Wireless Engine Downloader - Bluetooth Prototype

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What nobody wants to see

Why care?

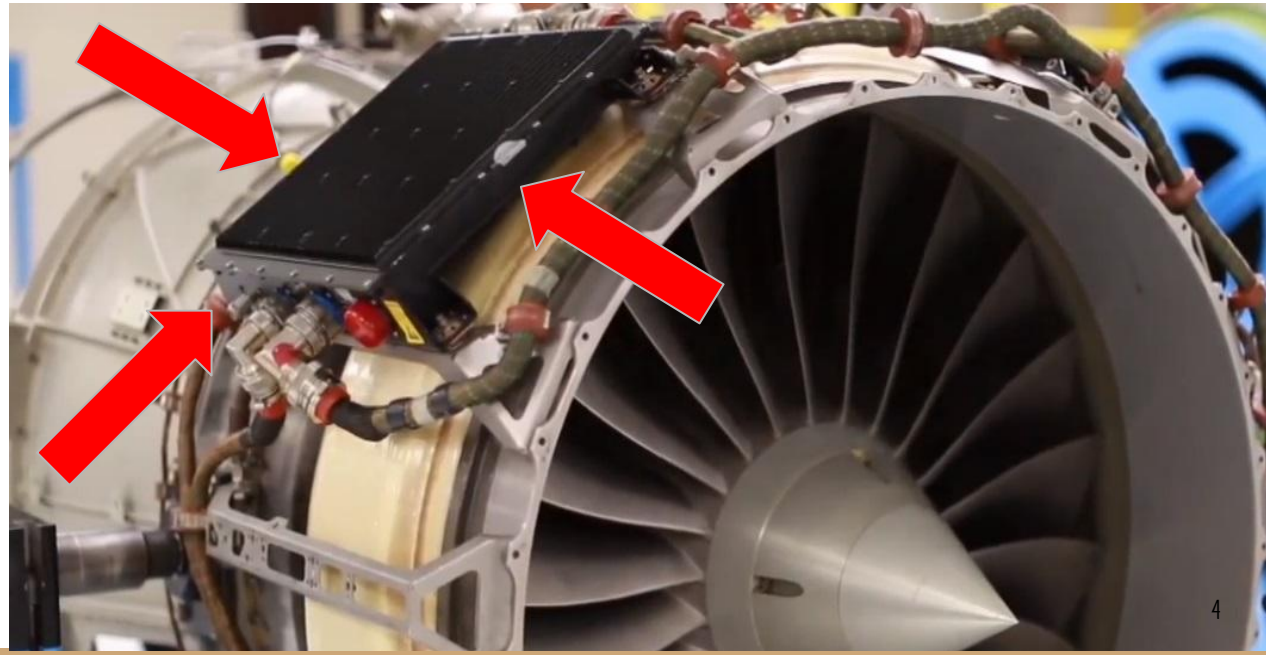
- In 2016 - there were 8,185,533 flights in the U.S.
- 65 had accidents 10 of which had fatalities because of them

2016 Safety Performance

	2016	2015	5 YEAR AVERAGE (2011-2015)
Fatalities*	268	136	371
Total Accidents	65	68	81
Fatal Accidents	10	4	13.4

Preventing Engine Failure

- Gathering data after every flight
- Collecting and analyzing data from many different flights
- Data is stored on an onboard computer called the engine control unit or ECU

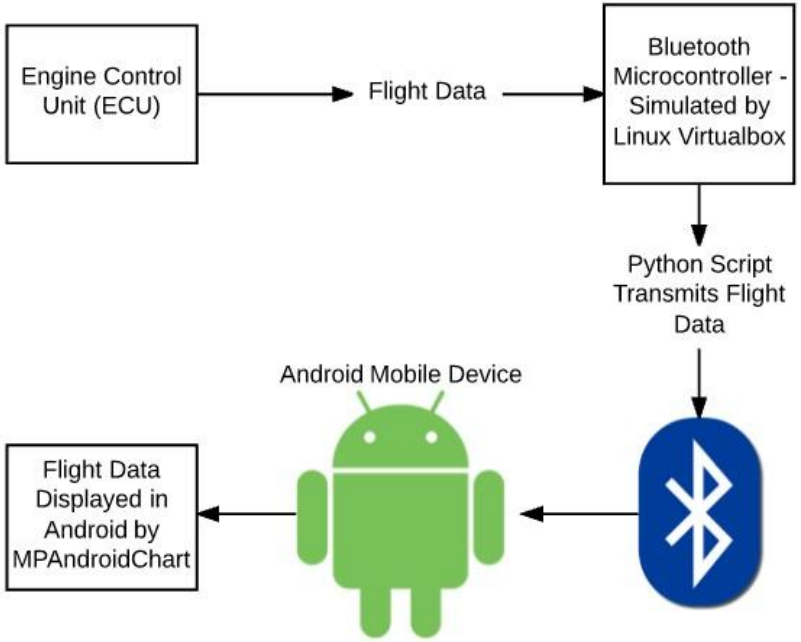


Current Problem

- Data must be downloaded manually through bulky and slow cables
- Cables must be carried into the plane and manually connected
- Download speed is very slow and currently this whole process takes around 30 minutes to get the data off the plane
- Electronic engine interface (EEI) is old and only runs on Windows XP
- All this makes for data that is collected rarely


Solution Overview

- Bluetooth connection to the ECU is paramount
- The functions of the ECU will be simulated with *Linux Virtualbox* for testing purposes
- *Android* will be our mobile platform of choice
- Flight data will be displayed using *MPAndroid Chart*

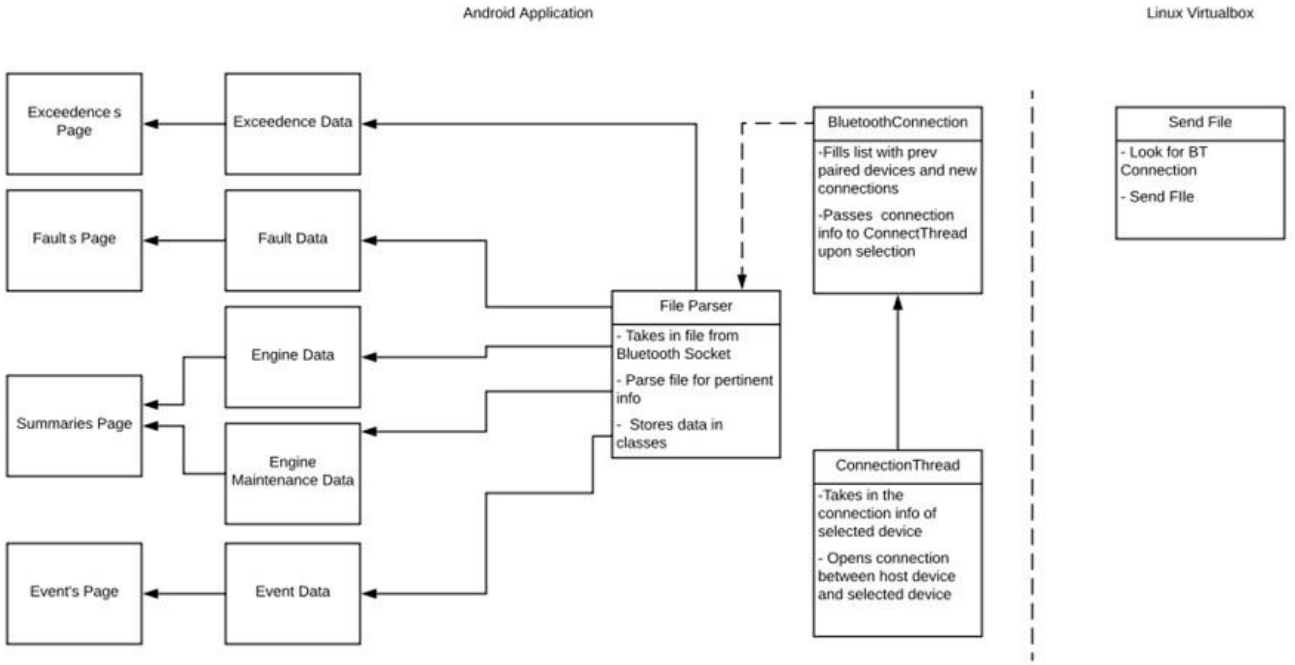


Key Requirements

- Engine download application connects to the ECU via Bluetooth and downloads engine data
  - Obtains Bluetooth socket
    - Connects to Bluetooth socket
  - Receives input stream
    - Reads from input stream
    - Data stored on device
  - Closes input stream and Bluetooth socket
- Engine data can be downloaded anytime or place the plane has landed, with only a smartphone running the engine download application
- Application should allow for review of engine data, with functionality similar to EEI

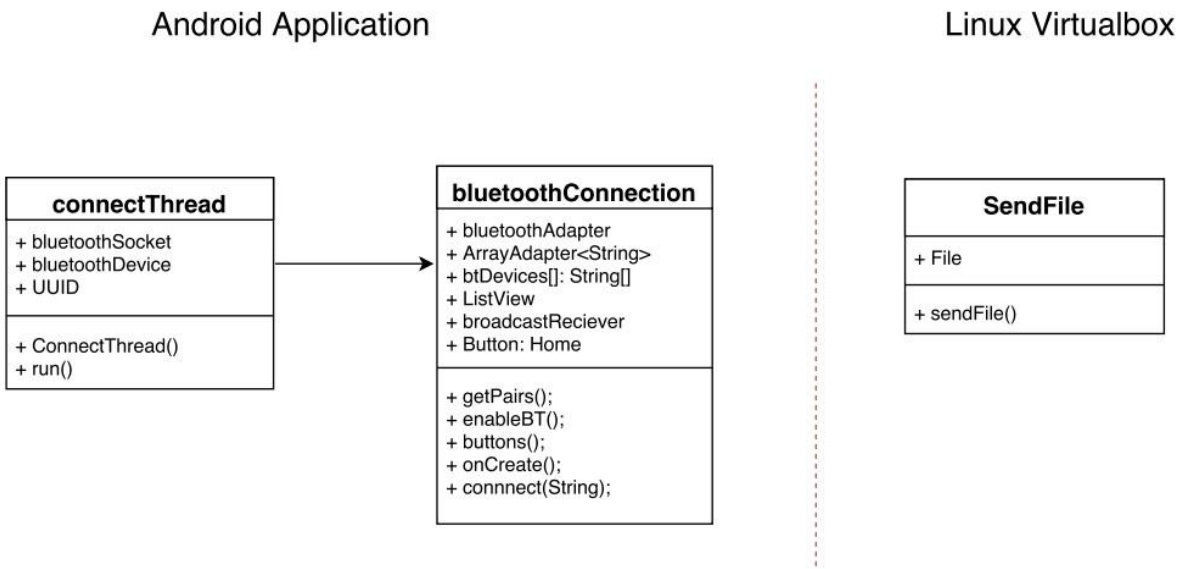
Architecture Overview

- Model-View-Presenter:
  - Model: Download file
  - View: GUI - Charts and Tables
  - Presenter: File parser



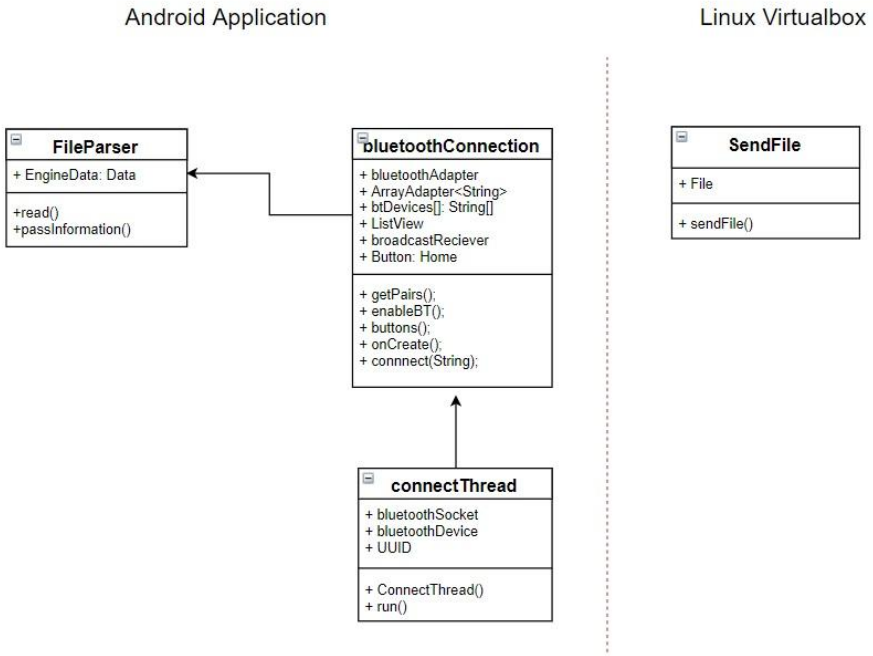
Implementation Overview - Bluetooth Handler

- Bluetooth Handler
  - Opens Bluetooth sockets
  - Writes data to file
  - Closes socket



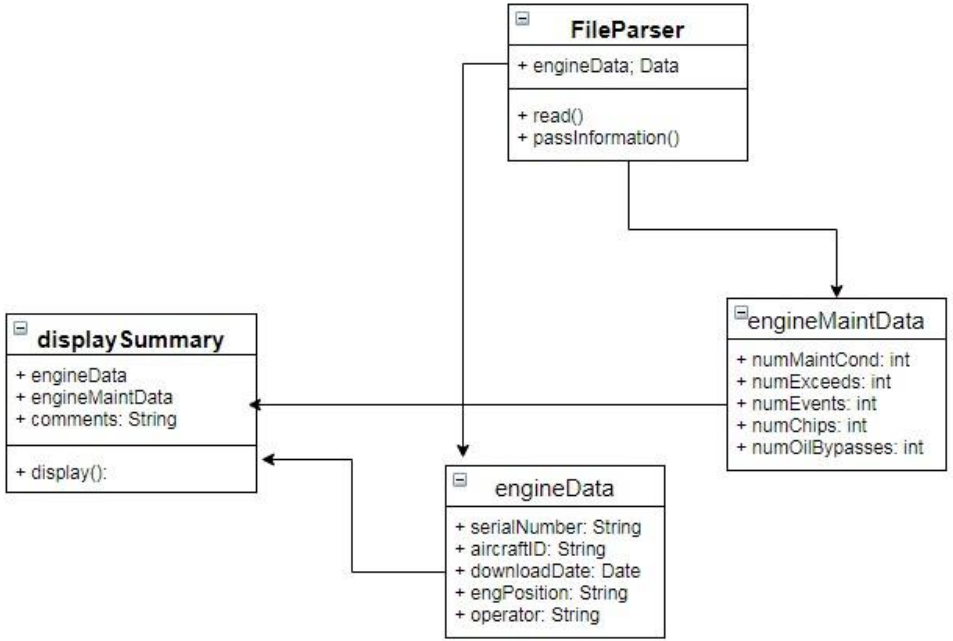
Implementation Overview - File Parser

- File Parser
  - Opens YAML file stored by the Bluetooth module
  - SnakeYAML is used to parse the data
  - Parsed data directly populates an object of DownloadData class



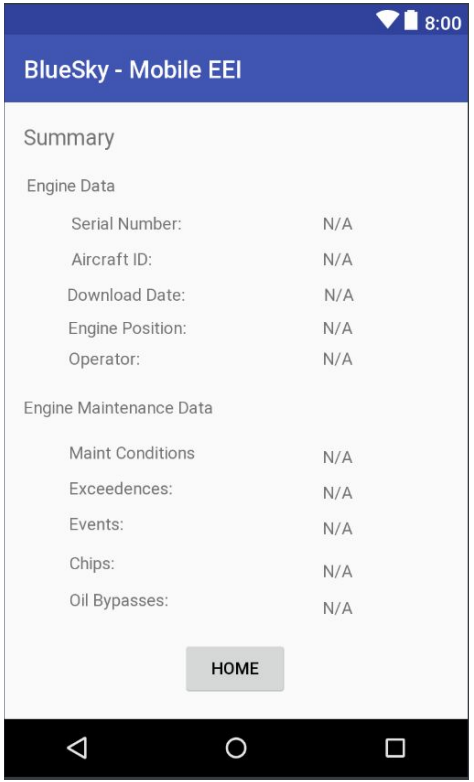
Implementation Overview - Individual Pages

- Individual Pages
  - Retrieves necessary data from DownloadData class
  - Displays this data
  - Some pages use MPAndroidChart to display data



Implementation Overview - GUI

- GUI
  - Data is displayed in a format easy for user to read
  - User is able to navigate through easily and find necessary information



Challenges/Resolutions

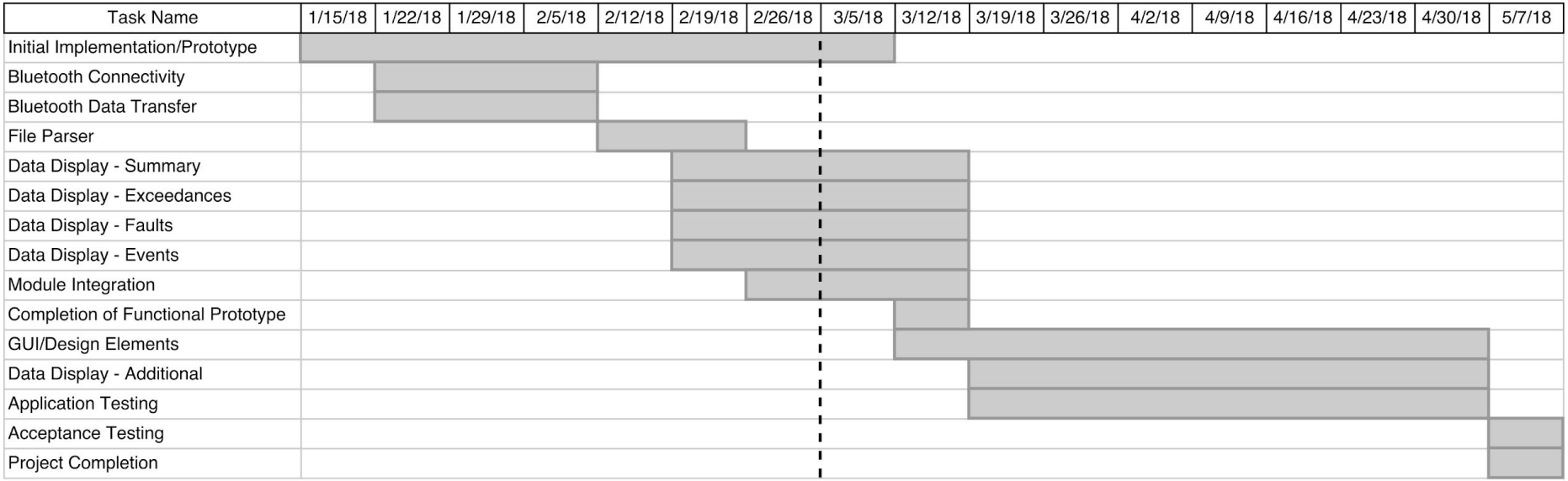
Challenges

- Debugging Bluetooth
- File Parser

Resolutions

- Append the devices MAC address to their name in the display for ease of access
- Use SnakeYAML to make the parsing of files less complicated.

Schedule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1/29/18
2/5/18
2/12/18
2/19/18
2/26/18
3/5/18
3/12/18
3/19/18
3/26/18
4/2/18
4/9/18
4/16/18
4/23/18
4/30/18
5/7/18
Initial Implementation/Prototype
Bluetooth Connectivity
Bluetooth Data Transfer
File Parser
Data Display - Summary
Data Display - Exceedances
Data Display - Faults
Data Display - Events
Module Integration
Completion of Functional Prototype
GUI/Design Elements
Data Display - Additional
Application Testing
Acceptance Testing
Project Completion

Conclusion

- Current Problem
  - Problems in aircraft engines can be fatal.
  - Our client builds and maintains aircraft engines.
  - Current method of extracting data off of the engine is cumbersome and slow
  - Engine data is not collected often enough
- Solution Overview
  - Build an application that downloads the engine data over Bluetooth.
  - The application should then display the data so that the technician can review it.

VS