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Latest Generation Data Portal for the Intelligent Mobility Meter

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FINAL RESEARCH REPORT

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Latest Generation Data Portal for the Intelligent Mobility Meter

Prepared by: Bernardo Pires

1. Introduction

The Intelligent Mobility Meter (IMM) is a portable data acquisition and analysis platform for the collection of fine-grained statistics on pedestrian, cyclist and vehicular traffic. The IMM has grown out of three UTC-sponsored projects (“Automatic Counting of Pedestrians and Cyclists”, “Measuring Pedestrian Wait-Time at Intersections”, and “The Intelligent Mobility Meter – Portable Fine-Grained Data Collection and Analysis of Pedestrian, Cyclist, and Motor Vehicle Traffic”) to create automatic and human-assisted tools for counting and analyzing car, bike, and pedestrian traffic.

1.1. Project Objectives

The objective of this project was to create a modern website and data portal for potential partner organizations to submit data for the IMM project to analyze. Through this website, the potential partners would be able to 1) get more information about the capabilities of the IMM; 2) submit data for analysis; and 3) download results of said analysis.

Many organizations already possess video data recording equipment, as well as the capabilities to use it to collect video of relevant areas, but are looking for cost-effective ways to analyze the collected videos. Outside of the traditional traffic studies, counting and data processing can be the major roadblock for organizations such as non-profits to get analytics about the mobility issues they are facing. Although the IMM project would like to support these organizations, because these possible partners are often not local to the Pittsburgh area, transferring and organizing their data, as well as effectively communicating results, is the primary bottleneck for a successful partnership.

1.2. Capabilities

To increase number of possible partnerships with organizations outside the local Pittsburgh area, we developed a modern web portal where entities can:

1. Upload their video data, organized by projects and data-collection sessions.
2. Add notes to their data so as to inform the IMM team on the relevant statistics to compile, as well as any out-of-the-ordinary situations that need special handling.
3. Receive messages from the IMM team and review the status of the data analysis.
4. Download the analysis results.

1.2. About this Report

The remaining sections of this report are organized as follows: Section 2 details the public facing website of the IMM project. Section 3 details the information flow of after a user logs in to the website, including upload and download flows. Section 4 discusses briefly the technologies used. Section 5 concludes this report.

2. IMM Public-Facing Website

Below is a screen capture of the IMM website as of the writing of this report. This is a public-facing website hosted under the Carnegie Mellon University's main cmu.edu domain. The website is located at the address: <http://www.andrew.cmu.edu/~bpires/imm>. As discussed above, the primary objective of the website is to provide information to the public about the project and the capabilities offered as well as to allow for any potential partners to get in touch with the project members.

FIGURE 1. The IMM Public Facing Website (1 of 4)

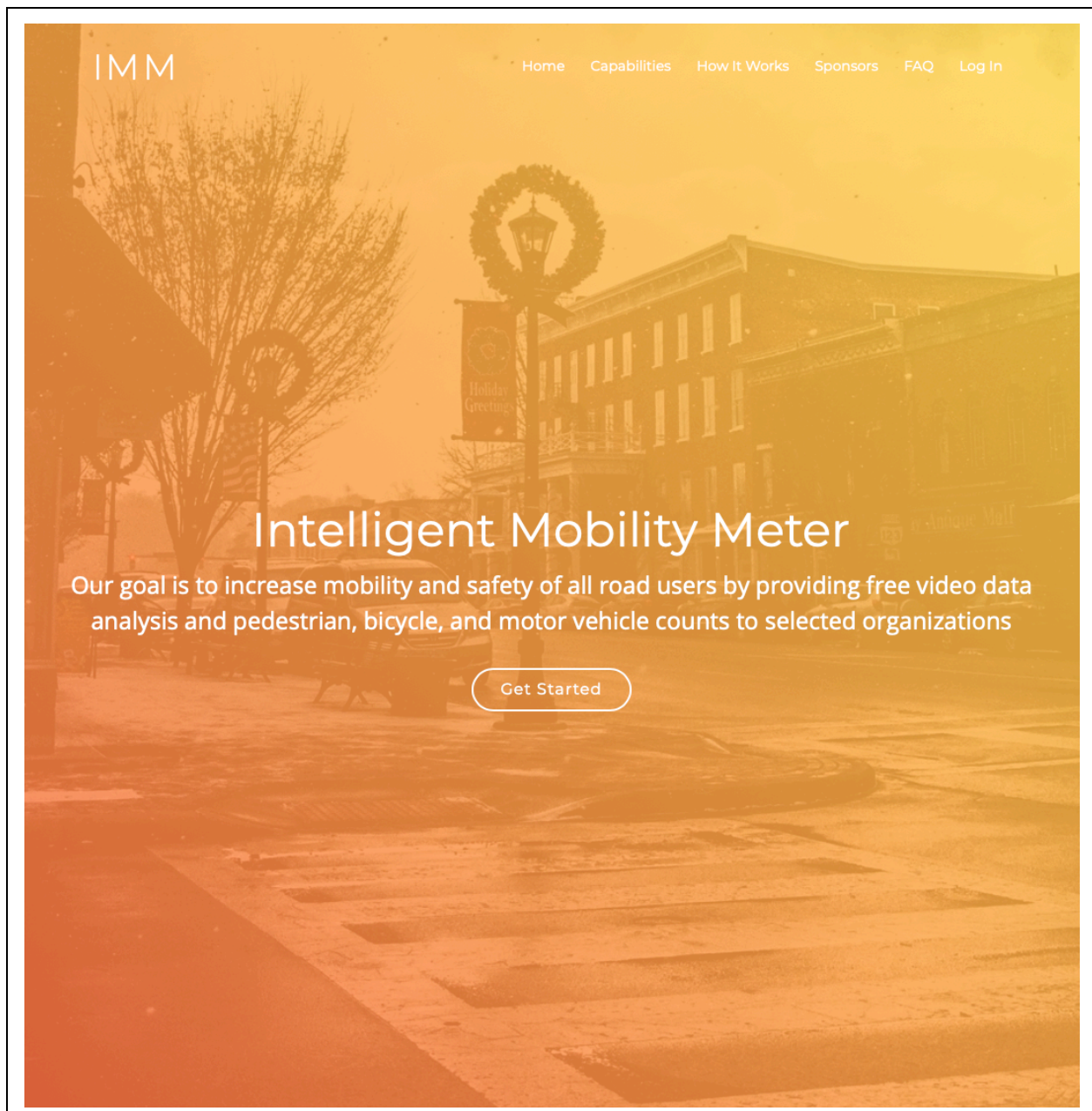


FIGURE 1. The IMM Public Facing Website (2 of 4)

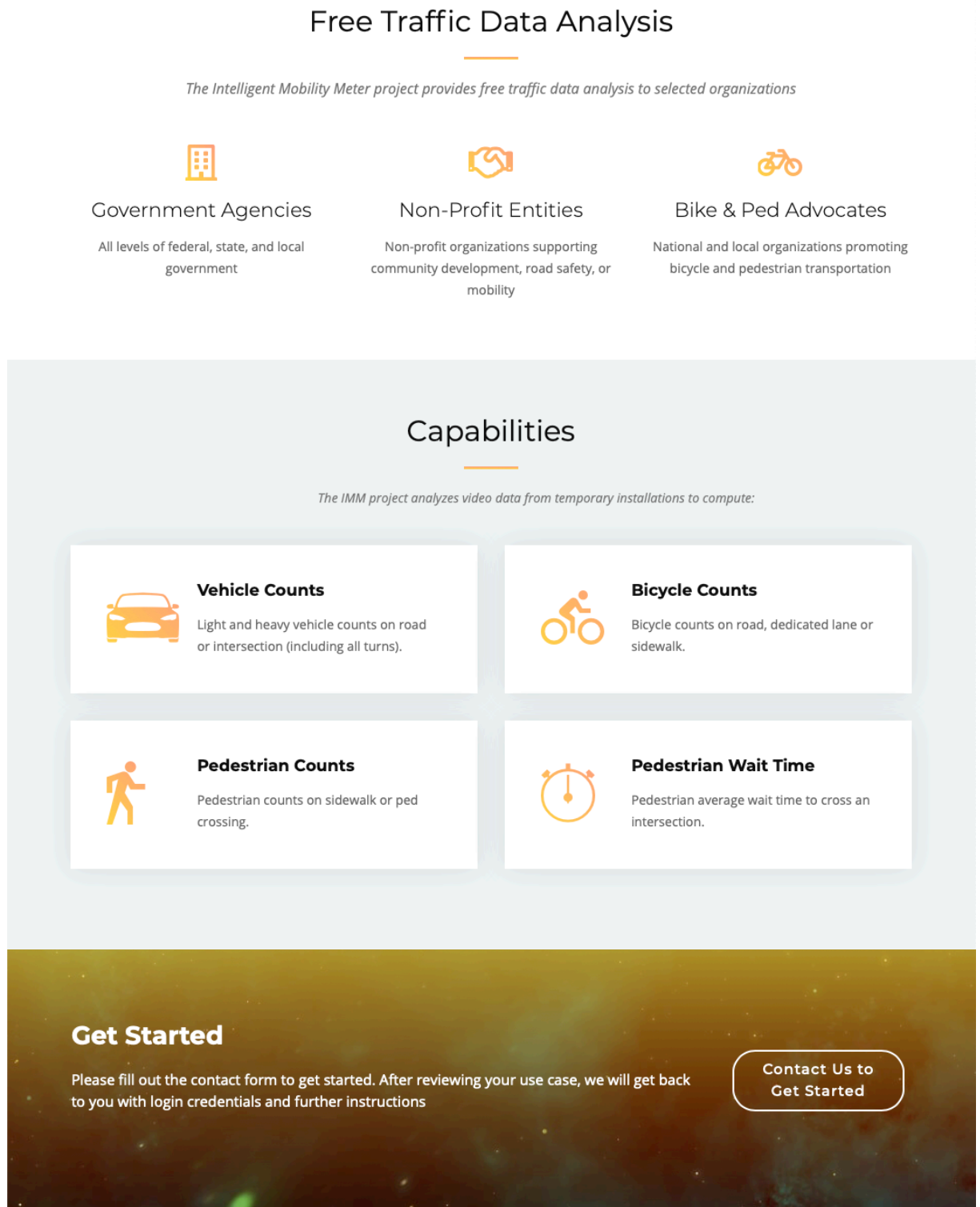




FIGURE 1. The IMM Public Facing Website (3 of 4)

How it works




Upload your traffic video

Your organization collects traffic videos and uploads them to the IMM platform



We process it




The video data is automatically processed by the IMM computer vision algorithms. All counts are verified by a human



Download your reports

You will be notified that your data has been processed and can log in to the IMM platform to download your report(s)

Sponsors



GET STARTED

Please fill out the contact form to get started.

Please tell us about your traffic data analysis needs.

Send Message

FIGURE 1. The IMM Public Facing Website (4 of 4)

Frequently Asked Questions

I believe my organization qualifies for the free data analysis, what's next?	+
My organization does not have video recording equipment. Can you help?	+
My organization qualifies for the free data analysis. Does this guarantee that you will process my data?	+
Can you create a traffic study based on the counts compiled?	+
Can you analyze streaming video from a fixed location?	+
I have data from non-video sensors. Can you analyze it?	+
I am part of a for-profit organization or traffic engineering firm. Can you still analyze my data?	+
Who should I thank for the IMM?	+

About the Intelligent Mobility Meter Project

The Intelligent Mobility Project is hosted by the Robotics Institute at Carnegie Mellon University. It has been developed under a number of research projects lead by Dr. Bernardo Pires. It started as a bike and pedestrian counter on the UTC-supported project "Automatic Counting of Pedestrians and Cyclists". The project "Measuring Pedestrian Wait-Time at Intersections" expanded the IMM's capabilities to include wait-time measurements. Finally the project "The Intelligent Mobility Meter -

Portable Fine-Grained Data Collection and Analysis of Pedestrian, Cyclist, and Motor Vehicle Traffic" consolidated the IMM's competences into a single framework and introduced motor vehicle counting.



3. Information Flow

Figure 2 below shows the Login screen presented to the user when they connect to the app. Once logged in, the user is taken to the Projects screen, shown in Figure 3. Here, the user can create, delete, and open projects.

FIGURE 2. The Login Screen

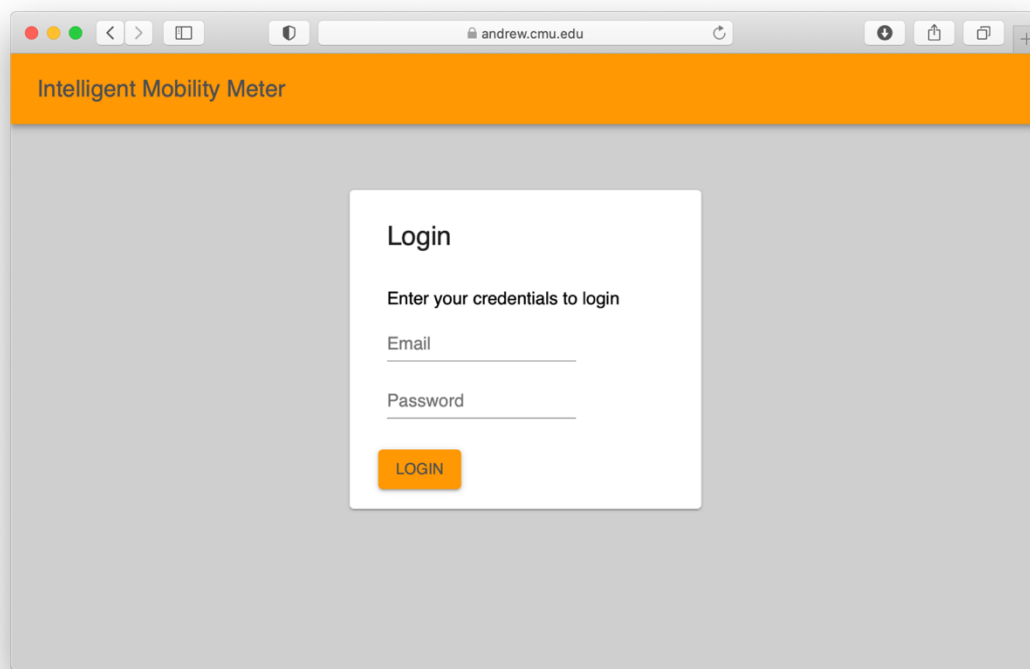
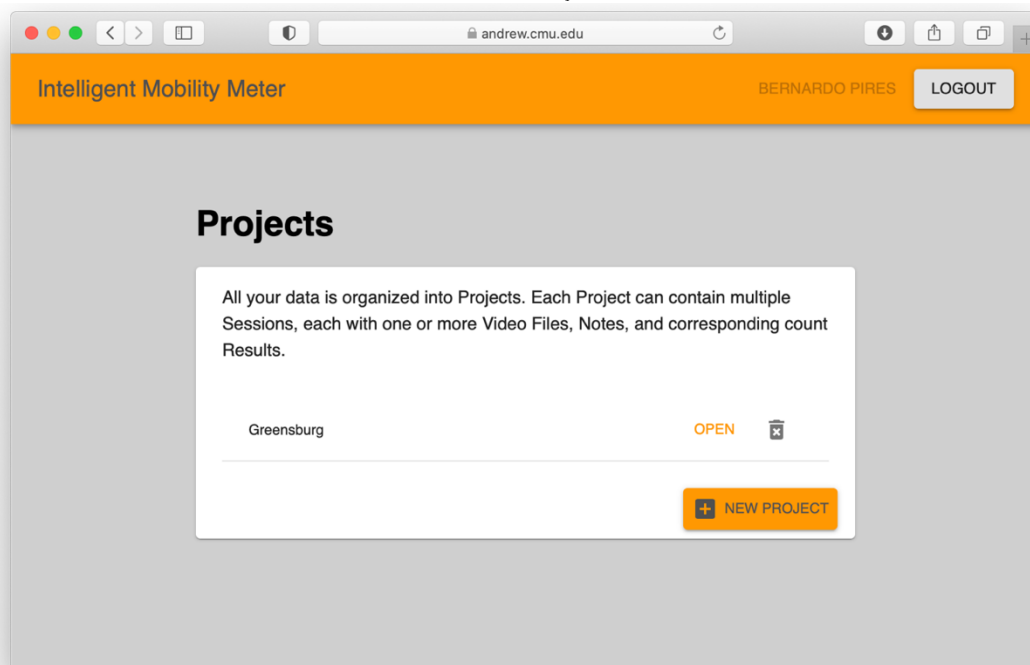


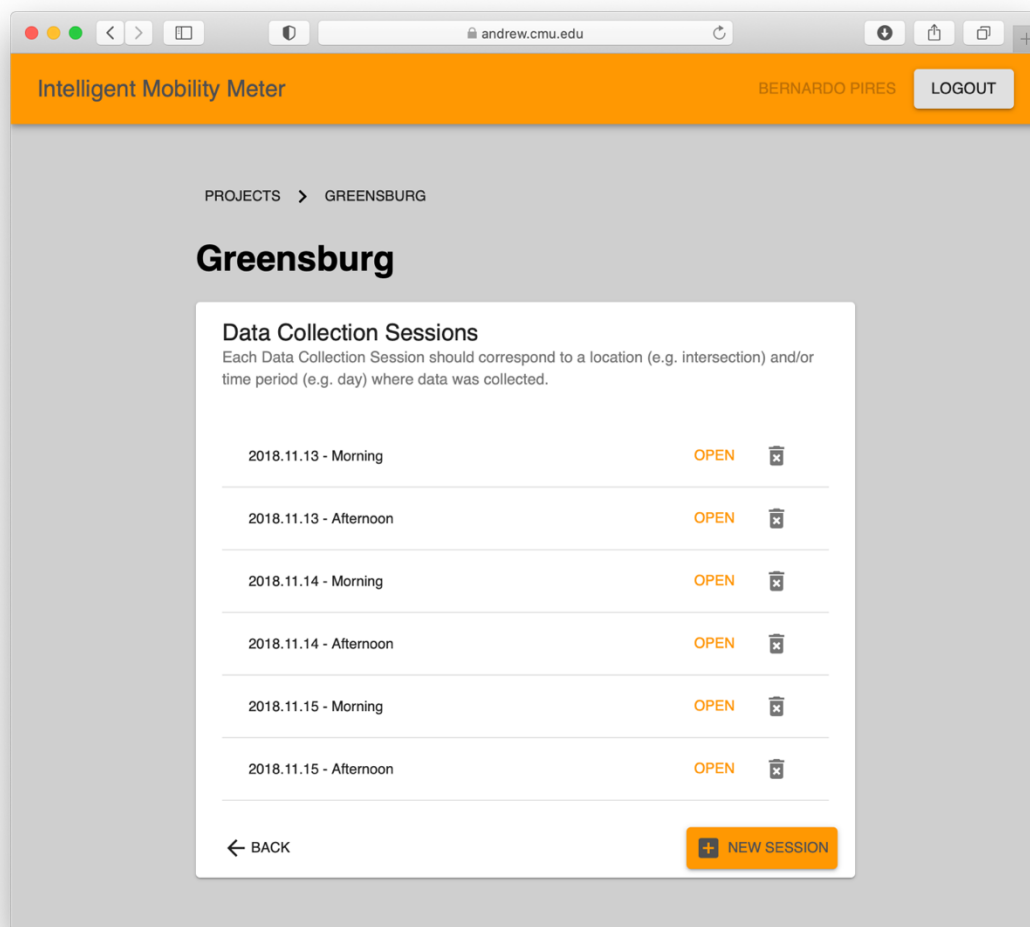
FIGURE 3. The Projects Screen



Once the user opens a project, they are taken to the Session screen as shown in Figure 4. Each project is organized into recording sessions, with each session corresponding to a location and a specific time period. The session paradigm for organizing the data collection does not impact the data processing. Sessions are only created to help the users to organize the data into manageable portions.

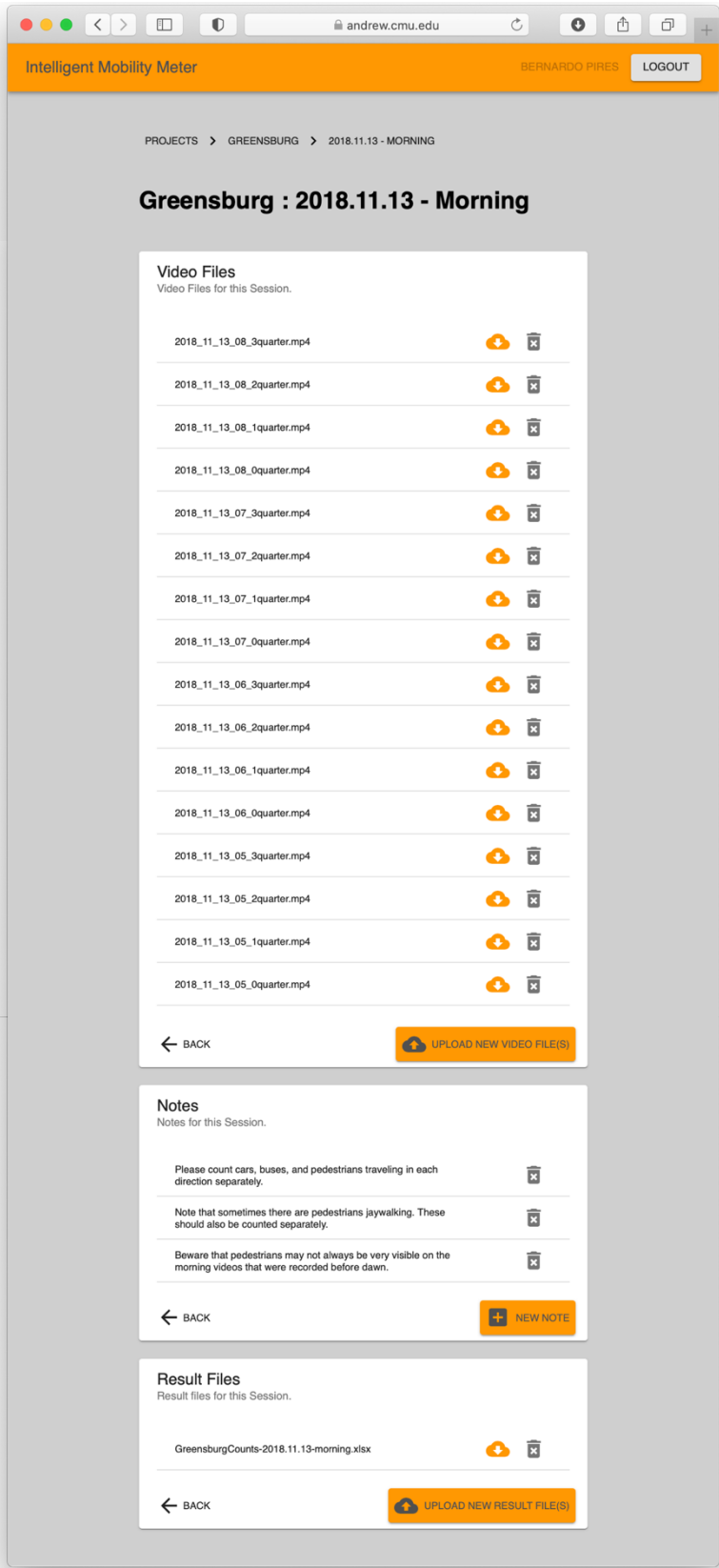
For the project shown, all the data was collected at the same intersection in Greensburg over a three-day period. In this case, the data is organized by recording period, with each session corresponding to a morning or afternoon recording period. Other projects could have been organized in different ways, with sessions corresponding, for example, to different data collection locations.

FIGURE 4. The Data Collection Sessions Screen



Finally, when the user opens a Data Collection Session, they are faced with three areas where they can respectively upload or download video files, add notes, and download results. The user is allowed to upload results files to account for situations where the user has already done some manual counting or wishes to correct any errors in the automatic process.

FIGURE 5. The Session Data Screen



4. Technologies Used

This project uses multiple web technologies:

- The public facing page is organized as a single web page based on a pre-defined theme for the Bootstrap library. Bootstrap is a popular front-end open-source toolkit that allows one to create responsive and mobile-enabled websites and features a number of prebuilt components. See <https://getbootstrap.com> for more information about the Bootstrap library.
- The login and post-login websites were custom built using the React JavaScript library. React, which is an open-source Facebook project, simplifies the creation of complex interactive UIs by using declarative views. See <https://reactjs.org> for more information about the React library.
- Many of the views on login and post-login websites used the Material-UI open-source suite of React Components, which implements many of Google's Material Design principles. See <https://material-ui.com> for more information about this library and <https://material.io> for more information about the design principles it is based upon.
- The authorization and data storage back-end are supported by the Firebase suite of products and services. The following products are used: Firebase Authentication (to support the login workflow), Firebase Realtime Database (for non-video data storage), Firebase Storage (for video storage), and Firebase Cloud Functions (to integrate the video and non-video storage). Firebase is a Google product. More details at <https://firebase.google.com>.

5. Conclusion

This project implemented all the capabilities that it set out to. It allows users of IMM to better communicate with the team, share video data, and receive analysis results. Although many more capabilities could be added to the data portal, the current version already opens the door to more collaborations, especially with organizations outside the immediate Pittsburgh area.