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Traveler Information Application for Route 1 and Route 18 Corridors

FINAL REPORT
July 2019

Submitted by

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16. Abstract

The final product of this research is an enhanced Mobile Application platform that receives travel time information, parking information and transit/shuttle schedule information in real time for the Routes 1 (from I-295 to Garden State Parkway) and 18 (from New Jersey Turnpike to Rutgers University – Piscataway, NJ) corridors, specific to certain destinations such as colleges and/or large employment destinations. The application enhancements were designed so that other corridors and/or destinations could be added to the system by the owner of the application.

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EXECUTIVE SUMMARY

The New Jersey Department of Transportation (NJDOT) created this project as a means to develop a hands-free Mobile Application (app) platform to aid travelers by offering travel information that utilizes the data it currently collects from its real-time transportation information systems and includes additional travel related information such as transit and shuttle schedules and availability of parking.

Before conducting this project, the only way New Jersey travelers could obtain travel time information was through Dynamic Messaging Signs (DMS), the 511 NJ website or through commercially available sources such as Google Maps and Waze. These traveler information technologies, however, have their own deficiencies. While DMS technology is strategically deployed, it cannot provide the variety of information necessary to assess alternate route options, parking availability, transit schedules, or cause of delay.

Dr. Catherine T. Lawson and her team at the Albany Visualization and Informatics Lab (AVAIL), in partnership with Information Logistics (ILOG), are developing a Mobile Application platform that builds upon ILOG's GeoTalkerTM Platform, by integrating travel time and delay related information from the TRANSCOM Data Fusion Engine (DFE), parking information from various sources, transit/shuttle schedule information in real time from NJ TRANSIT and MTA, and utilizes the commercially available real-time routing technology of Google Maps. This app will include auditory and visual information features that prompt travelers with pertinent travel information related to corridor specific travel time as well as transit/shuttle and parking information.

The final product of this research is a Mobile Application platform that receives travel time information, parking information and transit/shuttle schedule information in real time for the Routes 1 (from I-295 to Garden State Parkway) and 18 (from New Jersey Turnpike to Rutgers University – Piscataway, NJ) corridors, specific to certain destinations such as colleges and/or large employment destinations. The application is designed so that later, other corridors and/or destinations can be added to the system. This mobile application provides auditory and visual information related to corridor specific travel time as well as transit/shuttle and parking information in the study area.

BACKGROUND

The 511 NJ website offers travel time information and other kinds of transportation network information but is not a mobile optimized website. It is not designed to maximize the technological advancements of the smartphone, be responsive to different device screen sizes, access GPS to assess location, or offer updated routing information in real-time.

Google Maps, on the other hand, is designed to be mobile optimized and utilizes the richest set of real-time and archived probe data to determine real-time routing. Google Maps is even now integrating delay information regarding major incidents and work zones from Waze, which collects its information through crowd sourcing. Google Maps, however, does not incorporate the availability of parking along travelled routes, nor does it include official information about construction, incidents or detours. Its integration of Waze delay information means that it is dependent upon user self-reporting, which skews information away from less traveled roads.

The New Jersey Department of Transportation (NJDOT) created this project as a means to develop a hands-free Mobile Application (app) platform to aid travelers by offering travel information that utilizes the data it currently collects from its real-time transportation information systems and includes additional travel related information such as transit and shuttle schedules and availability of parking.

OBJECTIVES

The intent of this effort includes evaluating the utility and value of collecting pertinent traveler information from various sources for a single location (such as a university or a hospital). This information would assist specific types of road users, (such as students or commuters of single or multimode and/or single or multi route) to specific destinations along the corridor.

The final product of this research is a Mobile Application platform that receives travel time information, parking information and transit/shuttle schedule information in real time for the Routes 1 (from I-295 to Garden State Parkway) and 18 (from New Jersey Turnpike to Rutgers University – Piscataway, NJ) corridors, specific to certain destinations such as colleges and/or large employment destinations. The application enhancements were designed so that other corridors and/or destinations could be added to the system by the owner of the application.

This mobile application provides auditory and visual information related to corridor specific travel time as well as transit/shuttle and parking information in the study area.
It was the intention of this research that NJDOT would gain the following products:

1. An enhanced mobile application platform that could receive travel time information from the central data fusion engine and/or other travel time information sources.

2. A small scale examination of whether this mobile application enhancement could possibly be used to inform public about major incidents, work zones or delay due to adverse weather conditions.
3. A small scale test of whether this mobile application enhancement would have the ability to provide auditory and visual information related to corridor specific travel time.

INTRODUCTION

Dr. Catherine T. Lawson and her team at the Albany Visualization and Informatics Lab (AVAIL), in partnership with Information Logistics (ILOG), developed a Mobile Application platform that builds upon ILOG's GeoTalkerTM Platform, by integrating travel time and delay related information from the TRANSCOM DFE, parking information from various sources, transit/shuttle schedule information in real time from NJ TRANSIT and MTA, and utilizes the commercially available real-time routing technology of Google Maps. This app enhancement included auditory and visual information features that was able to prompt travelers with pertinent travel information related to corridor specific travel time as well as transit/shuttle and parking information.

UALBANY State University of New York AVAIL INFORMATION LOGISTICS

Figure 1 - Logos of Research Partners; UAlbany, Albany Visualization and Informatics Labs, and Information Logistics

SUMMARY OF THE LITERATURE REVIEW

AVAIL and ILOG conducted a search of the technology landscape for available software solutions with the potential to meet the needs of the Division of Transportation Mobility, specifically the Mobility and Systems Bureau. All such software technologies were identified and evaluated. AVAIL and ILOG then proceeded to present mobile travel app best practices to the Bureau of Mobility and Systems, to interview the staff members of this Bureau on its desired app features, to locate the data inputs and data types, and to assess the quality and quantity of useful input data for inclusion in the mobile travel application platform.

The project team started its data discovery process by conducting an inventory of the GeoTalker Application data points. GeoTalker is a proprietary platform developed by Information Logistics which powers the SafeTripNJ Application which is currently deployed by the New Jersey Turnpike Authority. This data inventory of the GeoTalker system included an investigation of its alert features, which include 511 integration as well as a back end for generating custom alerts.

The impetus behind the development of the GeoTalker™ platform was to deliver travel alerts to drivers that required no user-interaction (hands-free, eyes-free), and to provide only those alerts that are relevant to the driver's location. Relevancy to the driver's location is the most distinguishing feature of GeoTalker™ mobile apps. While each GeoTalker™ app is customized for a specific geographic region (e.g. New Jersey, Pennsylvania, West Virginia), users can further refine information they hear by specifying the distance between their location and the event. Additionally, the event-type can determine the distance before audio information is played.

For example, notification that a transit-center parking lot is nearby may be determined as best heard when within 500 feet of the facility, where a change in speed limit on a local (low speed) roadway may best be heard when within 100 feet of the change. The platform accepts almost any dynamic data feed, static data and also provides a manual data interface and tags each piece of information with location parameters, and performs the text to speech translation. The platform then presents each sound clip and each piece of information available to any app user who crosses into the general area, and whose settings and location would make the information relevant.

As an example, if a user selects parking information, they will receive audio information about parking lots as they get near the parking lot. Of course, visual information regarding parking lots would also be available regardless of the user's location dependent on the user's app settings. Similarly, the app can present both audio and visual travel times, slow downs, delays and virtually any category of information, as long as the information can be associated with a geographic location or area.

The ability to provide location-aware information means that the app is in an ongoing dialogue with the backend GeoTalker™ platform as the user travels. ILOG designed and built an extensive cloud-based infrastructure to channel ongoing, real-time communications between agencies and their drivers on the road so that app users and relevant information can be appropriately matched.

This project applies the GeoTalker™ platform to the Route 1 and 18 corridors, however, there are also events outside the corridor which may impact the corridor immediately, or in the very near future. For example, an event on the NJ Turnpike could cause repercussions on Route 18 or Route 1, and yet the event on the NJ Turnpike could technically be "outside the corridor". Staff members and leadership of the Bureau of Mobility and Systems Engineering requested to be able to specify that certain types of events within a certain area outside the corridor should also be included on the app due to their impact on mobility inside the corridor.

The approach for the mobile app has been to keep the app enhancements small (respect device memory and data usage resources); to keep the app anonymous where possible (respect users' privacy); to program for backend feature activation without publishing new app enhancement updates (respect agency and users' time for pushing functionality updates); and to leverage the adaptive website wherever possible to provide advanced features for the app enhancements without redundant programming for web and mobile (respect for budget constraints).

An Interoperable System
Traditional mobile apps for transportation agencies provide travel alerts and information for only the region within the agency's jurisdiction – which means that if a user crosses state or agency lines, they need to download a different app to get the new region's alerts.

GeoTalker™ is different. GeoTalker™ created a common platform for distributing advisories for any agency that has a GeoTalker™ app. This means that if neighboring states/agencies also have GeoTalker™ services, then when a driver from one state crosses into the neighboring state, local agency advisories can continue to be broadcast without the need to download an additional app - and without any interaction from the driver.

Currently PennDOT, WVDOT, NJDOT/NJTA, PTC agreed to share data across each other's mobile apps. This regional data sharing benefits users, expands the audience for hearing important travel information, and facilitates interagency incident coordination. In the case of this project, the different data types from the Route 1/Route 18 corridors were incorporated as user-selectable options on the other GeoTalker™ apps in use. The opportunity to leverage multi-system interoperability expands the cost effectiveness of all the stakeholders across the region.

User Anonymity and Probe Data
GeoTalker™ respects user privacy. No user-identifiable information is requested or stored. When a mobile device connects to the server, the platform assigns the device a temporary identification number. This connection "ID" number is used to communicate with the mobile device but is not associated with the user's phone number, device id, or other personal information.

The privacy intrinsic in the GeoTalker™ app is also critical for obtaining user geographic location related information. Along with location data (latitude and longitude), the platform receives other (anonymous) information including time of day, altitude, speed, heading, etc. This data is collected every 2-5 minutes from each active device, and can be passed back to an agency data store for analysis or integration into other systems as anonymous supplemental probe data.

The project team then investigated the GeoTalker's use of Google Maps for routing and traffic speed communication features. The Google Maps App is integrated into the SafeTripNJ App seamlessly for both Android and iOS via software development kit (SDK). The Google Maps App opens directly within the SafeTripNJ App. Similarly, this application allows users to launch Waze, so that Waze routing and alerts can be heard along side official alerts from NJDOT. Additionally the SafeTripNJ App harvests speed information generated by SafeTripNJ Users.

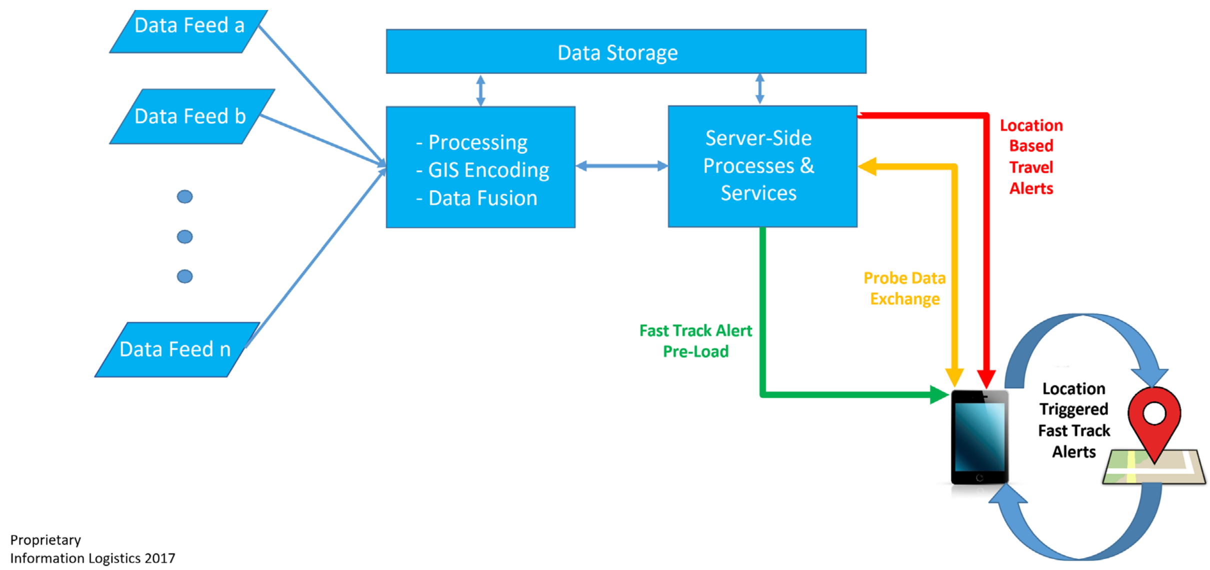


Figure 2 - Schematic of the GeoTalker Application from Information Logistics

Other Real Time Sources

Next the project team conducted a data discovery of available real-time data sources that had potential for integration with the GeoTalker Application. The Project Team reached out to NJTransit, North Jersey Transportation Planning Authority (NJTPA), Rutgers University, The City of New Brunswick, and various real-time parking software applications to locate a variety of data; parking, transit, Rutgers Shuttles and Events, and more.

Transit

The project team reached out to NJ Transit to assess a number of real-time data.

Real-Time NJ Transit Bus Info

Firstly the project team identified the MyBusNow system for real-time bus information: https://github.com/ankurp/NJBusNowRestAPI

Real-Time NJ Transit Train Info

NJ Transit offers DepartureVision as a free service that displays train departure screens on a desktop computer or web-enabled mobile device, including:

- Departure Time (time the train is scheduled to depart the station)
- Destination
- Train Number
- Line (using standard train line abbreviations, such as “NEC” and “NJCL”)
- Status (countdown to train arrival/departure starting at 30 minutes)

Users can click on the train's departure time and see all upcoming station stops, including estimated arrival times. The arrival times are automatically adjusted to reflect any delays the train has experienced en route.

Real-Time Rutgers Shuttle Info (NextBus)
The Rutgers-New Brunswick/Piscataway inter-campus bus and shuttle system is a service provided for all five campuses. It utilizes NextBus for its real-time bus information and is available to all members of the university community. NextBus uses satellite technology and advanced computer modeling to track vehicles on their routes. Each vehicle is fitted with a satellite tracking system.

NJ Transit App
The project team reached out to NJ Transit representatives who were responsible for the NJ Transit App, which is an application that NJ Transit uses for train/bus ticket purchases, real-time info, and alerts. The project team assessed its usefulness in providing real-time data and for purchasing transit tickets from within the SafeTripNJ Application. The NJ Transit App currently is not capable of handling deep linking, which is required for direct purchase of a train or bus identified in the SafeTripNJ application.

Parking Applications
The project team reviewed a variety of parking applications which provide a variety of information about real-time parking availability. The list of parking applications considered by the project team included the following:

1. ParkWhiz
    a. https://www.parkwhiz.com/amtrak-station-nwk-parking/
    b. https://www.parkwhiz.com/new-brunswick-station-parking/?daily=1
2. Parking Panda
    a. https://www.parkingpanda.com/Search/?location=Newark%2c+NJ%2c+United+States
    b. https://www.parkingpanda.com/Search/?location=New+Brunswick%2c+NJ%2c+United+States&place=ChIJpZJq8FXDw4kRDCOOeQZVkiU
3. Spothero
    a. https://spothero.com/newark-parking
4. Best Parking
    a. http://www.bestparking.com/developers/
5. Parker
    a. http://www.theparkerapp.com/
6. Pango
    a. http://www.mypango.com/
7. Parkme
    a. https://www.parkme.com/newark-parking
    b. https://www.parkme.com/new-brunswick-nj-parking
    c. https://www.parkme.com/developers
8. Parkmobile
    a. https://parkmobile.zendesk.com/hc/en-us/articles/203301620-New-Brunswick-NJ-New-Brunswick-Parking-Authority-Parkmobile-Info

Other parking
The project team also located examples of transit and freight parking data from other states. West Virginia, for instance, has real-time freight parking data and there are multiple examples of transit agencies providing parking information. The project team was unable to locate a source of real-time freight parking data in NJ, and found no real-time parking data from NJ Transit.

Rutgers Events
The project team discussed parking issues with Rutgers Transportation staff. They advised the project team that Rutgers has adequate parking except when large entertainment events occur during school hours. Although this is a rare occurrence, it may be possible to scrape event information from Rutgers' website for use in generating alerts.

Probe Speed Data
NJDOT purchases INRIX data for real-time traffic information and also has a close relationship with Transcom. The Transcom data fusion engine provide real-time travel times for specified routes; which are submitted to Transcom as predefined origin-destination pairs.

Additional Data Sources Considered
The project team reached out to North Jersey Transportation Planning Authority to discuss their data initiatives that include the following:

b. NJTPA is currently working on a **data sharing project**
c. Additional data sources – Transportation Management Agencies (ride sharing – bike usage)
d. Keep Middlesex Moving – KMM

After investigating these additional data sources, the project team determined they did not provide reliable real-time data for integration with the SafeTripNJ application.

SUMMARY OF THE WORK PERFORMED

Task 1 Data Discovery

The Project Team, led by AVAIL, and with input from NJDOT, identified the following real-time data sources for integration into the SafeTripNJ Application:

Final Real-time Travel Time Data Choices
The project team determined that the Transcom data fusion probe speed data could be utilized in a novel way as a new Virtual DMS technology.

Final Transit Choices

MyBusNow
The Project team initially developed a web-scraper to pull data directly from NJ Transit's MyBusNow website into an Application Programming Interface (API) developed at the Albany Visualization and Informatics Lab (AVAIL). As of May 2018, NJ Transit now

maintains a real-time rest API for MyBusNow, which is more stable than the web-scraper.

Departure Vision

The project team developed a web-scraper to pull data from NJ Transit's Departure Vision software application for real-time train information. As of May 2018, NJ Transit now maintains a real-time rest API for Departure Vision, which is more stable than the web-scraper.

Final Parking Choices

ParkMobile

The City of New Brunswick uses ParkMobile as its city-wide parking vendor, for both curb-side parking and city lots. AVAIL reached out to Harry Delgado at New Brunswick Parking Authority who offered to connect us with his contact at ParkMobile. In October/November 2017 when contact with Park Mobile was made, ParkMobile did not yet provide an API for its real-time parking data, nor did it provide any deep linking to it application. By March/April of 2018 it offered both a robust API and a variety to deep links that would allow for easy transition between the SafeTripNJ App and the ParkMobile App for parking purchases. The final research software application fully implemented the ParkMobile API but has serious questions about the ongoing functionality of the ParkMobile API due to inconsistencies with how the company shares its API Key.

ParkWhiz

ParkWhiz provides very professional developer tools for linking to their App. The only issue with ParkWhiz is that their application currently only targets parking lots and garages. The project team, however, implemented it as a supplement to the ParkMobile application because there are considerable differences in the parking locations that each application provides. Ultimately, due to parking lot redundancies, and data inconsistencies, the project team decided to choose only the ParkMobile API.

Rutgers Events

As of this juncture, no reliable source of real-time events information has been identified for Rutgers Events. The project team pursued this lead, but it is currently viewed as a low-reward objective due to the infrequency of the impact on parking at Rutgers.

Task 2 Software Specifications

The project team, led by AVAIL, and with input from staff members and leadership of the Bureau of Mobility and Systems Engineering, developed a set of software and database specifications that are fast, lightweight, agile, secure, and easy to host. The specifications make it easy for the research project team to link new real-time datafeeds to the GeoTalker platform, which is sturdy, consistent, and has multiple state DOT clients.

NJDOT IT and NJ OIT will determine the location of the final hosting and budget/maintenance contracts needed so that this enhanced computer application can be utilized by the application's owner. The specifications herein make the software hosting easy for whichever entity hosts the project.

The project team conducted design meetings with staff members and leadership of the Bureau of Mobility and Systems Engineering to make sure that all design needs and project components will meet their needs. The technical specifications for the project were presented to the NJDOT representatives by AVAIL and ILOG. The project consists of a simple format with four major parts:

1. Database
2. Server side data API for data management
3. User authentication
4. Client application.

This project leveraged the GeoTalkerTM platform for the dynamic communications with the app users. This is an Amazon cloud-hosted SQL-based solution. AVAIL and ILOG team has proved with this project's deliverables that they were capable of developing on a wide variety of web languages, frameworks, and databases. Only NJDOT IT can make final decisions regarding the future viability of this enhanced application.

Database: This project uses the GeoTalkerTM platform, which leverages Amazon Web-Services MySQL relational database.

Information Management: Any data that is submitted to the system is processed by the master database and stored in Amazon databases and Amazon S3 storage, as appropriate.

Data Querying and Reporting: The business logic is being built into the server API, into the mobile app and into any relevant web pages.

Interfaces: The project team is implementing a series of static web interfaces, built with React.js for its development agility and component reusability. These static web-interfaces are currently being by AVAIL hosted using Node.js (8.10 LTS). The project team must still determine a final hosting plan. AVAIL has developed all static web-interfaces for easy integration in whichever hosting platform NJDOT chooses.

Server and Infrastructure: AVAIL recommends cloud based infrastructure as demonstrated in the GeoTalkerTM platform. Local deployments can easily be overwhelmed with rapid upticks in usage, where Amazon cloud servers can rapidly expand to meet demand. AVAIL currently runs systems for clients both on Redhat CoreOS and Ubuntu servers that are located at the University at Albany as well as on Amazon EC2 and Amazon Lambda. Information Logistics deployed and manages an international Amazon cloud network hosting transportation applications in both Windows and Linux environments.

Security: Direct access to all parts of the data acquisition, processing and storage systems will be performed over a secure Virtual Private Network (VPN) and/or password protected. Depending on the data interface and type of user presentation required, any of a number of security solutions will be implemented including Tokens, encryption, and authentication. Any data identified as sensitive can be encrypted in the database, the database can also be encrypted, and the drive containing the database as well as the entire system drive can be encrypted for additional security, as needed.

Task 3 Data Processing

The project team pulled together each of the final data choices (Transit, Parking, and Real-Time Travel Time) and developed a plan for integrating them with the GeoTalker Platform. The project team decided to utilize publicly available Application Programming Interfaces (APIs) wherever possible. New Jersey transit maintains real-time rest APIs for Departure Vision and MyBusNow. The parking applications were also chosen for their free/publicly available APIs. The VDMS technology also utilizes Transcom's fully maintained Data Fusion Engine XML feed.

The project team then reviewed the data structure of each API to identify which fields provided useful information for the end-user. The following table is an example of the data fields that are available through ParkMobile:

Table 1 - Data Fields for the Parkmobile API

Field	Sub-field	Second Sub-field	Third Sub-field	Type	Description
ZoneId				numeric	id
InternalZoneCode				numeric	zonecode
SignageCode				numeric	signagecode
LocationName				String	name of the location
LocationCode				numeric	code for the location
ZoneInfo	Tariff Info			String	name of the location
	latitude			Array[Objects]	Location Lat
	longitude			Array[Objects]	Location Long
	street			string	street address
	city			string	not included by default
	state			string	state name
	country			string	country name
	zip Code			numeric	postal code
	cape Lot Id			numeric	id
	lot Quote	total Cost		numeric	total fee
		pricing Lines	label	string	fee label
			value	numeric	fee amount
			type	string	type for the charges
		product Id		numeric	id
		product Status		string	open or closed
		currency		string	currency type

Field	Sub-field	Second Sub-field	Third Sub-field	Type	Description
		available		boolean	T or F
		start		ISO 8601 Timestamp	beginning data and time
		stop		ISO 8601 Timestamp	end data and time
		has Inventory		boolean	T or F
		has Enough Schedules		boolean	T or F
		early Bird		boolean	T or F
		early Bird Conditions			not included by default
	zone Entrance Image Url			String	url from their sever (s3 from amazonaws)
	hours Of Operation			Array[Time Periods]	data and time for the operation
	description			String	detail inputs about parking lot
	geometry				not included by default
Type				string	indicate type (reservation or not?)
TypeId				numeric	not included by default
GarageImplementations				numeric	not included by default
DistanceMiles				numeric	not included by default
ParkMobileSystem	id			numeric	not included by default
	name			string	not included by default
countryCode				string	
GpsPoints	longitude			Array[Objects]	coordinate info
	latitude			Array[Objects]	coordinate info
	description			string	
	city			string	
	street			string	
	is Entrance Coordinates			boolean	T or F
	zone GPS Type			string	
ZoneServices	DISABLED			string	Parking for people with special needs
	COVERED			string	This location offers covered parking
	ELEV			string	Elevator on site
	CHARGE			string	EV Charging available
	HEIGHT			string	Height Clearance
	MOBILE_ACCEPTED			string	Mobile Pass Accepted
	PAVED			string	This location is a paved surface
	SELF			string	Customer Parks their own vehicle

NJDOT Traveler Information API

What follows is the documentation for Transit Information API developed during this project:

Nearest Bus Stops

GET ***/bus/stops/:lng/:lat***

This api returns an array of the 15 closest bus stops from NJTRANSIT GTFS data.

Response

status string - 'success' or 'error'. data *array* - An array stop objects, each value representing a bus stop, sorted in order from closest to the lat/lng point provided in the request.

Transit Stop Object

The transit stop object includes data about the transit stop from NJTRANSIT GTFS. *stop_id string* - GTFS Stop Id *stop_codestring* - GTFS Stop Code *stop_name string* - GTFS Name of Stop, stop_lat *number* - Stop Latitude *stop_lon number* - Stop Longitude *distance number* - Distance between request location and stop location in meters. *route_ids array of strings* - List of GTFS route ids for bus routes which service this stop *route_text_colors array of strings* (*optional*) - List of route text colors with array index corresponding to index of route ID, is often blank, depends on GTFS Data. *route_colors array of strings*(*optional*) - List of route colors with array index corresponding to index of route ID, is often blank, depends on GTFS Data. *route_names array of strings* (*optional*) - List of route names with array index corresponding to index of route ID, is often blank, depends on GTFS Data.

example request

`https://transitfinder.availabs.org/bus/stops/-73.8238464/42.6795008`

example response


```
{
   "status":"success",
   "data":[
      {
         "stop_id":"28802",
         "stop_code":"26254",
         "stop_name":"RT-17A 223' N OF IRON FORGE RD.",
      "stop_lat":"41.250608000",
      "stop_lon":"-74.311112000",
      "distance":163769.31168766,
   }, ]  "197",s":[":[],":[],
```

```
        ...
    ]
}
```

Nearest Train Stops

GET ***/train/stops/:lng/:lat***

This api returns an array of the 15 closest train stops from NJTRANSIT GTFS data.

Response

status string - 'success' or 'error'. *data array* - An array of transit stop objects (see above), each value representing a train stop / station, sorted in order from closest to the lat/lng point provided in the request.

example request

`https://transitfinder.availabs.org/train/stops/-73.8238464/42.6795008`

example response

```
{
   "status":"success",
   "data":[
      {
         "stop_id":"32906",
         "stop_code":"95065",
         "stop_name":"JERSEY AVE.",
         "stop_lat":"40.476912000",
         "stop_lon":"-74.467363000",
         "distance":1635.923866087,
         "route_text_colors":[
            null
         ],
         "route_colors":[
            null
         ],
         "route_ids":[
            "9"

         ],
```

```
            "route_names":[
               "Northeast Corridor"
            ]
      },
      ...
   ]
}
```


Nearest Parking

GET ***/parking/spots/:lng/:lat***

This endpoint returns an array of parking locations within 3 miles of requested location. It pulls information from the ParkMoblile API and returns them in a unified parking spot data object. The ParkWhiz API was retired due to the lower data quality returned by ParkWhiz.

Response

array of parking objects **- This route returns an array of parking objects**

Parking Object

The parking object includes data about the location from ParkMobile. coordinates *object* - contains lon, lat as numbers. *distance number* - Distance between parking and requested location in meters. cost *number* - Simple cost for parking in dollars. available *boolean* (*optional*) - Indicating if there are available spots. name *string* - Name of the parking location *address string* - Street address of the parking location. *city string* - City of parking location *amenities array of strings*(*optional*) - A list of strings describing available amenities are parking location. *id string* - Parking location ID from datasource *img string* (*optional*) - URL string to image of parking location. *datasource string* - denotes if location came from parkwhiz of parkmobile api height *Restriction boolean* or *number* - false if no restriction, a number in inches if a restriction exists.

example request

`https://transitfinder.availabs.org/parking/spots/-74.453/40.494`


```
[
   {
   "coordinates":{
         "lon":-74.452203,
         "lat":40.49462
```

```
        },
        "distance":140,
    "cost":3.3,
    "available":true,
    "name":"Plum St Deck",
    "address":"20 Plum St",
    "city":"New Brunswick",
    "amenities":[
            "ADA Parking",
            "Covered",
            "Elevator",
            "Mobile Pass Accepted",
        "Paved",
            "Self Park"
        ],
        "id":132659,

"img":"https://cnp-assets-
production.s3.amazonaws.com/assets/lots/3796/lot_ent rance.png",
        "datasource":"parkmobile",
    "heightRestriction":98
    },
    ...
]
```

Realtime Data

GET /*realtime?mode=train?stopId=31453*

This endpoint returns an array of data. The data returned depends on the mode supplied. If no mode is supplied then the API defaults to bus.

Response

***array of realtime objects* -**

Realtime Object: bus

route ***string* - route number. *description string* - description needed. *time string* - time until arrival. *bus string* - the bus number.**

example request

```
https://transitfinder.availabls.org/realtime?stopId=31453&mode=bus
[
```

```
    {
    "route": '818',
        "description": 'To 818 NEW BRUNSWICK STRATFORD APTS',
        "time": '24 MIN',
        "bus": '6154'
    },
    ...
]
```


Realtime Object: train

color ***string*** (*optional*) **- RGBA color.** ***dep_time string*** **- HH:MM time string.** ***to string*** **- description needed.** ***track string*** **- description needed.** ***line string*** **- description needed.** ***train_no string*** **- description needed.** ***status string*** **- time until arrival.***example request*

https://transitfinder.availabls.org/realtime?stopId=WB&mode=train


```
[
    {
    "color": '',
    "dep_time": "11:27",
        "to": "Long Branch-BH",
        "track": "1",
        "line": "No Jersey Coast",
        "train_no": "3235",
        "status": "24 Min"
    },
    ...
]
```

Database Structure

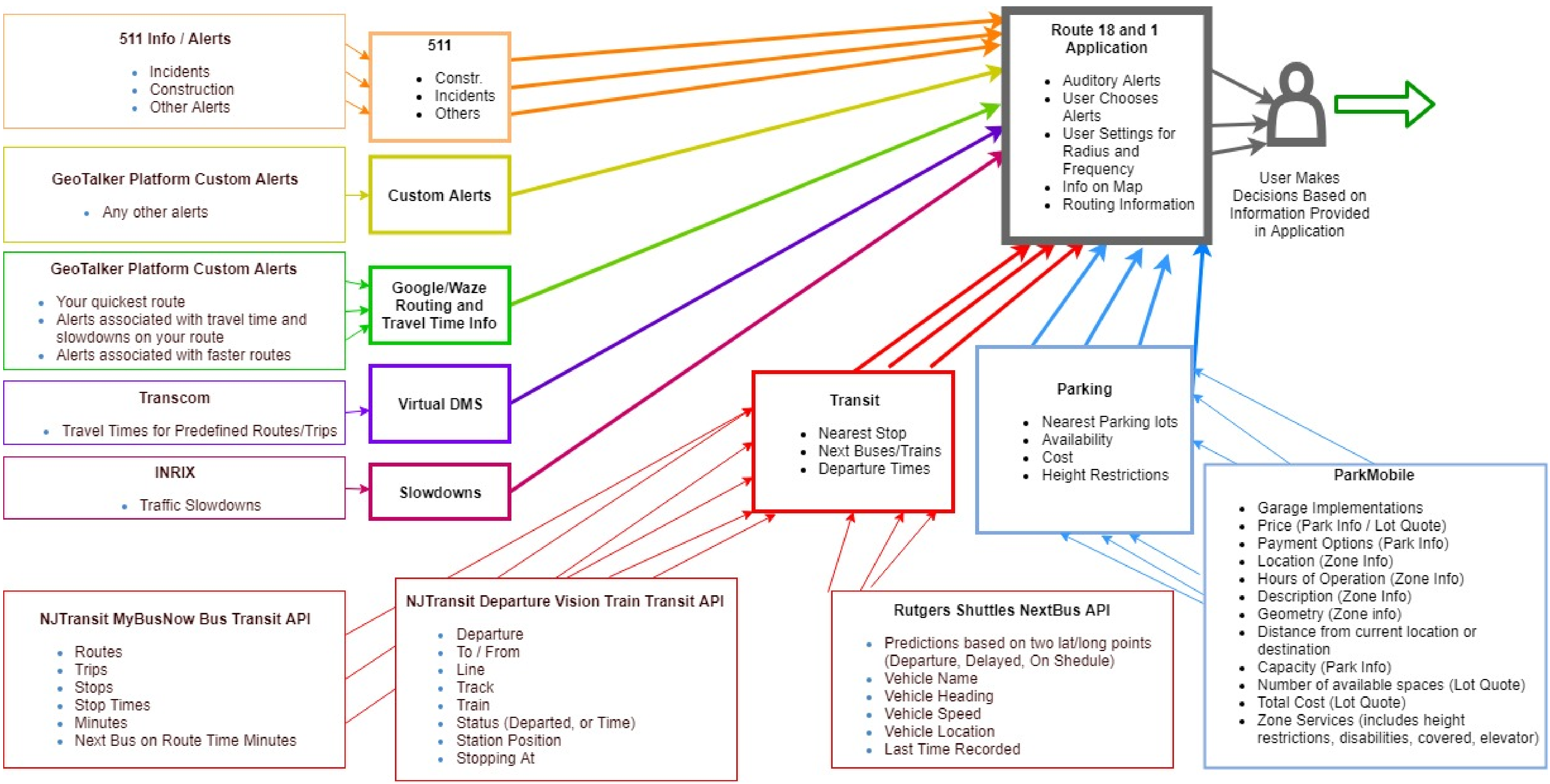


Figure 3 - Schematic of the NJDOT Traveler Information Application API

Task 4 System Design and Software Development

The software development process created the following design:

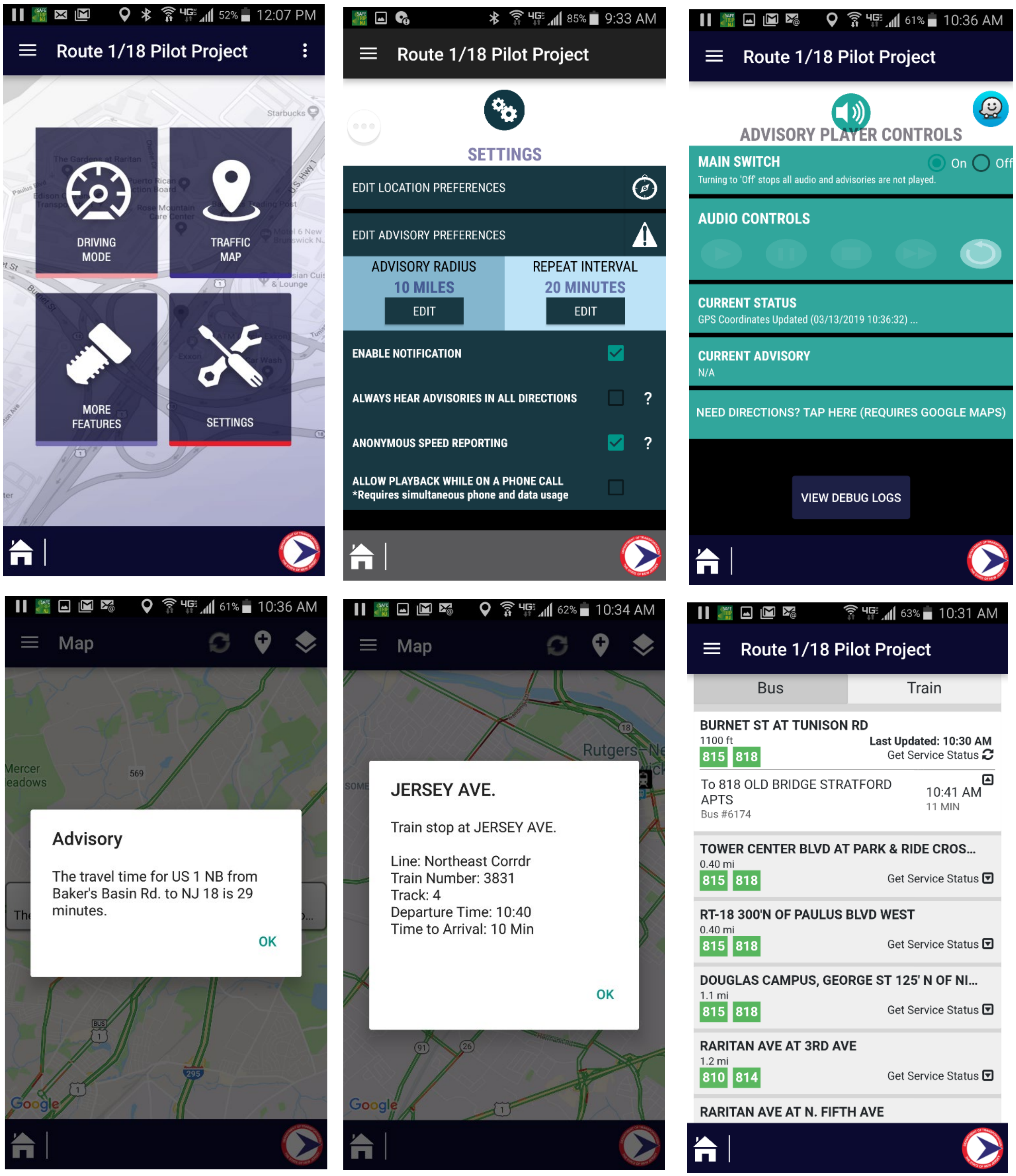


Figure 4 - User Interface Design for NJDOT Traveler Information Application for Routes 18 and 1

Software Application Architecture Wire-Frame

Figure 5 - Software Application Architecture Wire-Frame, includes all application features and interfaces

Task 5 Phased Deployment (Beta Test and Quality Assurance)

Task five is a phased deployment of the mobile travel application, starting with corridor specific enhanced real-time information features for the Route 1 corridor (from I-295 to Garden State Parkway) and sections of Route 18 (from New Jersey Turnpike to Rutgers University – Piscataway, NJ). The implementation of the mobile application, started with an initial test of a small group of users from the Bureau of Mobility and Systems Engineering. The users discovered a small number of bugs and provided feedback on usability. The application is fully performant.

CONCLUSIONS AND RECOMMENDATIONS

The following recommendations outline a Phase 2 scope of work for the Route 1/18 mobile application pilot project. The document is divided into several sections. Each section describes either a specific task, or an area of responsibility to be defined.

Host & Maintain APIs

ILOG is capable of hosting and maintaining transit APIs that have been developed by SUNY for this project. These would have included:

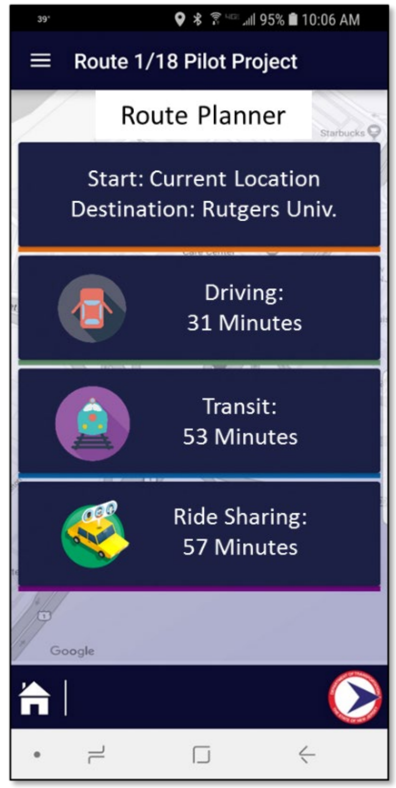
- nearest bus stops
- nearest train stops
- nearest parking
- real-time transit data

ILOG would have needed more extensive documentation about these API calls, particularly related to how they are stored, the code itself, and the source feeds before being able to assume control of these APIs.

Route Planning

A new "Route Planning" button could have been added to the mobile app. This button would have used Google API calls to provide travel routes and times across different modes of transportation. The benefit to using the Google API calls is that users will have the flexibility to enter custom starting and ending locations.

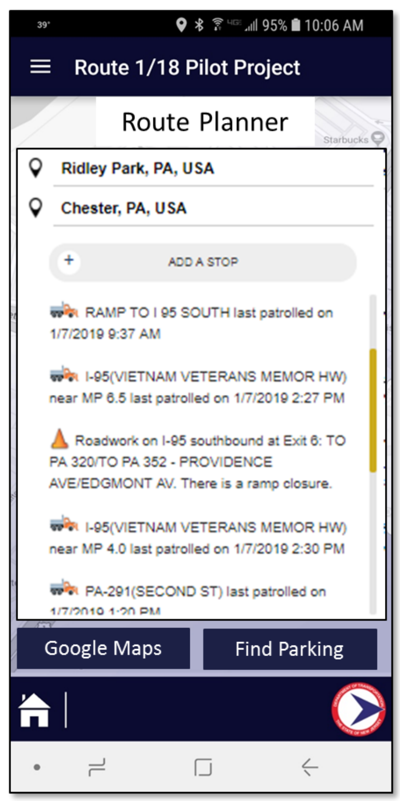
The user experience would be similar to the following:



After pressing the Route Planning button, the user would be prompted to enter a starting point (or use current location) and a destination point. They would also have the option to see routes to saved locations, which would include a point for "home" and a point for "work."

When typing the starting and destination locations, lists of options would auto-populate with Google answers, as the crossover to Google Maps in the app currently does. When selected, check boxes will be available to save the locations under the labels "home" and "work."

After selecting starting and ending points, the user would be presented with three options for their trip: driving, transit, and ride sharing (if available). These would be displayed as three buttons, with a title for the option (driving, etc.), an icon, and the estimated travel time for the primary route shown by Google. While this data will initially be populated through Google API calls, the source of travel times may be changed in the future to include other sources, which may include information developed by SUNY.



The option with the shortest travel time may have the button highlighted in some way. This may mean a different color, or highlighting.

Tapping any of these buttons would display the primary and alternative route options, if offered from Google.

If only one option exists, or if the user chooses a route option, a list with turn-by-turn directions would appear. This list would be interlaid with incident and construction points along the route, as Check My Route does on the 511PA site (www.511pa.com) does during winter months.

The events from the Check My Route function can be available for driving directions, and they can also be available for transit directions. This might be helpful to alert users to the types of road hazards that might be along their bus route. The Check My Route alerts would only be heard if Drive Mode were activated by the user.

Near the bottom of the directions list, a button will be available that says "find parking." This button should launch the internal app map, with the map centered on the origination or destination location (user will select), and the parking finder layer turned on by default. Before the map appears, the user will be prompted to select if they would like to see parking near the origination or destination.

On the directions screen, there will be a button that launches Google maps, with the origin, destination, and mode of travel already selected. If the user selects the driving option, the driving mode function in GeoTalker will also be launched, so that the audio alerts are heard in addition to the turn-by-turn directions.

For this version of the Route Planner, the owner of this enhanced computer application would need to procure a Google license, which would be used to generate the travel data that populates the app, and for other required Google-related API calls.

Commuter Virtual DMS

Phase 1 work included the incorporation of various DMS travel times along the Route 1/18 corridor (from TransCom trip data) plotted on the app's map. These would have been selected in the Advisory Preferences section of the app for Phase 1. Phase 2 would expand the virtual DMS to include several additional features:

- The Virtual DMS will be announced as part of the Drive Mode function. ILOG is capable of creating the ability to allow the owner of this enhanced computer application to determine a threshold at which Virtual DMS travel times will be re-announced. They would initially be announced upon app startup.

- A more robust user selection of available DMS could be made available through the app's settings. Instead of being integrated into the app's current alert selection structure (which is checkbox-based), a separate DMS selection menu could be created. This would appear as a list of selectable rows that the user may use to organize their selection. There could also be a search feature, which would allow users to search by specific terms, such as "95."

- If transit data is also found to be suitable for a virtual DMS announcement, a similar structure may be created for selecting transit route data that would be announced.
    - Clarification in any future phases with the owner of the enhanced computer application would be necessary to determine the source of data and how it would be used by the public.

- The virtual DMS could be structured to incorporate state-wide sign data, although beta testing might focus on an initial set of signs along the Route 1/18 corridor.

GeoTalker Upgrade Features

Several features could be planned as enhancements to the general GeoTalker platform as parts of other projects, and they will be made available to the owner of the enhanced computer application.

These features should be included as part of any software-service agreement made with the owner of this enhanced computer application. These include:

- In-app notifications – which may be used in place of certain types of alerts. For instance, these could be a different way of alerting travelers of updates for transit cancellations.

- Additional controls for users, in terms of when they would like to hear alerts.

- The ability to link to detailed detour information.

Beta Testing Phase

The beta testing for Phase 2 would have included test apps for both Android and iOS platforms. These apps would not necessarily be available to the general public, but members of the public may be solicited for testing at the computer application owner's discretion. All testers, internal or from the public, would be invited via the Google Play and iTunes off-market testing platforms. The number of testers allowed would need to conform to any restrictions imposed by iTunes and/or Google Play.

For the beta testing, ILOG is capable of programming the enhanced computer app to prompt users for feedback before exiting the app. This could be done as a message screen before confirming the user exiting the app, but may need to be modified to accommodate iOS restrictions.

ILOG is capable of providing written instructions for how users may become testers, and how to set up the test apps on phones. A tutorial video would also be made available, which will give testers an overview of the app's functions.

Hosting

Phase 2 scope would have included both hosting for the identified SUNY APIs, as well as the licensing/hosting cost for the GeoTalker platform, which continues to be offered as software-as-a-service. Hosting could have continued to be provided by ILOG in our cloud-hosted environment, however, hosting decisions will be made internally at NJDOT with NJ OIT's approval and guidance.

Data Ownership

All probe data generated by the app would naturally be the property of the owner of the enhanced computer application, which could be used for future research/analysis purposes.

Risks

The following external dependencies do or would exist for the app's performance:

- Google data - route information, traffic layer on app map.
- AWS for service hosting.
- TransCom data feed for travel times, as well as existing GeoTalker feeds.
- Parking information from ParkMobile, and any other vendors that are added.
- NJ Transit GTFS data – bus and train information.

- PennDOT, PTC, and INRIX data feeds for Pennsylvania information.

This list of external dependencies does not include additional data feeds that may be incorporated as part of any Phase 2 work, such as additional transit data.