University of Regina

CS 455 – Mobile Computing
Milestone 3: Project Update

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Revised Project Proposal

Team Members

- Michael Dickenson
    - Sensor suite
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- Joel Rich
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- Santiago Félix Cárdenas
    - Data processing/visualization
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ON the Road

The amount of mobile devices in the world is constantly increasing, and new devices are being designed, making them smaller, more powerful, adding newer and better features, etc. Similarly, the amount of information that modern mobile devices can collect and process is increasing at an incredible rate, and as a result, the opportunities for innovation, research and development are endless. Consequently, the amount of mobile devices has significantly impacted the amount of data created every day. Due to the fact that a modern device have numerous sensors and features that allow developers and companies to collect different kind of data. However, we as computer scientists, must know how to gather that information, process it, interpret it and obtain knowledge from it, otherwise the information is useless.

As we try to learn to develop for iOS devices, we want to take advantage of all the tools that mobile devices provide us, in order to create useful and meaningful applications that will hopefully impact the user in a positive way.

As modern vehicles have different types of diagnosis and analytics already built in, older cars do not share the same luxury. However, an app like ON the Road would allow any person with a mobile device (iOS) to keep track of their everyday driving and provide them with different kinds of analytics, which could be important and helpful for them. Most modern vehicles provide us with some fuel efficiency information or distance traveled in a trip (or overall lifetime of the vehicle), yet the information is only available in the vehicles dashboard and it is overwritten as soon as we start a new trip, therefore, if we wanted to keep track of daily distance, daily fuel consumption and time spent driving, we would have to do it manually. We want to create a friendly application where the user can feel comfortable navigating, a powerful application that provides useful and meaningful information that the user can interpret and understand, and we want to create a universal application that can be practical to any user with an iOS device.

The purpose of ON the Road is to provide the user with clear and simple analytics that can help improve the driving experience of the user. Additionally, we want to develop something innovative and different from the countless applications that already exist. After looking in the AppStore for similar applications, we were not able to find an application that could compare to our idea, therefore, we hope to bring something new for users interested in that area.

As soon as the user opens the application for the first time, he/she will be prompted to create a profile for their vehicle, enter some basic information about the vehicle and finally select whether the vehicle is for personal or work use. In case the vehicle is used for both purposes, the user will have the option to switch between work and personal and save different driving logs. After one or several vehicle profiles are created, the user will be directed to the app's dashboard. Here users will be able to select different options from the navigation menu that will always be displayed at the bottom of every screen of the app. From the dashboard, a user can start recording a trip, which will record the route the user is taking to reach a destination (Maps), record the different velocities at which the vehicle is moving and significant acceleration and deceleration changes. When the user reaches the desired destination they can stop the

recording and the information will be stored on the device and used in the construction of the other features of the application.

Once the information is saved, a log will be created and each trip will have a name that the user will determine. The log screen can be accessed through the navigation menu at the bottom of the screen. The log screen will have a list of different trips that the user has saved and each one of them will show basic but important information about each trip. In this screen is where the 3D touch comes into play, enabling the peek and pop feature. By selecting a specific trip with a hard press, a preview of the trip's route will be displayed. Adding on, by only doing a normal select touch the user will be able to access to more detailed information about that trip, such as a color coded and detailed map of the route showing the efficiency of the drive at different times by analyzing sensor readings, total trip time, overall efficiency and the date of the trip. As a handy feature, there will be an option in the navigation menu to access the map of the most recent trip completed, that way the users do not have to access the trips log and select the last trip.

The analytics window will consist of multiple friendly charts or graphs. They will display the total time of a trip as well as how much time the user spent in each different efficiency zone. It will also be able to compare efficiency between trips, and it will be able to display analytics for distance traveled during trips.

Features and functionality

- Driving analytics
    - Driving time
        - Total driving time
        - Time spent driving at different speeds
    - Driving efficiency
    - Kilometers driven per trip
- 3D touch features
    - Enable 3D touch to access shortcuts from device home screen
    - Add peek and pop feature to preview a map of a logged trip

    - Enable 3D touch to display additional information in trip maps and analytics charts/graphs
- Allow users to create multiple vehicle profiles with the option of switching between a personal and a work vehicle
- Prompt the user to stop recording trip based on device position
- Allow the user to discard trips and edit trip names

Extra features and functionality if time allows it

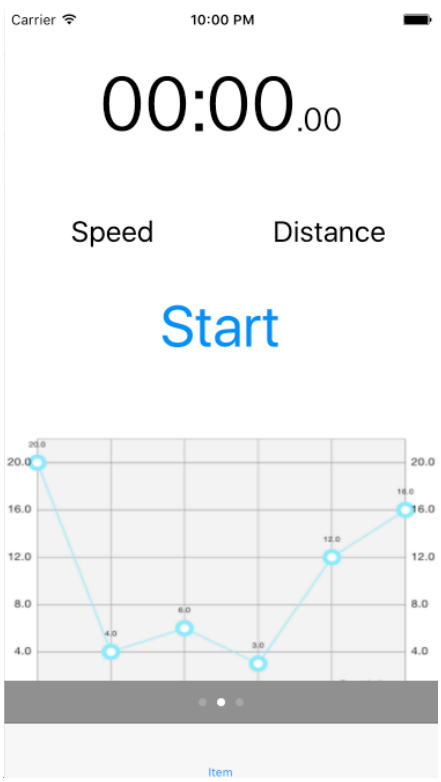
- Allow the app to run in the background at all times and automatically start recording when the vehicle reaches a certain speed
- Lock device while recording a trip
- Connect to the appropriate car information API to determine each vehicles fuel consumption and gas tank size and determine the unit system (km/l or mpg) based on the users current location

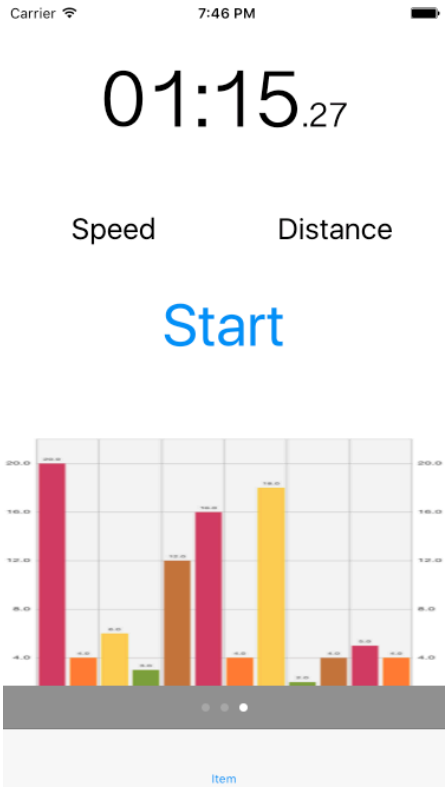
Key Tasks

- Start/Stop Trip – In Progress

    The initial screen of the application has been redesigned with the purpose of displaying to the user different information about the trip. Our home screen was designed to be a navigation screen in addition to the main navigation bar at the bottom of the screen. However, following the feedback given to us in the project proposal, we decided to take advantage of the device capabilities and do something more functional for the user, instead of creating a different interaction mechanism that would duplicate an existing one.
    Adding on, we have also added a page control at the bottom of the screen so the user can have a better idea of what the application and the interface provide.

    Although we are still working on the design and style of the screen, the following image shows the approach we are taking.





Note: Graphs are just images for now due to the fact that the analytics part of the project is still under development

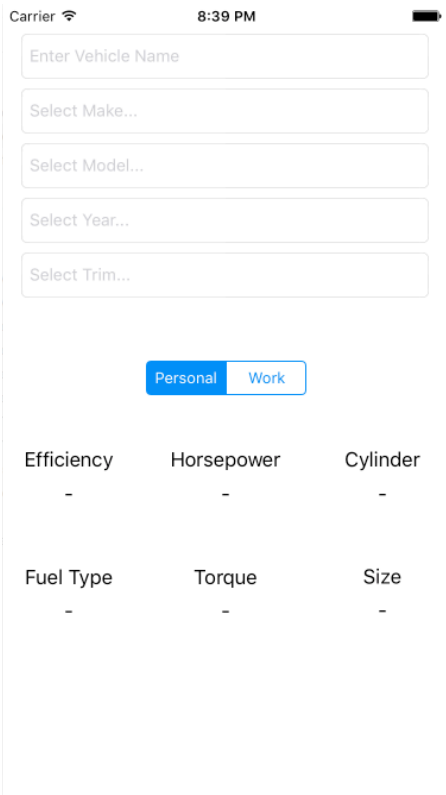
- Add additional info to a trip – In Progress
- Create/Edit a vehicle profile – In Progress

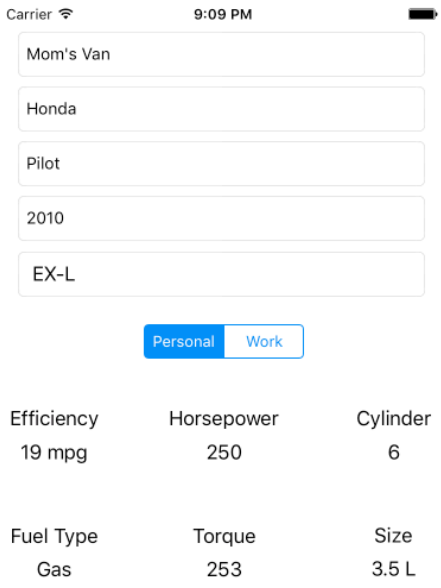
At this point in the development of the project, a vehicle profile can be created by entering the basic information of the vehicle. A name for the vehicle can be given if desired but it is not required, as well as the information that can be added in the additional information segue.

To create a vehicle profile, the users have to select from a list the vehicle make, model, year and trim. Each field must have a selected item before the user can select an item in the next field. By allowing the user to select from a list instead of making them type the information, and by disabling user interaction with the text fields (while the previous text fields are not completed), we eliminate

any accidental error created by the user that could cause the application to crash. Moreover, by making API requests and giving the user valid information we are able to acquire and display the more detailed information about the vehicle that most users would not know without looking at their vehicle guidebook (efficiency, torque, horsepower, etc). Finally, the user has the option to select their vehicle type, whether it is for personal use or for work.

As our previous tasks, the work in terms of design and style is still in progress as well as the option to edit a current profile.





- View/Edit/Delete a log entry – No yet started
- Compare Analytics – Analytics in progress

GPS:

We will be using CoreLocation and MapKit to track and record the user's path as well as their speed and acceleration/deceleration. We will be storing these readings in the Trip class to later generate our analytics for each trip. We are currently working on getting the location recording working properly and acceptable sensor readings.

Compare Analytics:

For the current rough working-model for the analytics we will first need to get all the different sensor and GPS readings created during the trip, once we have the different values we can start deriving the different values and graphics that we will need to display to the user on the analytics page.

tripTime:

endTime

TripDistance:

(End odometer reading) – (Start odometer reading)

Speed:

- The readings will be taken every 1/5 seconds.
- The records will be grouped into batches of 5 seconds (25 readings)
- We'll take the average of the readings for a grouping and that will represent that segment in the analytics.

Acceleration Efficiency:

Using the accelerometer's readings we'll decide how efficiently they are accelerating in a grouping:

$x < 2$ m/s	Good
2 m/s $< x <$ 4 m/s	Normal
4 m/s $< x$	Bad

And will use that to give us a multiplier to be used in later calculations. Good will be 0.5, Normal will be 1.0, and Bad will be 1.5.

Sustained Speeds Efficiency:

Once again taking the readings gained under the speed section, we'll check to see if the user is driving at a sustained speed for extended periods of time and is driving at good speeds.

x < 80	Good
80 < x < 120	Normal
120 < x	Bad

And will use that to give us a multiplier to be used in later calculations. Good will be 0.5, Normal will be 1.0, and Bad will be 1.5.

Overall Efficiency:

(Acceleration Efficiency) x (Sustained Speeds Efficiency)

Fuel Consumption:

(CarsRecordedEfficiency) x (Overall Efficiency)

Trip Consumption:

(TripDistance) x Avg(Fuel Consumption)

Graphs

For the visuals displayed in the analytics screen we are going to have three graphics and one image.

The image item will be a map with the user's trip overlaid on it, the route segments will be displayed in different colours depending on the user's efficiency at that point in time, with each segment being in 5 minute blocks.

The first graphic will be a bar graph broken into 10 segments; the segments will be gained by taking the trip's time and dividing it by 10. We will then display the L/100kms for that segment of time.

The second graphic will be a time plotted graph that shows the user's efficiency rating (good, normal, bad) over time, each point being the average taken over 5 minutes.
The final graphic will be a pie chart showing the user's efficiency ratings (good, normal, bad) over the trip.

Class Diagrams: Models and Controllers