X-Plane TCAS Plugin Development

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Abstract

Aircraft flight has been made accessible to the general public through the use of computer run applications called flight simulators. Flight simulation software artificially recreates an aircraft's controls and readouts, as well as the entire environment in which it flies to give the user the most realistic experience possible. These applications can be use for leisure and recreational purposes, as well as pilot flight training and the design and development of aircraft.

In the background, these flight simulation programs use many algorithms and large arrays of constantly changing data points to accurately provide the user's instruments with up-to-date readings and gauge visuals.

Since there is so much data available, there are more instruments that can be created to use that data in ways built-in instruments have not. That is the purpose of this project: To create a plugin for the X-Plane flight simulator that can take some of that data, and through algorithm development and visual design, track potential collisions with other aircraft, and display that information to a Traffic Collision Avoidance System(TCAS) gauge that the operator can see.

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1.0 Plugins Overview

A plugin is a modular component of software that is created to add or improve a feature of an existing computer application. Plugins are often developed by users of the application for distribution to the broader community, and often are open-source and not-for-profit.

When an application supports plugin integration, it enables the user to customize their experience or enable desired functions not included in the core product. Common examples of plugins include Adobe Flash Player and Java for browsers, which provide extra media support beyond the base browser's code. X-Plane supports plugin development on this level, and there is a large user community that has been actively producing plugins for the application for some time now.

2.0 TCAS Overview

A traffic collision avoidance system (TCAS) is an aircraft system designed to prevent the collision of aircraft in flight, and to function independently of the ground-based air traffic control system. The TCAS monitors the airspace around the aircraft for other aircraft equipped with a corresponding active transponder, independent of air traffic control, and warns pilots of the presence of other transponder-equipped aircraft which may present a threat of mid-air collision.

There are two versions of TCAS, TCAS I and TCAS II. TCAS I's main focus is providing traffic advisories to assist the pilot in the visual identification of possible threats.

TCAS II provides the same traffic advisories as TCAS I, and has the additional function of supplying the pilot with resolution advisories as well. These resolution advisories are recommended courses of action or escape maneuvers in the vertical dimension to either increase or maintain the existing vertical separation between the aircraft to avoid a collision.

In aircraft that use mechanical instrumentation, the TCAS display may be integrated into the Vertical Speed Indicator (which indicates the rate with which the aircraft is descending or climbing).

3.0 TCAS Plugin Development

We began the development of out TCAS plugin by looking over existing Federal Aviation Administration documentation on the system. This provided an outline of the basic components that composed a TCAS, and a sample of gauge and indicator standards on which to base our graphical representation of the data. We then proceeded to identify any existing attempts or implementations of this system with regards to X-Plane, and found there was ample room and need for our plugin to be developed.

We then moved on to familiarization with X-Plane development tools including the plugin Software Development Kit(SDK) which would provide the libraries necessary to write code that would interact with the X-Plane application. The SDK is written using C and C++, so Microsoft Visual Studio was chosen for Windows based development. This allowed us to write and share code more effectively, and control library linkage and 3rd party library inclusion.

For software version control we selected Git and its complementary site github.com for our plugin during development and in the future. This allowed our team to remain up to date on all code changes and documentation creation.

The first portion of the module developed was the functional “hello world” plugin that would test interaction with the X-Plane application. After successfully creating and writing this we moved on to enhancing that plugin with the ability to read aircraft and TCAS relevant data generated by X-Plane during simulation. This is the data we would need to feed into our algorithms in order to display the correct information to our system.

After the data was successfully being passed and tested we worked on networking to instances of X-Plane on different machines in order to transmit the relevant data between aircraft, simulating a transponder.

4.0 Figures

Fig [1]: Example Vertical Speed Indicator TCAS Gauge

5.0 Conclusion

Development of this TCAS plugin for the X-Plane flight simulator application served as an introduction not only to plugin development, but to developing a product for a community larger than a small class-based team, and provided a chance to work with new tools and libraries. Through additional enhancements the plugin will mature to the point where it can be used cross-platform, and with minimal README time needed.

References

Fig [1] : http://www.dbsim.com/Tcas/dbs.tcas.htm

FAA TCAS II Documentation : http://www.faa.gov/documentLibrary/media/Advisory_Circular/TCAS%20II%20V7.1%20Intro%20booklet.pdf