BACKGROUND

Textron Aviation (TAI) is working in cooperation with the MA 490 class at Embry-Riddle Aeronautical University to create a widget that can monitor the health of the two Lithium-Ion Main Ship Batteries installed on their Cessna Model 700. The Model 700 is a super-midsize jet that is recognized for the longest maintenance intervals in its class. The two Lithium-Ion batteries located on the left and right of the aircraft is key to the safe operation and operational availability of the aircraft. The battery is used for Auxiliary Power Unit starting, limited ground power use, and emergency power reserve in flight. This aircraft also is included with the TAI LinxUs software that displays the diagnostics of the aircraft. The aircraft is connected to the application and diagnostics are displayed live to the user when the aircraft is on. This software can be viewed through an app or a web page which enhances their customer's aircraft information viewing experience.

DATA

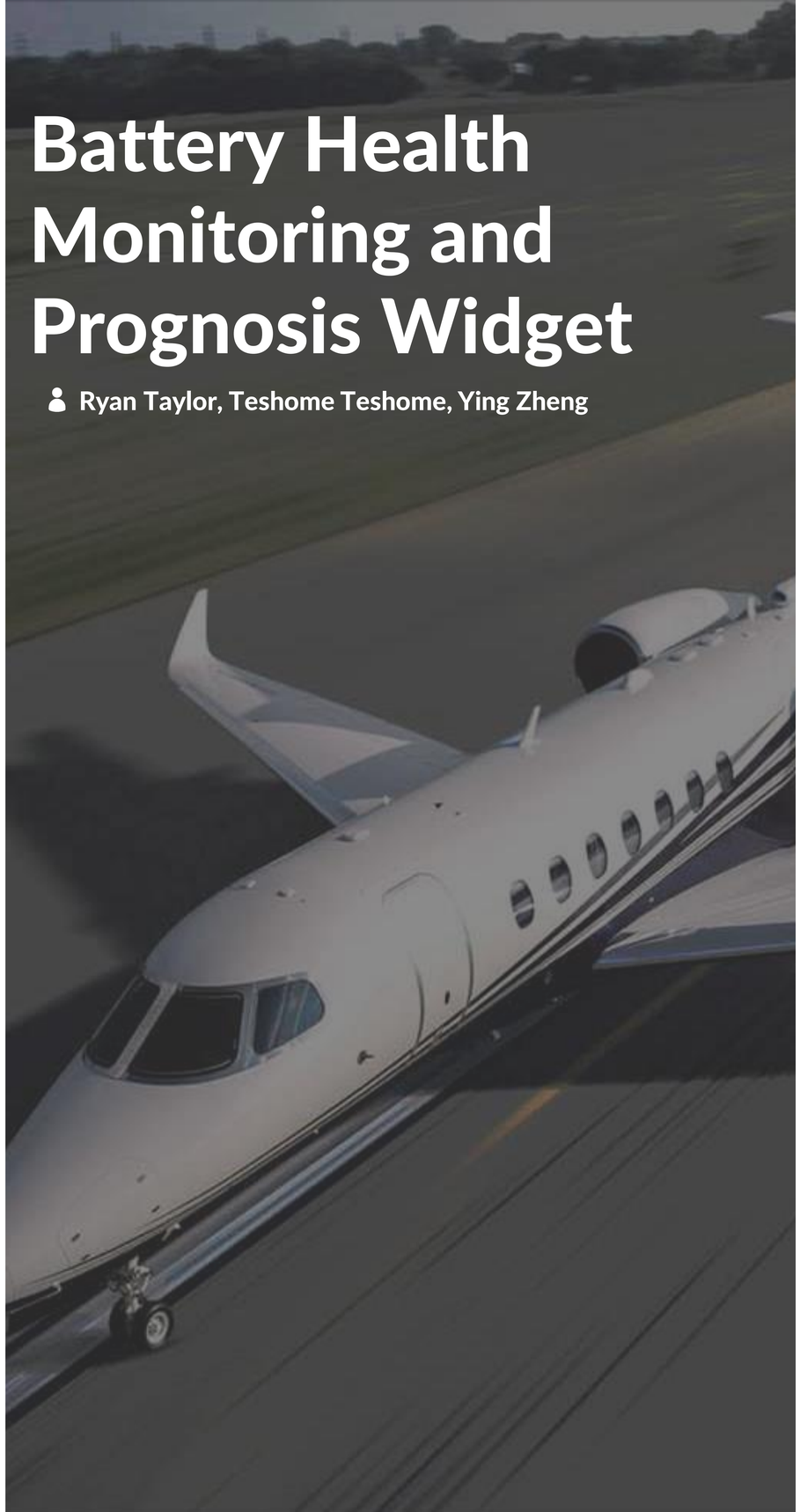
The data for this project is obtained directly from the Model 700 batteries through a recorder called AReS II. AReS uploads the battery data in real-time to a TAI repository. TAI provided 60 CSV files of battery data for a single unique flight among 3 different model 700 aircrafts. AReSView software and its flight data were also provided as supplement to the CSV files as visualization for the flights. The data contains 167 features that need to be processed to determine importance. These features are battery parameters that assist in determining state of health and risk of faults.

STRATEGY

In order to create a widget that can predict the battery health, a model needs to be built that trains from existing data. The chosen machine learning models used are Long Short –Term Memory (LSTM) and Support Vector Machine (SVM) models. LSTM is a sequential model that keeps track of long-term dependencies through backpropagation. The SVM model creates a hyperplane using the data given and will use the hyperplane for regression. The model will then be implemented into PowerBI to allow users to see charts of the battery health and any potential faults.

Battery Health Monitoring and Prognosis Widget

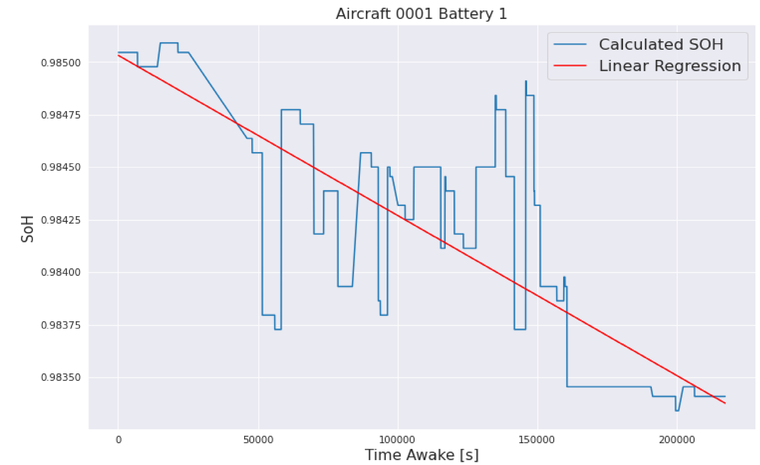
Ryan Taylor, Teshome Teshome, Ying Zheng

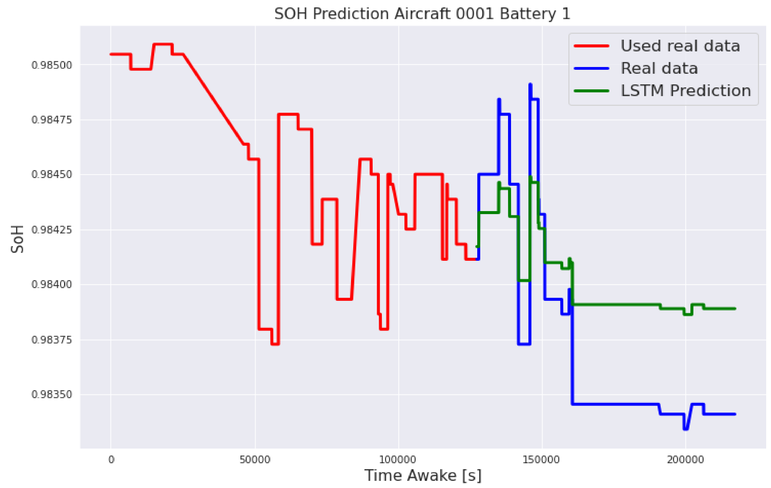


TAKE AWAYS

Using LSTM machine learning, a training set made from half of the data from a battery was used to produce a model that could predict the battery SOH for the remainder of the data. The resultant prediction was calculated to have a root mean square error of .00040 and a mean absolute error of 0.00037 when compared to the training data.

Implementation of these model allows for forecasting the need for maintenance such as a replacement of the battery well in advance of the actual problem, allowing for more flexibility in scheduling maintenance. Additionally, the summary of many variables related to battery health given by the SVM model provides a more complete summary of battery health than the estimation obtained using capacity or impedance alone.





Cessna Beechcraft BY TEXTRON AVIATION

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY