques and identify the suitable algorithm.
- A **prediction algorithm** has been formulated based on the data gathered from the Airport Authority and generated Data.

Methods:

The data are gathered from Cargo Section, Kempegowda International Airport (KIA), Bengaluru, Anna University, Chennai and Cargo Section, Chennai International Airport, Chennai. As only minimum number of datasets from AA are received, the Google Dataset and Data Generated using UAV/Drone are added for preprocessing the data. Preprocessing is carried

in order to remove the noisy data from the dataset. Then, an analysis is carried out to compare the existing techniques and to identify the suitable algorithm. Finally, a prediction algorithm is proposed to identify the location where the ULD/object is falling during the disaster. This was tested by dropping the objects using drone and the data are fed into the algorithm to find the location of the object.

Major Findings / Results:

- Collected data from **British Airways, Air India, Lufthansa** have been **preprocessed to remove the noisy data.**
- An analysis has been done to understand the **complexity on the sizes of various ULDs.**
- In the **absence gravity**, the falling ULD continues with horizontal motion at constant velocity.
- The Free falling ULDs accelerating at **the rate of acceleration of gravity** which used as input dependent parameter for the proposed prediction algorithm.
- The **accuracy of the algorithm** is found to be **93.87%** and it is obtained by simulating the algorithm.

Publication Details:

1. Indian patent (IPR) titled **"Device to Predict the Location of Falling Object using Internet of Things"** *(Application Published and Examination Awaited)*