ELECOMP CAPSTONE
VIRTUAL SUMMIT
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THE UNIVERSITY OF RHODE ISLAND

THINK BIG WE DO™

TouchPoint Companions

Modeling Digital Twins

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IGT

Project Motivation

TouchPoint terminals are lottery-based devices that process online wagers. These devices range from point of sales devices to self-service devices. These devices typically stay deployed in the field for many years and need to be serviced in order to keep them running for the duration of a contract. The motivation behind this project is to create a functional digital twin of a TouchPoint terminal device. This will allow IGT to collect live telemetry from the physical TouchPoint terminal devices in the field and have the ability to proactively fix devices that exhibit slight abnormalities in the data before they stop functioning completely. Devices that are down cost IGT not only in missed ticket sales but also in having to pay the contractee out for the time the device was down. Being able to predict when a device will fail and fixing it before it does will result in major savings.

Key Accomplishments

Design and Build of Interface Box
We put together what we as a team are referring to as an “interface box” which will house the majority of the sensor components used for collecting telemetry off of the terminal, as well as the Arduino microcontroller for handling all of the data. The interface box also contains a standard NEMA wall-plug power connector that can be used to plug in the terminal itself.

Improve Vibration Sensing Performance
At the conclusion of the fall semester (post-symposium) it was decided that the current way we were measuring vibrations on the device would be inadequate for the kind of data we were looking to collect. Due to its size, and possible mounting positions, the previous sensor was not able to collect significant data on the amplitude of the vibrations when the terminal was running. It was replaced with sensors that can mount flat on the gearbox of the terminal which allows us to get the most accurate reading possible of the vibrations in the terminal.

Connected the MQTT broker on the terminal to the broker on AWS
The local MQTT broker on the terminal was originally being used to collect all the telemetry on the terminal. To create a digital twin, we needed to find a way to bridge the connection from the local broker to the MQTT broker on the AWS side. After this was completed, any data that was getting posted locally is now not only inside the local MQTT broker but is also forwarded to the broker on the AWS side for the digital twin.

Proof of Concept
At inception, the base assumption for this project was that the play-slip reader would draw more current when its rollers were clean versus when they were dirty. For the first semester we simulated this by using multiple play slips to mimic more resistance in the reader. While this was a simple solution it was not ideal. For this semester, we obtained a second play-slip reader in which dirty rollers were installed. After testing both the clean and dirty readers with identical play slips we found that our initial hypothesis was indeed proven true and the dirty reader did draw more current. See figure 2 for more details.

High Level Document
For this project, we put together a high-level document. One thing IGT wants to do is build upon our progress. The document is sufficient enough to transfer knowledge of everything one needs to know about the project to keep working on it. It contains information of everyone associated with the project, risks, constraints, every piece of hardware used, software documentation, etc.

Schematics
Along the entirety of the project, we have had to make schematics. Just like how we made progress and changes to the project, we also had to make changes to these schematics. These schematics make it easier to see what you need to do and following them ensures you do not make mistakes. We made tons of schematics and flow charts for both the hardware and software sides. The hardware ones to help us wire all the sensors together and the software ones so that we knew how everything needed to flow. One very important schematic was the wiring of the whole project. This goes back to how documentation and schematics are important because this diagram was so detailed that someone outside of the project was able to help and make connectors for us. All he had to do was follow the diagram and he knew exactly what we needed.

Anticipated Best Outcome

The Anticipated Best Outcome is a functional prototype of a digital twin TouchPoint device by the completion of the ELECOMP Capstone program in May 2020. The prototype device will make use of the telemetry that is currently collected from the TouchPoint terminals and additional sensors to show a true representation of a digital twin.

Ideally the digital twin will be able to interface with a predictive maintenance engine. The predictive maintenance engine will then be able to use the gathered telemetry to anticipate a failure and solve the problems outlined in the Project Motivation.

Project Outcome

The Anticipated Best Outcome was not achieved.

The device is very near completion for a future team to work on.

Figures

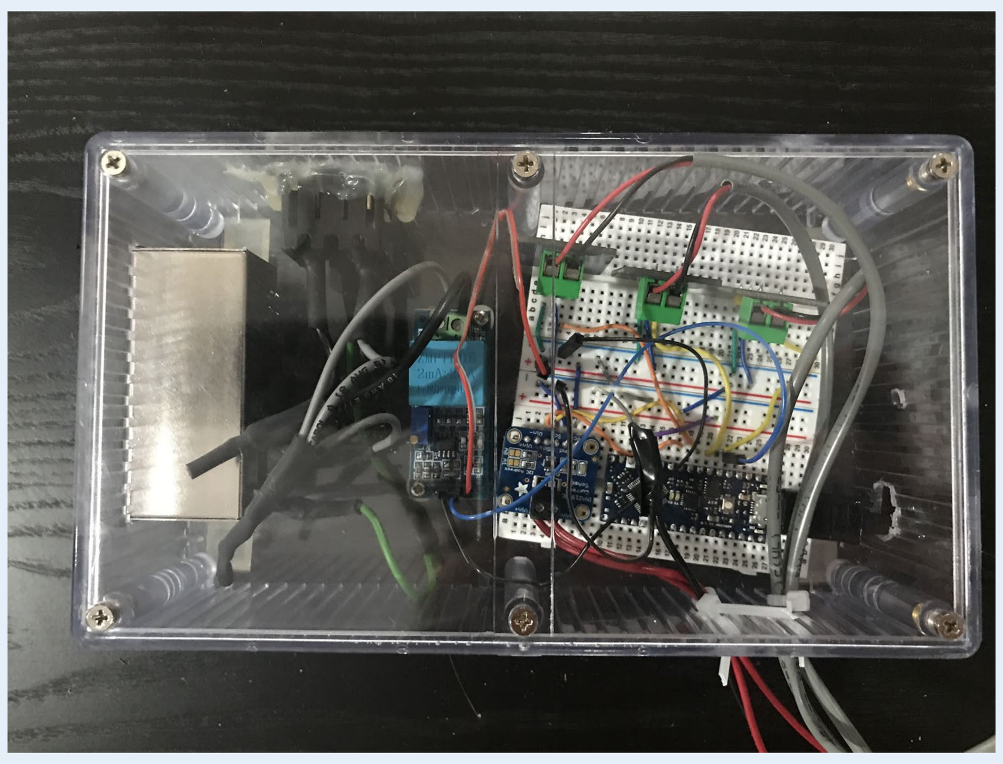

Fig 1: Image of interface box with internal components.

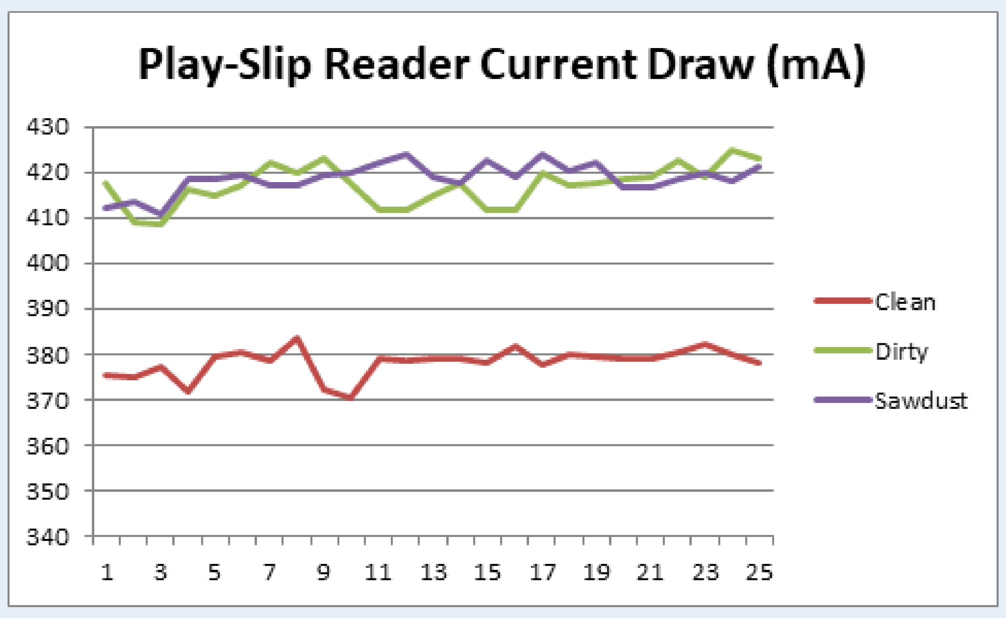

Fig 2: Current draw of play-slip reader when clean, dirty, and dirtied with sawdust.

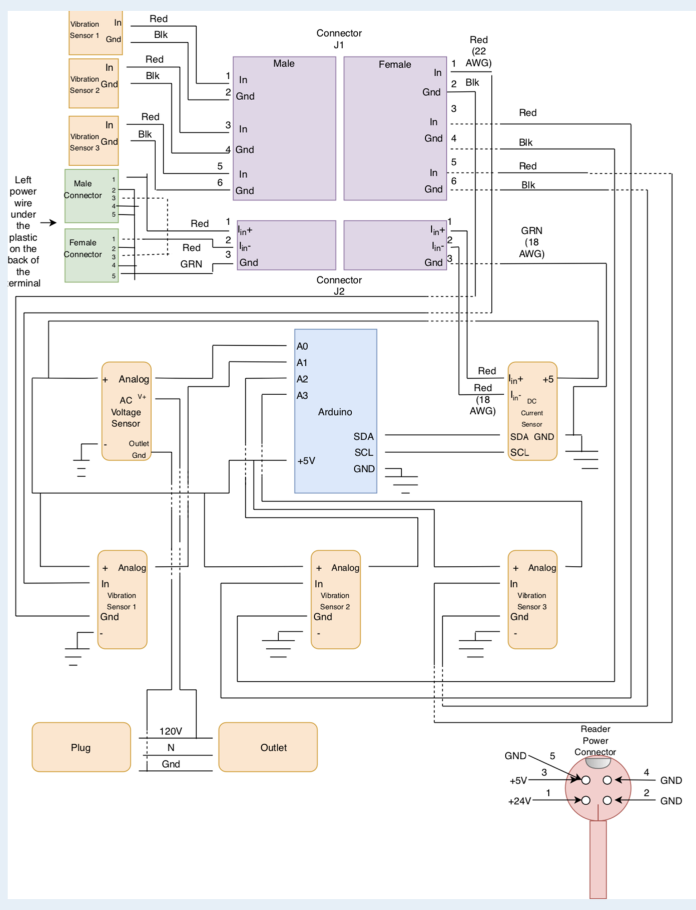

Fig 3: Schematic/wiring diagram of all components used to collect telemetry.

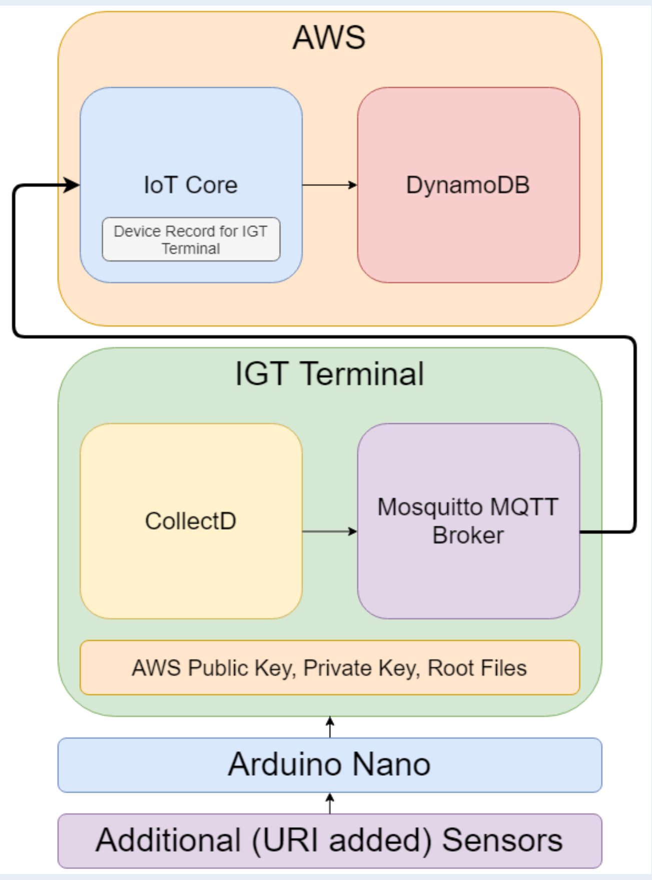

Figure 4: Depicts flow of data when it is collected by the sensors to the point it reaches Amazon Web Services.