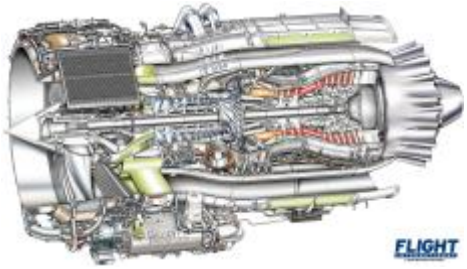
CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: Wireless engine downloader – Bluetooth prototype	
Sponsor Information: Honeywell	Harlan Mitchell, Systems Technical Manager HTF7K Controls Systems Integration https://aerospace.honeywell.com/en/products/engines/htf7000-turbofan-engine https://en.wikipedia.org/wiki/Honeywell_HTF7000 https://youtu.be/E8RlNXnyIgE Honeywell Harlan.mitchell@honeywell.com 602-206-7223

Project Overview:

Honeywell is known for small to mid-sized engines including auxiliary power units (APUs), propulsion engines, and turbo-chargers (note: vehicle turbo-chargers are similar in some ways to gas turbine engines). Honeywell is the largest producer of gas turbine APUs found on many leading aircraft with more than 100,000 APUs produced and more than 36,000 in service today. Within the propulsion engines group Honeywell has applications on helicopters, business jets, turbo props, military jets, and even the US Army Abrams Tank.



Within the Honeywell engines enterprise, our group, the Controls Systems Integration (CSI) group, is responsible for all aspects of engine control including the ECU (Engine Control Unit). In addition to the ECU itself the control system is comprised of temperature/pressure sensors, valves, the fuel pump, and other hardware components. The largest current project we are working on is the re-application of the HTF7000 engine on the new Cessna Citation Longitude business jet which was just certified on August 25th 2017. The Cessna Citation Longitude site is: http://cessna.txtav.com/citation/longitude

The ECU saves trending and maintenance data in non-volatile memory (NVM) during normal operation. This data is then downloaded by maintenance personnel either on a routine or as needed basis. The current method for doing the engine download is to connect a laptop to the aircraft engine maintenance port (usually in the cabin) using a 4 port RS-422 USB device and a cable. The user then uses software called EEI (Electronic Engine Interface) to do the download and review the data. See the video's below for more information.

HTF7000 EEI Download - https://youtu.be/LOjHXjF-JDE

HTF7000 EEI Data Review - https://youtu.be/ff5dytZUSQc

In 2018, Honeywell will begin a project to allow engine downloads on mobile devices. The software that communicates to the ECU and does the download will be hosted on a small embedded computer located on the aircraft. If the user wants to manually initiate an engine download they will use a mobile device to command the embedded computer to do a download. This command will be sent via Bluetooth and the resulting download file will be transferred back to the mobile devise also via Bluetooth. The software on the mobile device (similar to EEI but needs a new name) will be used in the same way EEI is used to review data.

The primary functions of EEI are to:

- Download engine data from the 4 ECU's.
- Review engine and fault data.
- There are other functions that are not frequently used that are out of scope.

A typical EEI usage scenario is shown in the video's above.

While the current EEI and wired engine download meet our needs, a more modern method for this functionality is needed. As an example our newest customer, Cessna, is marketing its aircraft as completely wireless forcing Honeywell to mature our toolset.

The aim of this project is to prototype a modern mobile GUI and Bluetooth architecture for use in the new "EEI" tool to serve as proof-of-concept and starting point for upcoming development of our new engine downloader. The results of this project will directly impact the development of a tool that will be used in aircraft worldwide for years to come.

The primary objective of the project is to demonstrate the GUI and Bluetooth interface. The project team will be expected to develop a Linux based software module, running on a laptop, that will receive the Bluetooth commands and send back simulated engine data. The project team working with Honeywell will generate a dataset that will be used in testing, real engine data will not be used on the project. While many improvements and extended functionality could be included in the project the primary objective is to focus on the "EEI" GUI and Bluetooth connectivity. Detailed specifications for the tool will be provided by the sponsor, as well as being developed during requirements acquisition.

Knowledge, skills, and expertise required for this project:

As with all projects, the team will be expected to learn the knowledge and skills required for this project early on. Beyond standard senior-level capabilities in programming and software design, helpful skills will include:

- Familiarity in iOS and/or Android app development. The exact platform will be chosen in negotiation with the chosen project team.
- Basic familiarity with Bluetooth operation and development.
- Skills in interface design, testing and refinement.

Equipment Requirements:

No special equipment should be required beyond a standard development platform (your laptop), as well as freely available environments and software tools.

Software and other Deliverables:

1. Software implementing the functionalities outlined above.
2. Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.
3. A strong as-built document that details the design and implementation of the software. This must be robust enough to allow a future development team to easily pick up where you left off.