**1. Problem Statement**

**1.1 Historical Introduction**

Unmanned aircraft systems (UASs) have been in use for over a century and a half. A UAS system includes everything needed to fly an aircraft remotely such as the airframe, controller, user, ground station, and extra application items. The first were used by the Austrian military in 1849 to attack Venice [1]. Since then, they have been used for many tasks ranging from military missions to filming movies.

Unmanned aerial vehicles (UAVs), which are the airframes used in a UAS, are used for many tasks including filmmaking, photography, and recreational activities. The main reason that UAVs are used for these tasks is because they are an inexpensive way to get great results. Because of the low market cost of UAVs more are being bought and flown by recreational users which means that there is a much larger risk of colliding with other aircraft. There were 764 recorded incidents from November 2014 to August 2015 that involved a UAV endangering another manned aircraft [2]. Many of these near misses are because the operators were not aware of their surroundings. There has yet to be a device that allows UAVs to be able to detect nearby aircraft to help avoid potentially harmful situations.

The ability to coordinate airplanes already exists through automatic dependent surveillance–broadcast (ADS-B), which was created by the Federal Aviation Administration (FAA) for the purpose of mapping planes by setting aside frequencies for air traffic communication [3]. ADS-B will also be required on all class A aircraft in 2020 [4]. UAS Alert will allow UAV users to monitor ADS-B frequencies and will provide a warning to assist in avoiding possibly fatal incidents.

**1.2 Market and Competitive Product Analysis**

The current selection of affordable avoidance systems for UAVs is limited, with the most notable systems for consumer use being collaborative work between Uavionix and companies such as DJI. They provide the hardware necessary to implement a detect and avoid system but do not provide the entire system. Uavionix sells small, lightweight ADS-B receivers and transceivers that have a price range of $125 to $1200, and currently support integration into the Pixhawk flight controller. In collaboration with DJI, Uavionix is also currently developing an ADS-B collision avoidance developer kit for DJI products; however, this kit is not yet available and is specifically for DJI products [5]. To have their avoidance system, the consumer must incorporate the supported flight controllers in addition to the ADS-B equipment sold by Uavionix. This would require that the consumer replace their own flight controller and spend $100 to $130 dollars on the supported device. The alternative to this would be to buy a supported drone from DJI. The cheapest of these would currently be the DJI Phantom 3 which sells for $499, which doesn’t include the avoidance equipment from Uavionix.

UAS Alert will be attachable to any UAV that is capable of carrying it, and will not need to be connected directly to the UAS flight controller. Since the system is not dependent on being able to interface with a particular flight controller, it will be applicable to a wider range of consumers. The aviation community would benefit from a system like this, as an ADS-B system that is able to be equipped to a variety of UAVs would increase availability and help to provide a safer environment for other aircraft pilots. The anticipated selling price is system is approximately $250.

**1.3 Concise Problem Statement**

As mentioned above, recent data from the FAA concerning mid-air collisions shows the future landscape for UAVs and safe airspace is still being imagined. Our product offers a percentage of the solution to minimizing these situations, also creating a platform to connect with other FAA efforts in making safety a priority for human-operated aircraft. Without knowledge of FAA regulations among UAV pilots and the only warning for nearby aircraft being line-of-sight, lack of awareness becomes a dangerous issue.

UAS Alert, at its core, is awareness technology. The basic function of the UAS Alert is to give UAS pilots the best possible view of any near ADS-B OUT equipped system. UAS Alert will give a visual representation of nearby aircraft, displayed on the ground station on a user-friendly interface. Any aircraft considered to be close enough to compromise the safety of the aircraft will trigger an alert to be displayed on the ground station interface.

**1.4 Implications of Success**

Upon successful implementation and marketing of UAS Alert, users will become more aware of their surroundings. This awareness should decrease the frequency of UAV intrusion into the immediate vicinity of aircraft and increase the safety of all aircraft, manned and unmanned, that may share the same airspace. In the long term, the UAS could potentially save large sums of money and lives due to mid-air collisions caused by uneducated or unaware UAV pilots.

The use of a plug and play device coupled with a custom pc-based software installation will enable UAS Alert to have a low-cost benefit as compared to competitors. Due to this reduction in cost, UAS Alert will become a competitor in the UAV position tracking and collision avoidance markets.

There are other benefits that will also strengthen the marketability of the UAS Alert system. The appropriate use of clear advisories, audibly and visually represented, will open the system up for use in a wider market segment. Since the advisories will be presented in both of these mediums, deaf UAV pilots will be able to successfully implement the UAS Alert system into their flight sessions.

**References**

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