Project Proposal for MBTA: The Ride

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Project Overview

We are looking for a way to cut costs and maximize efficiency for the MBTA's The Ride service. We want to boost ridesharing services and productivity, while keeping costs low.

Project Purpose

The goal of this project is to cut transportation costs by optimizing driving routes for the MBTA's The Ride. In 2017, 109 million dollars were spent on delivering 1.8 million rides for 33 thousand customers in the greater Boston area. Each ride costs around $35 for the MBTA, whereas the customer pays a flat fee of $3.15 or $5.25 depending on location. In order to reduce these costs, The Ride would like to increase the amount of shared rides given. Through shared rides, the "dead-head" time, or the time a vehicle drives without a rider, is reduced. "Dead head" time occurs when the driver drops off a rider and proceeds to pick up the next rider without having a rider present. Not only will shared rides limit dead-head time, because there will more riders transported at one time, but they will also limit the amount of buses needed for use in a day. By optimizing route efficiency, The Ride will be able to save money and serve the Boston community in a more efficient manner.

We will know we are successful if the application program produces a viable output that meets The Ride's requirements and cuts overall costs. This means that the application program must take into consideration a list of rides to be scheduled a day in advance. It must use this list of rides to then calculate the optimal driving routes to lower transportation costs.

Scope of Work

The client currently has a system that costs $109 million in FY2017, serving 1.8 million trips. The average cost per trip is $35, paying car vendors on a per trip model. A major issue with the FY2017 model is the low amount of ride sharing. The new system needs to increase ride sharing in order to bring costs down, and to serve more people. The Ride is currently transitioning from a pay-per-ride model to a pay-per-hour model. Instead of charging per ride, vendors will be paid on a per hour model from the time of the first pickup to the time of the last drop off. This means that if a car is on "slack time", or not in use because no ride has been scheduled, the vendor will still be paid for that time.

This emphasizes that an optimal driving route needs to schedule rides such that drivers will have the least amount of, "slack time" and, "dead-head" time. In the new system, The Ride vehicles are paid $50/hour and so optimizing each hour will help reduce costs. An optimal route calculator would attempt to always have a rider sitting in the car.

The Ride has three car companies that it uses for vehicles. These companies are: Greater Lynn Senior Services, Veterans Transportation Services, and National Express. Previously, the system was set up in such a way that specific zones of Boston were dedicated to one of these three companies. However, The Ride is transitioning to no longer dedicating zones to specific companies.

The input files must contain data such as date, pickup location, pickup time, drop off location, info, notes, ride ID, and trip ID. This data is saved in a file - a CSV file, for example. The system must then be able to intake this file and optimize routes, drivers, and possible ridesharing opportunities. By optimizing ridesharing, “slack time” will be reduced and the number of vehicles needed to drive will decrease, thereby lowering costs. The system must then output trip manifests with this information.

Stakeholders

Client: The client is the MBTA, more specifically The Ride. Our main contacts are Diogo Lousa, Manager of Transportation Innovation, and Nathaniel Larson, MBTA Innovation Consultant.

Potential Customers/End Users:

1. The Ride Users

Every passenger of The Ride is a stakeholder in this project. The efficiency of the routing algorithm that The Ride incorporates will greatly affect the rate at which students/teachers/elderly/etc. are picked up and dropped off on time. The Ride users are in need of an effective algorithm because most passengers may have no other form of transportation and The Ride is what they rely on in order to navigate through the streets of Boston. Without an effective scheduling and routing system, The Ride passengers may be left stranded at their residences and could miss important deadlines or appointments. Our performance on this project greatly affects all citizens of Boston that may ever need to use The Ride for public transportation.

2. The Ride Drivers

The Ride drivers are the primary employees of the organization. They will be impacted greatly by our software, as their routes and pick-up times will change drastically after they are re-implemented by our algorithms. The Ride drivers are middlemen in this project-- they serve end users and physically deliver the services that we map out in our application. The Ride drivers also know the streets of Boston better than anyone, and could be a viable resource when we try to find the most optimal routes to set up.

3. Car companies used by The Ride

The Ride has three car companies that it uses for vehicles: Greater Lynn Senior Services, Veterans Transportation Services, and National Express. Each of these companies rely on The Ride to notify them on the preset routes their cars and drivers must drive every day. Optimizing routes will impact each individual company’s driving schedules and navigation. Ridesharing may

increase as well, and this will modify drivers' pickup routines as each driver may be need to accommodate more passengers than before.

4. Scheduling and Call Centers
An essential component of The Ride is a centralized call and dispatch center. The car companies themselves are not responsible for their own dispatching and scheduling; that duty falls on the call centers. These companies rely on the call centers for route scheduling, and clearly the car companies will be affected by changes to routing. They will need effective routes in order to schedule efficiently and at the discretion of our algorithmic routing system.

5. Taxpayers
The taxpayers of the Greater Boston area are the primary stakeholders in our project. As they are responsible for the funding of public services such as The Ride, taxpayers are rightly concerned with where their money is being spent. The efficiency of routes and scheduling may reduce transportation costs, thus allowing money currently allocated to this service, to be used in other projects.

6. Uber/Lyft/Ridesharing
These ridesharing companies are competition within the transportation department. With the optimization of routes for The Ride, their services may be impacted.

Use Case 1

Use Case:	Error Saving Outputted File Containing Optimal Driving Routes
Primary Actor:	System Administrator
Goal in Context:	The system administrator experiences an error while saving the outputted driving schedule. The goal is to get the error fixed.
Preconditions:	After 5pm, the rides to be given for the next day is saved in a file. The file was successfully uploaded into the application, and optimal driving routes were created and outputted.
Trigger:	The system administrator tried to save the created file (containing the optimal driving routes) as a PDF, for example, and experienced an error.

Scenario:	1. The system administrator attempts to download the file containing all driving schedules. 2. The computer is unable to download the file and the file stops downloading. 3. An error message occurs (unable to download file, etc.) 4. System administrator attempts to download the file again and succeeds.
Exceptions:	1. The system administrator is unable to download the file on the second attempt. If this occurs, contact IT personnel to help resolve the issue and download again.
Priority:	Very High
When available:	Fall 2017, upon completion of project
Channel to actor:	Application program
Secondary Actor:	Bus drivers, IT personnel
Channels to Secondary Actors:	The downloaded file, saved as a PDF for example.
Open Issues:	1. What happens if the file is unable to be downloaded even with the help of IT?

Use Case 2

Use Case:	Allocating drivers and creating a driving schedule for the next day.
Primary Actor:	System administrator for the application (someone with clearance access to the file of detailed scheduled trips).

Goal in Context:	Creating an optimal driving schedule for dedicated/non-dedicated vehicles. This means a file detailing scheduled trips routes should be outputted.
Preconditions:	All scheduled trips for the next day have been received. This means that the location pickup time, location pick up address, drop off address and estimated cost of route is listed for each ride.
Trigger:	It is 5pm. This is the deadline for scheduling or cancelling rides for the next day. This means that at 5pm, all rides have been put into a file of schedule trips.
Scenario:	1. System administrator makes final updates to the file containing information about all routes. This means that information about each ride - pickup time, pickup location, drop off location and ride cost are known for all rides. Each ride is known by a ride ID. 2. System administrator loads file into the application. 3. System confirms all records have been read correctly. 4. System administrator clicks “calculate routes” button. 5. Application outputs a file listing scheduled rides for the next day - this means that for each route, a route ID number is created and a list of pickup locations and times follows. Some routes may only have one pickup and dropoff location, while other routes might have several pick and drop off locations if ridesharing is successfully incorporated into the route. 6. System administrator schedules an available bus driver for each route and notifies him/her of the route to be followed tomorrow.
Exceptions:	1. Application is unable to read the file inputted by the system administrator. This indicates

	something was off about the file (input data was off or wrong - a wrong ride ID was inputted or a similar error). See *Input File Issues.*
Priority:	Very High
When available:	Fall 2017, upon completion of project
Channel to actor:	System administrator interacts through the application program.
Secondary Actor:	Bus drivers, anyone using on The Ride, the call center.
Channels to Secondary Actors:	Bus drivers interact with the call center through email or phone to know what the schedule for the upcoming day is; a rider interacts with the call center through a call or online webpage to schedule a ride in advance.
Open Issues:	1. Should the system suggest a rider get picked up 5-10 minutes early if it allows for a better ride?

Use Case 3

Use Case:	Ride Cancellation
Primary Actor:	The Ride user
Goal in Context:	The Ride user decides to cancel their ride by calling in to the call center.
Preconditions:	The Ride user must have a scheduled ride within the system.
Trigger:	The Ride user has a conflict where they are unable to make their ride appointment.
Scenario:	1. The Ride user has a ride scheduled. 2. The Ride user figures out they have a conflict and cannot make use of their ride.

	3. The Ride user must call in to the call center to cancel their ride. 4. The call center notifies the ride scheduler. 5. The ride scheduler shall remove the specific user's route from the system.
Exceptions:	The Ride user called in too late (after 5PM before the day of their ride). If this happens, there will be repercussions for the user, such as being written up the first time or suspended thereafter.
Priority:	Medium priority compared to Adding Rides and creating schedules, as cancellation cannot happen without having rides first.
When available:	Fall 2017.
Channel to actor:	Phone call.
Secondary Actor:	The call center, the ride schedulers, the drivers (they no longer need to make that stop).
Channels to Secondary Actors:	The ride scheduling system.
Open Issues:	What should be done if the user does not call in on time but still needs to cancel their ride? What should be done if the user does not call in at all but does not show up to get picked up for their ride? What should be done if the user calls in and cancels their ride, but somehow the administration makes an error and is not able to cancel the ride through the system?

Use Case 4

Use Case:	Input File Issues
Primary Actor:	System Administrator
Goal in Context:	The system administrator tried to input the file to the application and received errors. The goal is to successfully understand the error that occurred and resolve it.
Preconditions:	System administrator tried to input the file (listing scheduled rides for the next day) and recieved an error.
Trigger:	System administrator tried to create routes for the next day.
Scenario:	1. System administrator loads the file listing scheduled rides for the next day into the application. 2. The application is unable to read and accept the file. There was something wrong with it. 3. The application stops and outputs an error. This error tells the system admin was is wrong with the file (it has a formatting issue, it was missing a value somewhere, etc.) 4. System administrator opens the file, sees the error, fixes it, then tries to load it back into the application. 5. The application accepts the file because all the errors were fixed.
Exceptions:	
Priority:	Very High
When available:	Fall 2017, upon completion of project

Channel to actor:	Application program, input file
Secondary Actor:	People working at the call center - the person who updates the file when rides are scheduled.
Channels to Secondary Actors:	Through the file listing rides for the next day.
Open Issues:	Does the system administrator have access privileges to change the input file if something is wrong with it? What if the error message is not clear?

Further Questions to Consider and Ask the Client

1. Say there is construction on a street, or a change in traffic and The Ride vehicles can no longer travel on certain streets without being late or breaking rules. Should the routing system take into account, “banned streets” when creating routes?
2. Do addresses (in the file input) need to be validated when calculating routes?
3. If someone requests to be added to the system, are we responsible for handling that, or is it added to the file (containing all information such as pickup locations, ride IDs, etc.) that we are not responsible for creating?
4. Will the Ride be working with other car ridesharing companies such as Uber and Lyft, or are these ridesharing companies competition?

References

1. First client meeting held with Diogo Lousa and Nathaniel Larson (lecture given on September 22, 2017).