Development Environment Setup and User Manual

for

AGORA

Version 2.0

A Versatile Environment for the Development of IntelliDrive Applications

(Visual …Extensible …Rule-Based)

Department of Computer Science, Western Michigan University

Table of Contents

Revision History

Name	Date	Reason For Changes	Version
Vinay B Gavirangaswamy	01/24/2010	Initial Draft	1.0
Vinay B Gavirangaswamy	02/16/2010	Changed project name from VII to AGORA, changed paragraph formatting, and reformatted cover page.	1.1
Vinay B Gavirangaswamy	06/22/2010	Enhanced TMC related documentation	1.2
Jamie Lynn Groos	06/23/2010	Enhanced VIS related documentation	1.3
Vinay B Gavirangaswamy	07/06/2010	New version release	2.0

1. Introduction

1.1 Purpose

AGORA refers to a set of application and infrastructure which constitutes intellidrive environment that is being developed at Computer Science Department, Western Michigan University. This project consists of several software applications and hardware components. This infrastructure consists of On-Board Equipment (OBE), Road Side Equipment (RSE), and Traffic Management Centers (TMC), which work together to increase the safety and efficiency of the transportation network.
This document is intended to help internal and external team member to get up to speed with the development environment, installation procedures and user manual for the different systems that are being developed.

1.2 Intended Audience

Document is primarily intended for members of MDOT team which consists of graduate students working under the guidance of Dr. Ala Al-Fuqaha and Dr. Dionysios Kountanis.

1.3 References

- http://www.oracle.com/us/technologies/java/index.htm
- http://netbeans.org/
- http://www.mysql.com/
- http://www.eclipse.org/
- http://javafx.com/
- http://www8.garmin.com/support
- https://glassfish.dev.java.net/

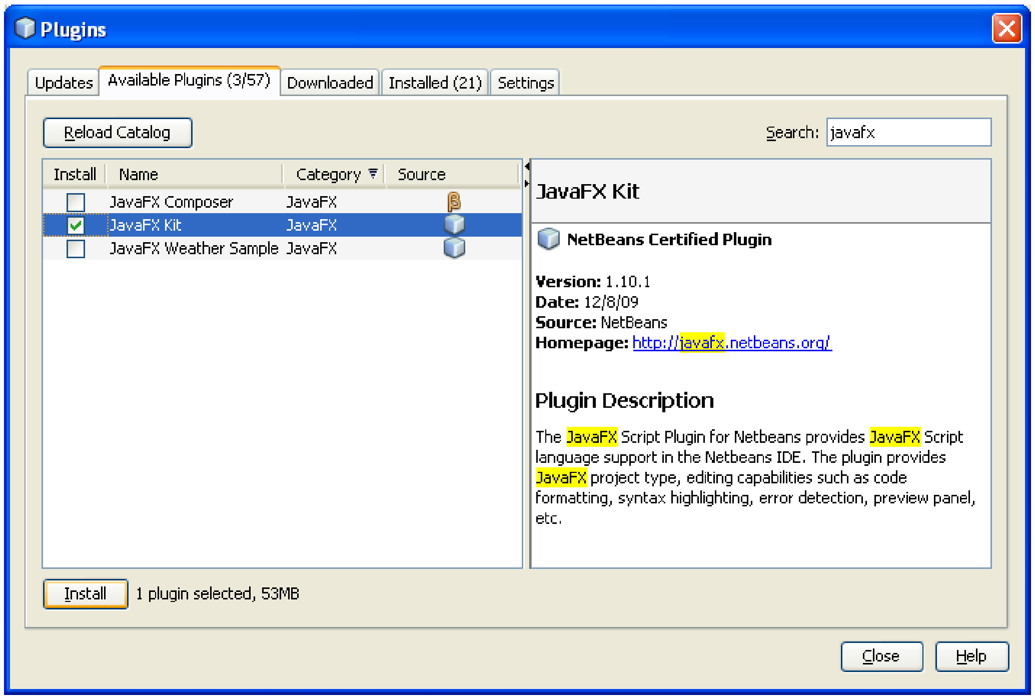
2. Installation Procedure

2.1 VIS/A3/Gov 2.0

Operating System: Microsoft Windows XP Professional Service Pack 3

Install JDK 6 Update 17 with NetBeans 6.8
1. Download from http://java.sun.com/javase/downloads/widget/jdk_netbeans.jsp
2. Run installer (accept all defaults).

Install JAVAFX Plugin for NetBeans
1. Open NetBeans.
2. Open Plugins Manager Tools > Plugins
3. Switch to Available Plugin tab and type *javafx* in the search box.
4. Check *JavaFX Kit* box.
5. Click Install (accept all defaults).



Install	Name	Category	Source
☐	JavaFX Composer	JavaFX	
✓	JavaFX Kit	JavaFX	
☐	JavaFX Weather Sample	JavaFX	

JavaFX Kit

NetBeans Certified Plugin

Version: 1.10.1
Date: 12/8/09
Source: NetBeans
Homepage: http://javafx.netbeans.org/

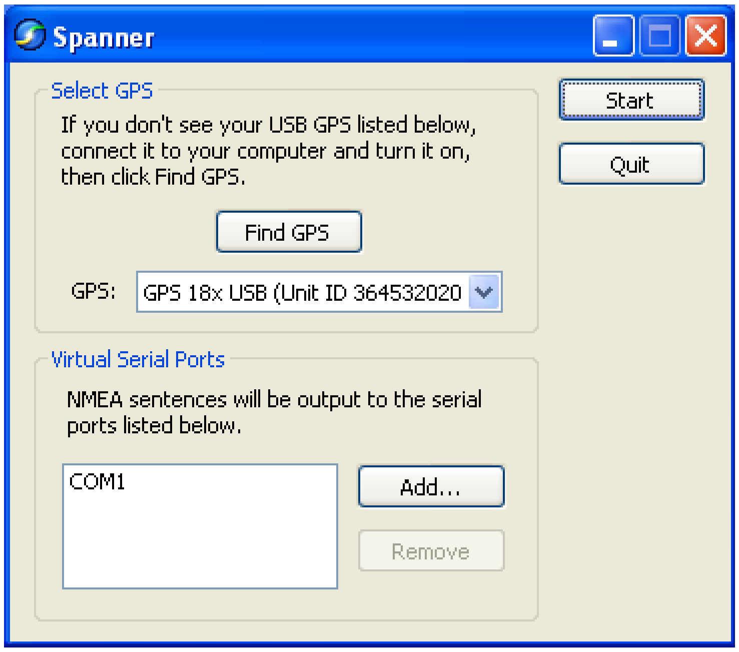
Plugin Description

The JavaFX Script Plugin for Netbeans provides JavaFX Script language support in the Netbeans IDE. The plugin provides JavaFX project type, editing capabilities such as code formatting, syntax highlighting, error detection, preview panel, etc.

Install Spanner (used for accessing Garmin GPS)
1. Download from http://www8.garmin.com/support/download_details.jsp?id=1627
2. Unzip to desired folder (default: C:\garmin).
3. Run SpannerSetup (accept all defaults).

Add Spanner as a Startup Program
1. Copy Spanner program
Start > All Programs > Garmin > Spanner > Right-click > Copy
2. Paste to Startup Folder
C:\Documents and Settings\All Users\Start Menu\Programs\Startup > Right-click > Paste

<u>Test GPS Connectivity</u>
1. Attach the GPS device to an available USB port.
2. Run the Spanner program.
3. Select the GPS from the drop down box.
4. Click the Start button.



Spanner

Select GPS

If you don't see your USB GPS listed below, connect it to your computer and turn it on, then click Find GPS.

GPS: GPS 18x USB (Unit ID 364532020

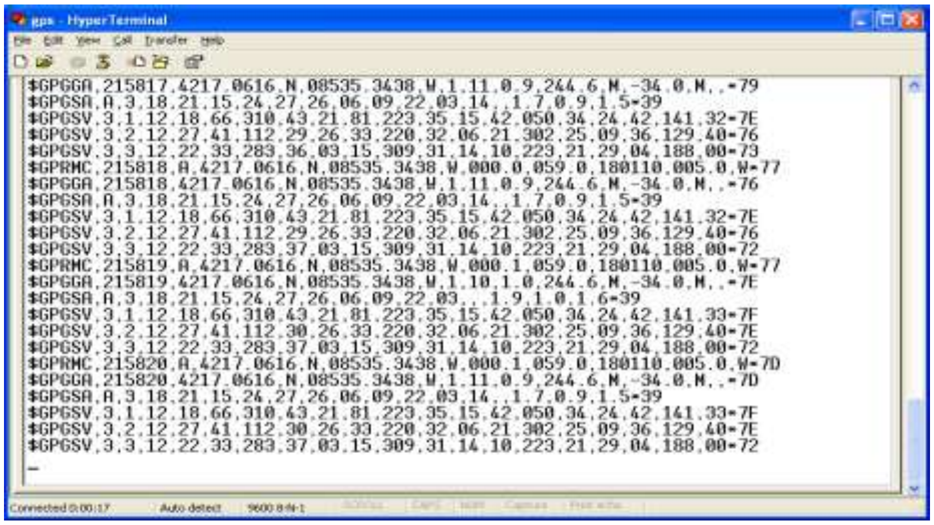
Virtual Serial Ports

NMEA sentences will be output to the serial ports listed below.

COM1

5. Open HyperTerminal
Start > All Programs > Accessories > Communications > HyperTerminal
6. Type *gps* in the Name box.
7. Click OK.
8. Connect using: COM1
9. Click OK.
10. Change Bits per second to 9600.
11. Click OK.

*If a connection to the GPS is made, data should be displayed similar the image below.



gps - HyperTerminal

```
$GPGGA,215817,4217.0616,N,08535.3438,W,1,11,0.9,244.6,M,-34.0,M,,*79
$GPGSA,A,3,18,21,15,24,27,26,06,09,22,03,14,,1.7,0.9,1.5*39
$GPGSV,3,1,12,18,66,310,43,21,81,223,35,15,42,050,34,24,42,141,32*7E
$GPGSV,3,2,12,27,41,112,29,26,33,220,32,06,21,302,25,09,36,129,40*76
$GPGSV,3,3,12,22,33,283,36,03,15,309,31,14,10,223,21,29,04,188,00*73
$GPRMC,215818,A,4217.0616,N,08535.3438,W,000.0,059.0,180110,005.0,W*77
$GPGGA,215818,4217.0616,N,08535.3438,W,1,11,0.9,244.6,M,-34.0,M,,*76
$GPGSA,A,3,18,21,15,24,27,26,06,09,22,03,14,,1.7,0.9,1.5*39
$GPGSV,3,1,12,18,66,310,43,21,81,223,35,15,42,050,34,24,42,141,32*7E
$GPGSV,3,2,12,27,41,112,29,26,33,220,32,06,21,302,25,09,36,129,40*76
$GPGSV,3,3,12,22,33,283,37,03,15,309,31,14,10,223,21,29,04,188,00*72
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$GPGSA,A,3,18,21,15,24,27,26,06,09,22,03,,,1.9,1.0,1.6*39
$GPGSV,3,1,12,18,66,310,43,21,81,223,35,15,42,050,34,24,42,141,33*7F
$GPGSV,3,2,12,27,41,112,30,26,33,220,32,06,21,302,25,09,36,129,40*7E
$GPGSV,3,3,12,22,33,283,37,03,15,309,31,14,10,223,21,29,04,188,00*72
$GPRMC,215820,A,4217.0616,N,08535.3438,W,000.1,059.0,180110,005.0,W*7D
$GPGGA,215820,4217.0616,N,08535.3438,W,1,11,0.9,244.6,M,-34.0,M,,*7D
$GPGSA,A,3,18,21,15,24,27,26,06,09,22,03,14,,1.7,0.9,1.5*39
$GPGSV,3,1,12,18,66,310,43,21,81,223,35,15,42,050,34,24,42,141,33*7F
$GPGSV,3,2,12,27,41,112,30,26,33,220,32,06,21,302,25,09,36,129,40*7E
$GPGSV,3,3,12,22,33,283,37,03,15,309,31,14,10,223,21,29,04,188,00*72
_
```

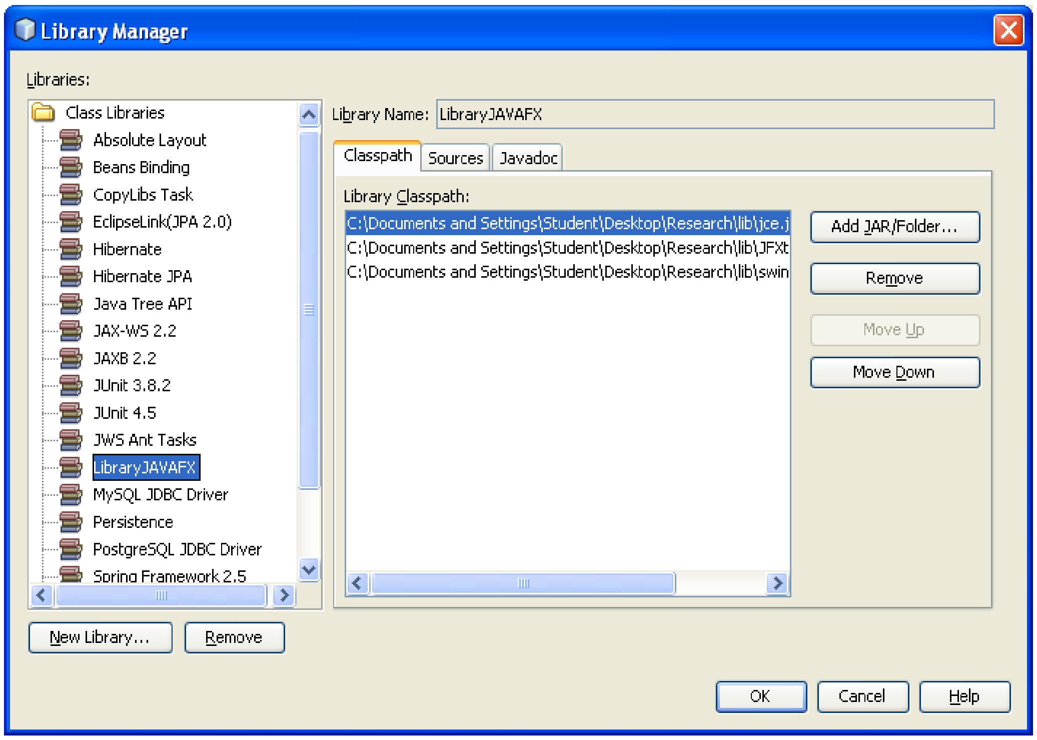
Connected 0:00:17 Auto detect 9600 8-N-1

Install Java Media Framework (JMF) 2.1.1e
1. Download from http://java.sun.com/javase/technologies/desktop/media/jmf/2.1.1/download.html

2. Run installer (accept all defaults).

Add OBDII Library:
1. Copy rxtxSerial.dll to C:\Documents and Settings\Student\.netbeans\6.8\javafx-sdk\lib\desktop

Setup MDOT Project in NetBeans
1. Copy MDOT files/folders to desired location.
(Default: C:\Documents and Settings\Student\Desktop\Research)
2. Open NetBeans.
3. Add new project.
File > Open Project > (browse to mdot folder)/PathAnimationNew > Open Project
4. Create LibraryJAVAFX
Expand PathAnimation in Projects Tab
Right-Click Libraries > Add Library > Manage Libraries > New Library
Library Name: LibraryJAVAFX
Library Type: Class Libraries
Click OK.
Add JAR/Folder > (browse to MDOT directory)/lib
Select: jce.jar
JFXtras-0.5.jar
swing-layout-1.0.3.jar
Add JAR/Folder
Click OK.
Select LibraryJAVAFX from Add Library window > Add Library

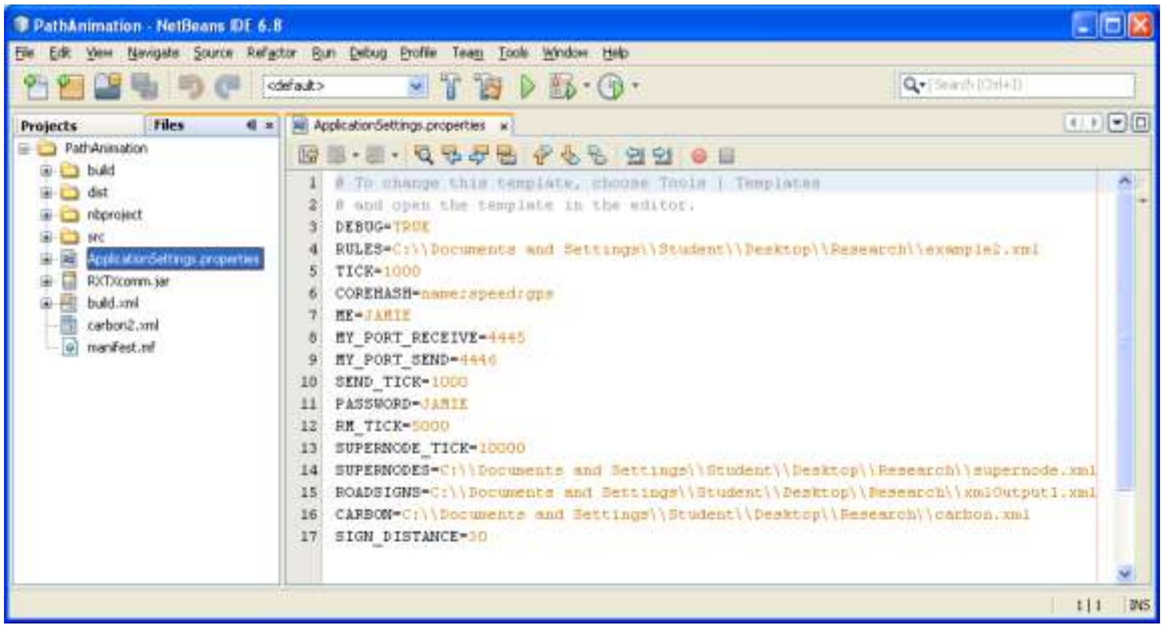


Library Name: LibraryJAVAFX

Library Classpath:
C:\Documents and Settings\Student\Desktop\Research\lib\jce.j
C:\Documents and Settings\Student\Desktop\Research\lib\JFXt
C:\Documents and Settings\Student\Desktop\Research\lib\swin

5. Change path in Application Settings File.
Click on the Files tab.

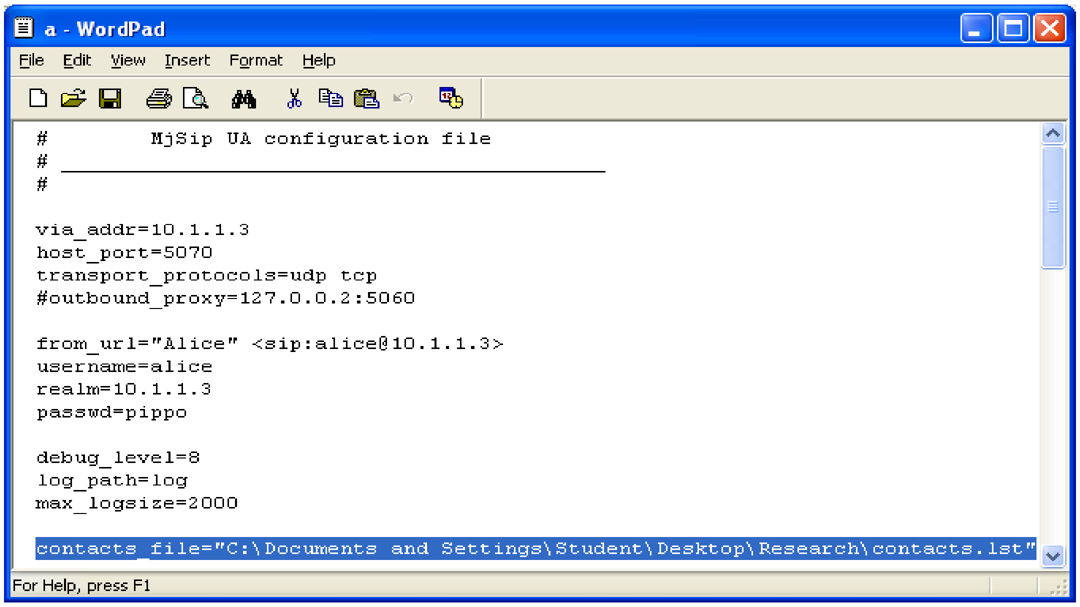
Expand PathAnimation.
Double click ApplicationSettings.properties file.
Change path of RULES, SUPERNODES, ROADSIGNS to point to corresponding xml files. (example2.xml, supernode.xml, xmlOutput.xml - found in MDOT folder)



```
# To change this template, choose Tools | Templates
# and open the template in the editor.
DEBUG=TRUE
RULES=C:\\Documents and Settings\\Student\\Desktop\\Research\\example2.xml
TICK=1000
COREHASH=name:speed:gps
ME=JAMIE
MY_PORT_RECEIVE=4445
MY_PORT_SEND=4446
SEND_TICK=1000
PASSWORD=JAMIE
RM_TICK=5000
SUPERNODE_TICK=10000
SUPERNODES=C:\\Documents and Settings\\Student\\Desktop\\Research\\supernode.xml
ROADSIGNS=C:\\Documents and Settings\\Student\\Desktop\\Research\\xmlOutput1.xml
CARBON=C:\\Documents and Settings\\Student\\Desktop\\Research\\carbon.xml
SIGN_DISTANCE=30
```

Change Path/Settings in VOIP config file:
1. Create a folder named *log* in the Research folder.
2. Edit .cfg file (in Research folder) that corresponds to a VOIP user (a.cfg or b.cfg)

contacts_file="C:\Documents and Settings\Student\Desktop\Research\contacts.lst"



```
#        MjSip UA configuration file
# ____________________________________________
#

via_addr=10.1.1.3
host_port=5070
transport_protocols=udp tcp
#outbound_proxy=127.0.0.2:5060

from_url="Alice" <sip:alice@10.1.1.3>
username=alice
realm=10.1.1.3
passwd=pippo

debug_level=8
log_path=log
max_logsize=2000

contacts_file="C:\Documents and Settings\Student\Desktop\Research\contacts.lst"
```

Note: If building and running the NetBeans project, you get the error message:

Unable to start java.exe: The system cannot find the file specified.

Java did not get installed on the system (even though it should be in the NetBeans bundle). Download and install Java 6 Update 18 from http://www.java.com/en/download/manual.jsp

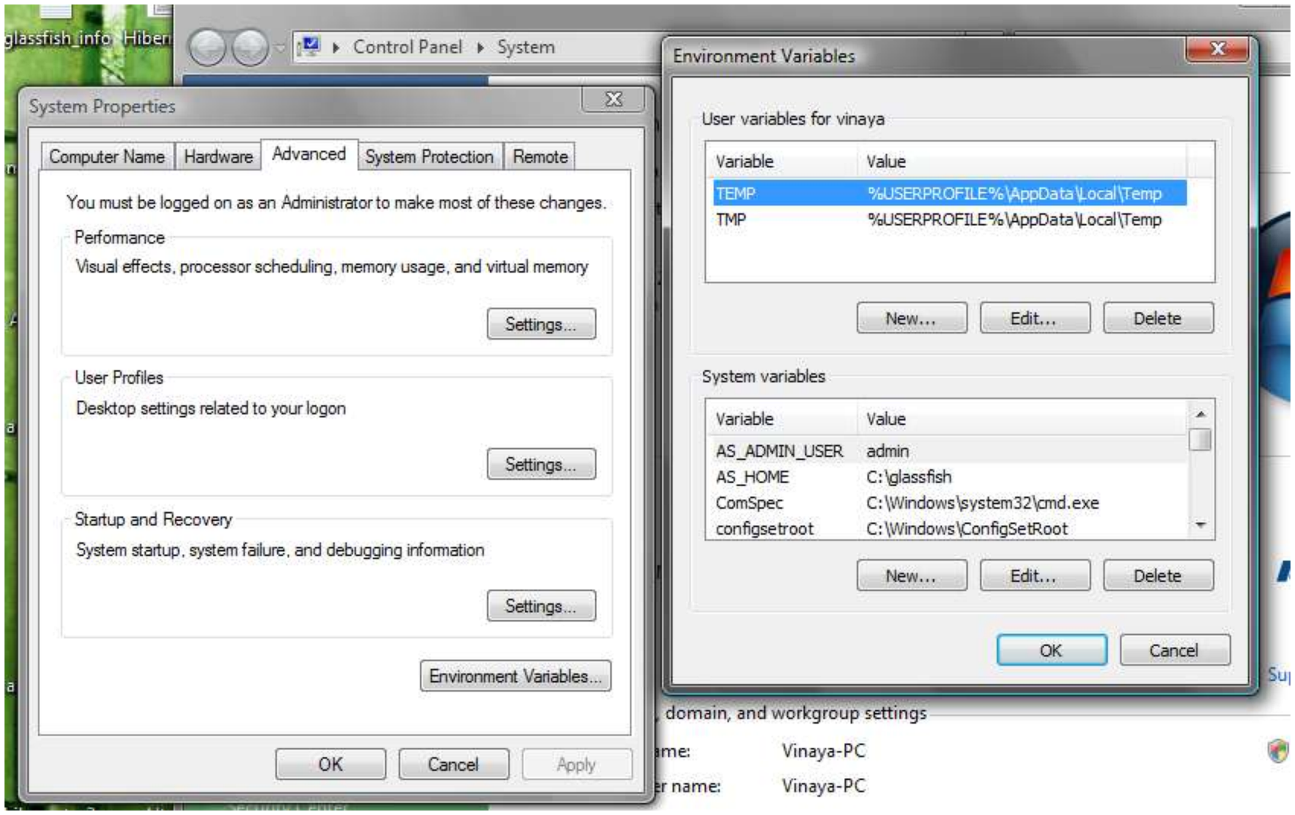
2.2 TMC

Download and install

Glassfish

Version: 2.1.1
URL: https://glassfish.dev.java.net/public/downloadsindex.html
Install location: c:\glassfish
Install instruction: Please refer to glassfish web site for install instructions
Environment variables:
Please setup following system environment variable as shown below

Variable Name	Value
AS_ADMIN_USER	admin
AS_HOME	C:\glassfish
JAVA_HOME	<your system java install directory>



You must be logged on as an Administrator to make most of these changes.

Performance
Visual effects, processor scheduling, memory usage, and virtual memory

User Profiles
Desktop settings related to your logon

Startup and Recovery
System startup, system failure, and debugging information

User variables for vinaya

Variable	Value
TEMP	%USERPROFILE%\AppData\Local\Temp
TMP	%USERPROFILE%\AppData\Local\Temp

System variables

Variable	Value
AS_ADMIN_USER	admin
AS_HOME	C:\glassfish
ComSpec	C:\Windows\system32\cmd.exe
configsetroot	C:\Windows\ConfigSetRoot

domain, and workgroup settings

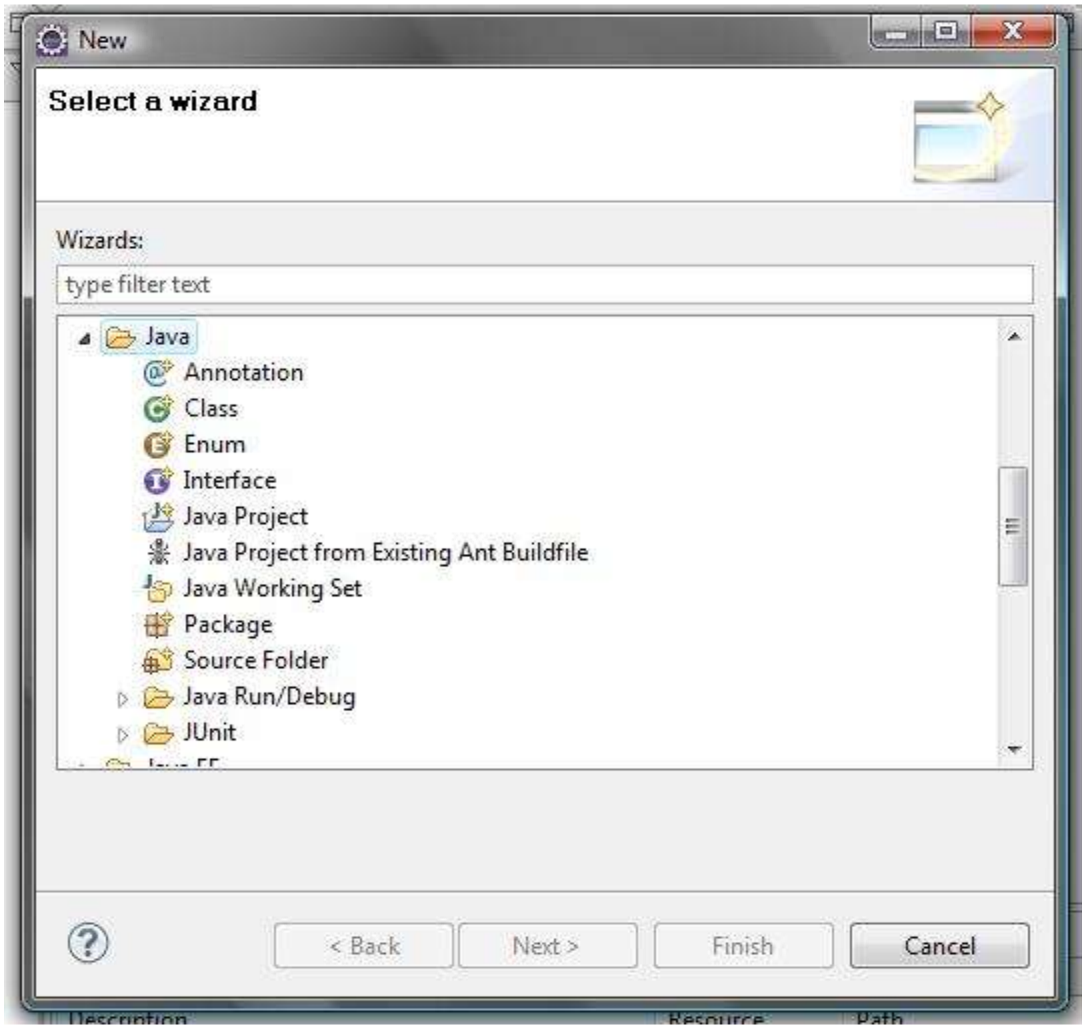
me:	Vinaya-PC
r name:	Vinaya-PC

Eclipse Java EE IDE for Web Developers

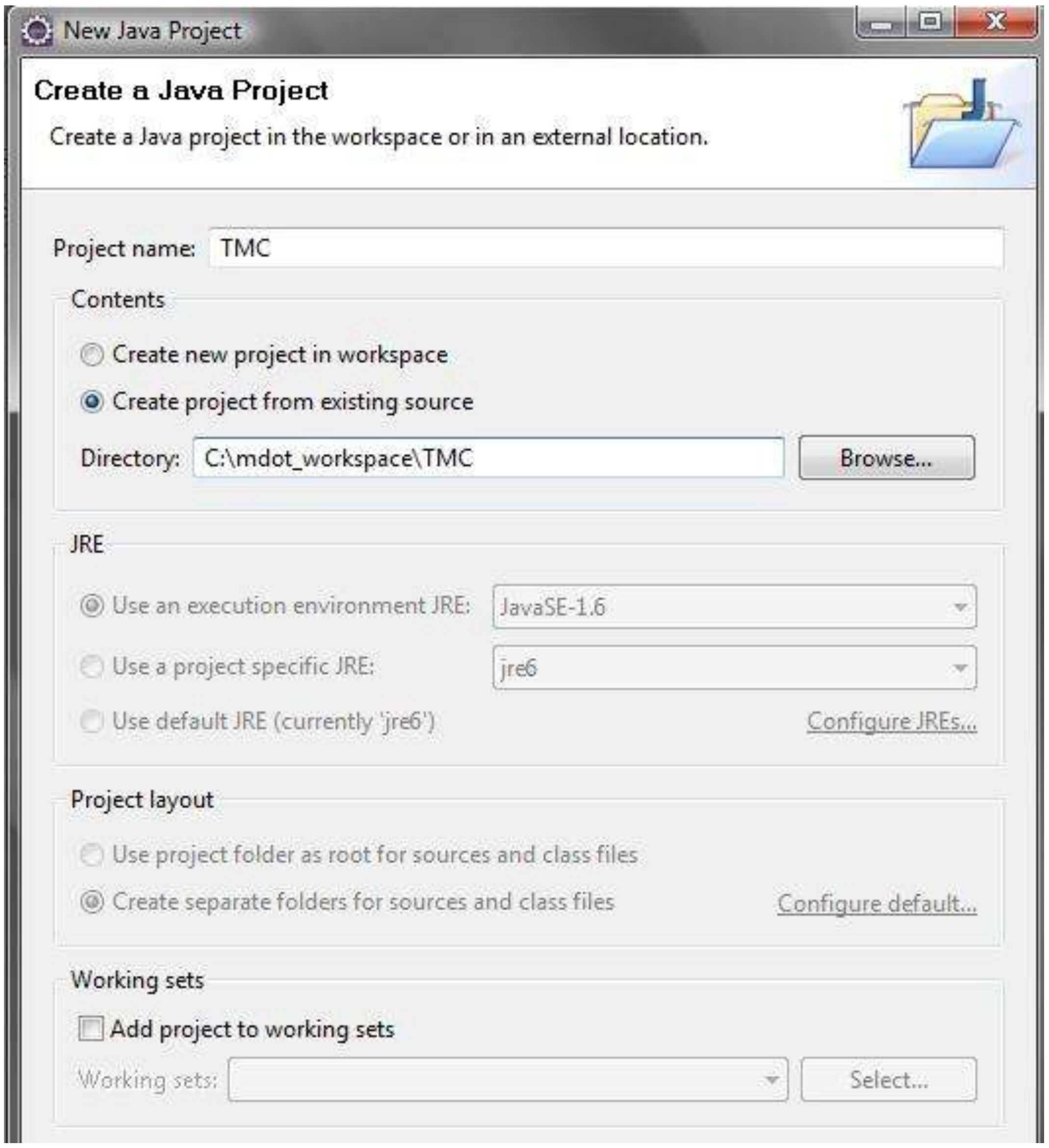
Version: any
URL: http://www.eclipse.org/downloads/
Install location: c:\eclipse
Install instruction: unzip downloaded archive to above specified directory

TMC Application Setup:

Copy TMC.zip to a directory called c:\mdot_workspace
Upzip archieve
Open eclipse and select c:\mdot_workspace as your workspace
Goto file->new->other



And enter following information in the next screen


New Java Project

Create a Java Project

Create a Java project in the workspace or in an external location.

Project name: TMC

Contents

( ) Create new project in workspace

(●) Create project from existing source

Directory: C:\mdot_workspace\TMC [Browse...]

JRE

(●) Use an execution environment JRE: JavaSE-1.6

( ) Use a project specific JRE: jre6

( ) Use default JRE (currently 'jre6') Configure JREs...

Project layout

( ) Use project folder as root for sources and class files

(●) Create separate folders for sources and class files Configure default...

Working sets

☐ Add project to working sets

Working sets: [Select...]

Accept default options for the rest and click Finish.

Build and deploy Instructions:

Run ant script under TMC\build\build.xml. This will create a war archived file under TMC\bin\war. Deploy this war file in glassfish application server.
Note: To read on how to deploy application on glassfish server please refer to appropriate section of glassfish application sever documentation.

3. User Manual

3.1 Gov 2.0

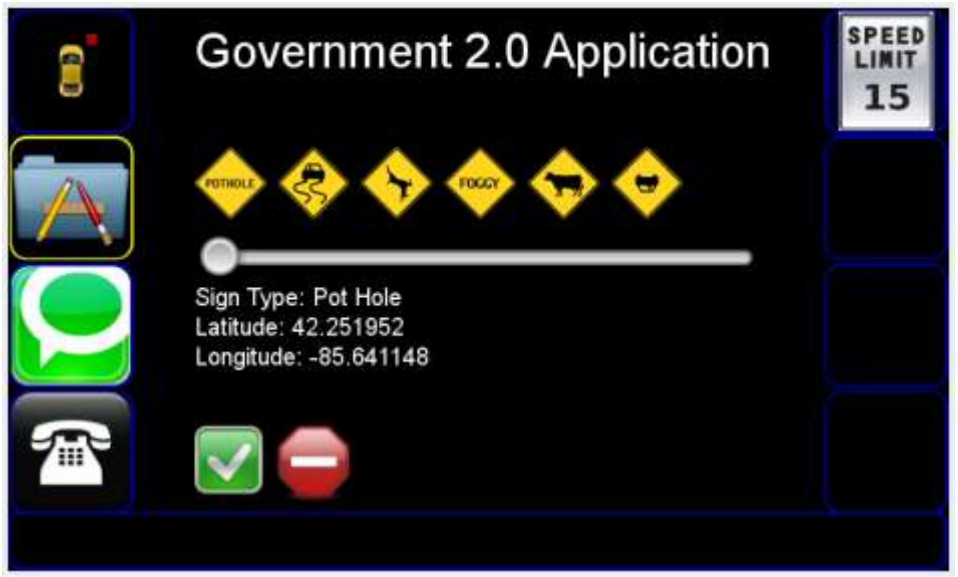
3.1.1 Navigation Instructions

Application Icon →Gov 2.0 Icon

3.1.2 Screen Shots

Application Selection Screen:

Gov 2.0 Application Screen:



Sign Type: Pot Hole
Latitude: 42.251952
Longitude: -85.641148

Figure 1: Gov 2.0

Description:

In some cases it is necessary for a diver to provide information about current driving conditions to a Traffic Management Center (TMC). For example, if a driver encounters an accident, they should have a way to easily report the accident so that proper authorities can be dispatched and other drivers alerted of the possible hazards. The Gov 2.0 (Government 2.0) provides the very functionality described above.

How It Works:

The Gov 2.0 application displays hazards (as icons) that a driver may encounter in the transportation system. When a driver encounters a hazard that needs to be reported, he/she selects the proper hazard by touching the correct icon. Once the icon representing the hazard is selected, a verification area is displayed to confirm the type of hazard along with the latitude and longitude locations of the hazard. The driver then selects the confirm or the cancel button and depending on the action, the hazard information is transmitted to the TMC, where it is stored in a hazard locations database. Based on the frequency of a certain hazard being reported (at a particular location), the transportation authority can prioritize the hazards and take the appropriate actions. This hazard information is also conveyed to the users of VIS in the same geographic area through the on-demand A3 application (or dynamic signs/alerts) as described in section 3.2.

3.2 A3

3.2.1 Navigation Instructions

Application Icon →A3 Icon

A3 Application Screen:

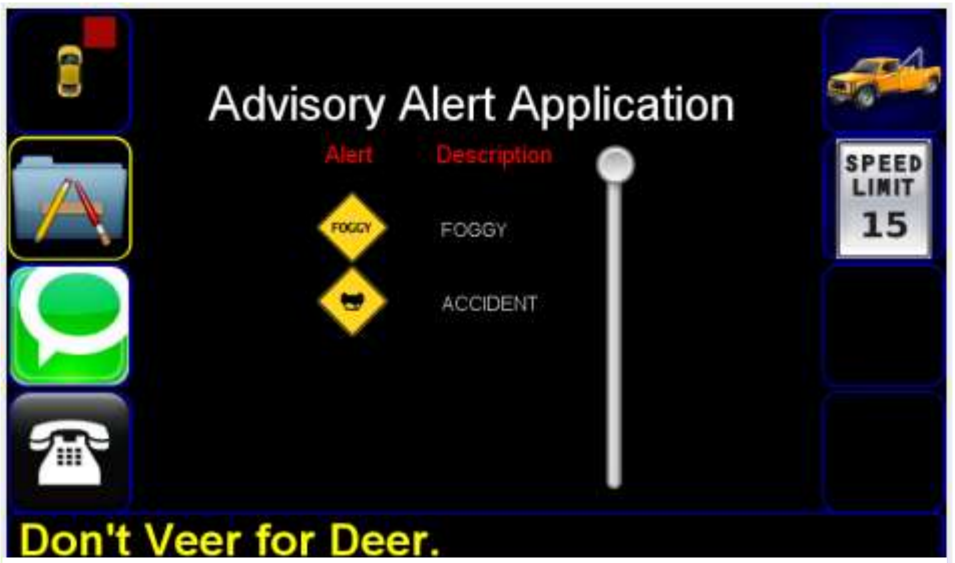


Figure 2: A3

Description:

In order to keep drivers safe it is necessary for them to know about the hazards in their area. The Advisory Alert Application (A3) offers an easy way for drivers to be alerted of possible hazards in their area.

How It Works:

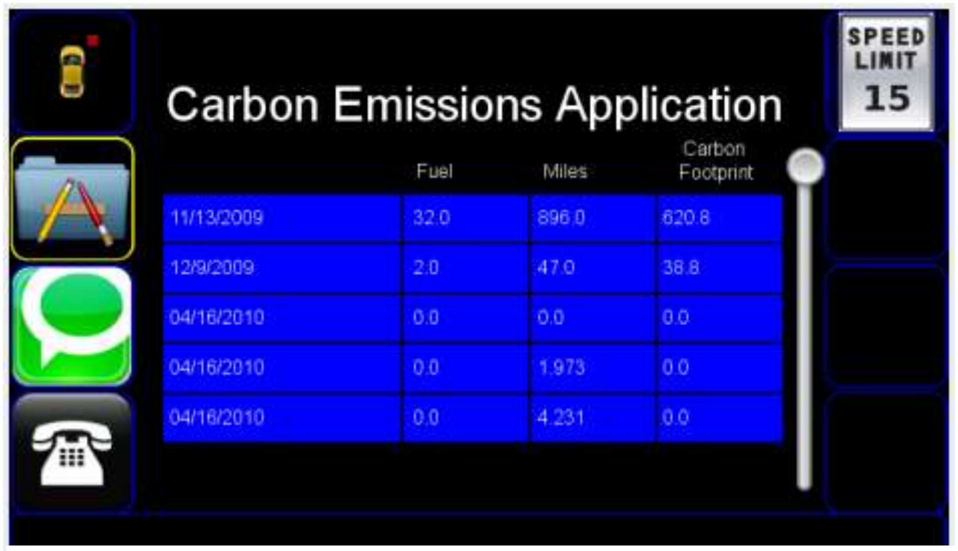
When the driver selects the Advisory Alert application from the applications menu, a message is sent to the TMC that includes the driver's current latitude and longitude. Based on this information the TMC searches its hazards database and determines the hazards that are in the driver's immediate area and sends back a list of hazards that the driver should be aware of. The hazards are visually displayed with a small icon and some corresponding text that explains the details.

3.3 Carbon Emissions Tracker

3.3.1 Navigation Instructions

Application Icon →Car Emissions Tracker Icon

Carbon Emissions Tracker Application Screen:



Carbon Emissions Application

	Fuel	Miles	Carbon Footprint
11/13/2009	32.0	896.0	620.8
12/9/2009	2.0	47.0	38.8
04/16/2010	0.0	0.0	0.0
04/16/2010	0.0	1.973	0.0
04/16/2010	0.0	4.231	0.0

Figure 3: Carbon Emissions Tracker

Description:

With the increasing threat of global warming, individuals are becoming more conscious about their impact on the environment. The Carbon Emissions Tracker allows individuals to track the amount of carbon their vehicle puts into the atmosphere each time they turn the car on by simply displaying it on the screen in a trip-by-trip format.

How It Works:

The Carbon Emissions Tracker calculates the miles traveled, fuel used and carbon foot print for each “trip” which is defined to be the time from which the engine is started, to the time it shut off. The number of miles traveled is calculated using the GPS device which is attached to the system. Every 10 seconds, the GPS is polled for the new location of the car. The distance between the new latitude and longitude location and the old latitude and longitude location is then calculated and added to the running distance total.

The Carbon Emissions Tracker is able to calculate the amount of fuel consumed during a trip by using data read from the OBD (On-Board Diagnostics) System that is standard on cars manufactured starting in 1996.

The values of mass air flow and speed are requested from the OBD and then plugged into the following equation which returns the instantaneous miles per gallon (MPG) of the vehicle.

Instantaneous MPG = (14.7 * 6.17 * 454 * SPEED) / (3600 * MASS AIR FLOW)

- 14.7 grams of air to 1 gram of gasoline - ideal air/fuel ratio
- 6.17 pounds per gallon - density of gasoline
- 454 grams per pound - conversion
- 3600 seconds per hour conversion

To find the average MPG during a trip, the instantaneous rate is averaged over time.

The carbon footprint during a trip requires a few calculated values. First, to calculate the CO2 emissions from a gallon of fuel, the carbon emissions are multiplied by the ratio of the molecular weight of CO2 (m.w. 44) to the molecular weight of carbon (m.w.12): 44/12.

CO2 emissions from a gallon of gasoline = 2,421 grams x 0.99 x (44/12)

= 8,788 grams

= 8.8 kg/gallon

= 19.4 pounds/gallon

Note: If C02 for emissions for diesel is need, substitute 2421 grams with 2778 grams.

Next, number of gallons used is calculated by dividing miles traveled by the average MPG. Finally the C02 emissions constant (19.4)is multiplied by the gallons which results in the carbon footprint.

The values of all the calculated variables for a trip are written to an XML file (carbon.xml) for easy storage and retrieval. The values automatically populate the grid when the application starts, so no interaction is needed by the driver.

3.4 Smart Cone

3.4.1 Navigation Instructions

Application Icon →Smart Cone Icon

Smart Cone Application Screen:

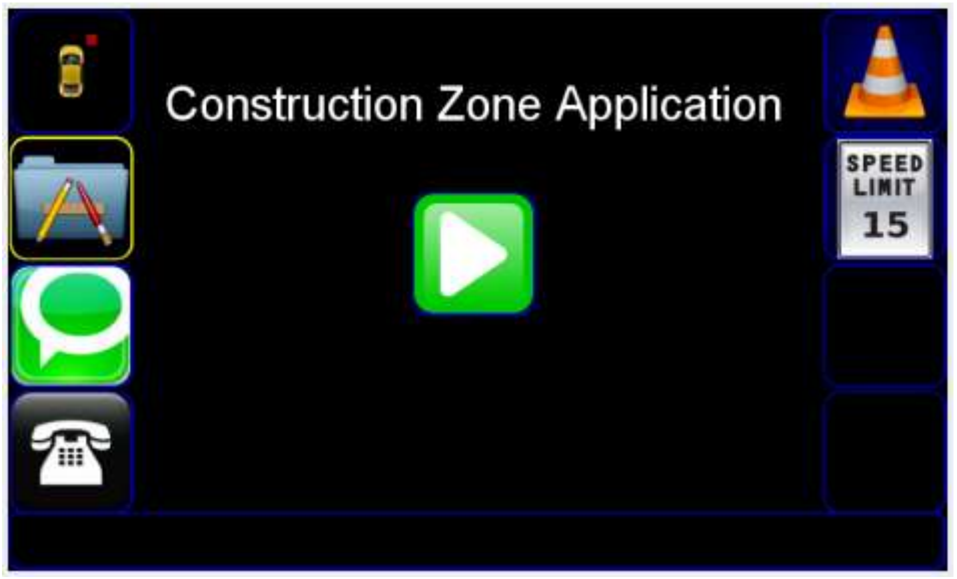


Figure 4: Smart Cone Application

Description:

Construction zones can quickly produce hazardous conditions for both drivers and construction workers. The goal of the Smart Cone application is to quickly create an “alert” area warns the driver that they are in a construction zone and should be on the lookout and slow down. With the Smart Cone application, and the click of a button, a construction zone can be communicated rapidly, and removed just as quickly.

<u>How It Works:</u>

The Smart Cone application is simply a way of changing a vehicle “type” from a standard vehicle type to a “Smart Cone” type. When the green go button is clicked in the application, the type value in the vehicle's hash table is update to be the Smart Cone type. This information is then propagated in the vehicle's hash table to the neighboring vehicles. Neighboring vehicles look through their context in search of the “Smart Cone”, and if it is found, displays the construction cone icon in their alert area.

Similarly, when the application's stop button is clicked, the vehicle type is changed back to that of a standard vehicle, and the propagation process through the hash table is again followed.

3.5 Course/Fine Context

3.5.1 Navigation Instructions

Application Icon →Course/Fine Context Icon

Course/Fine Application Screen:

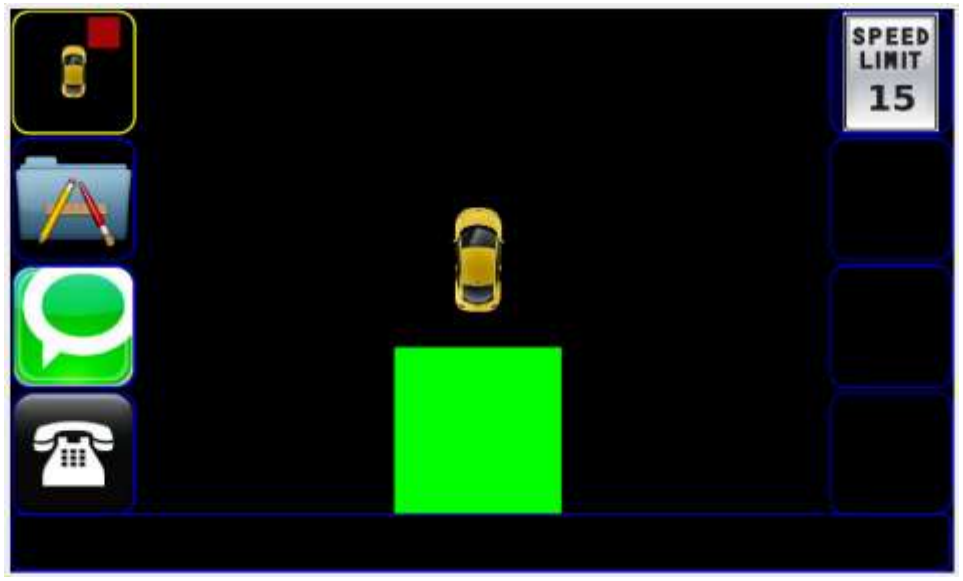


Figure 5: Course Context Application

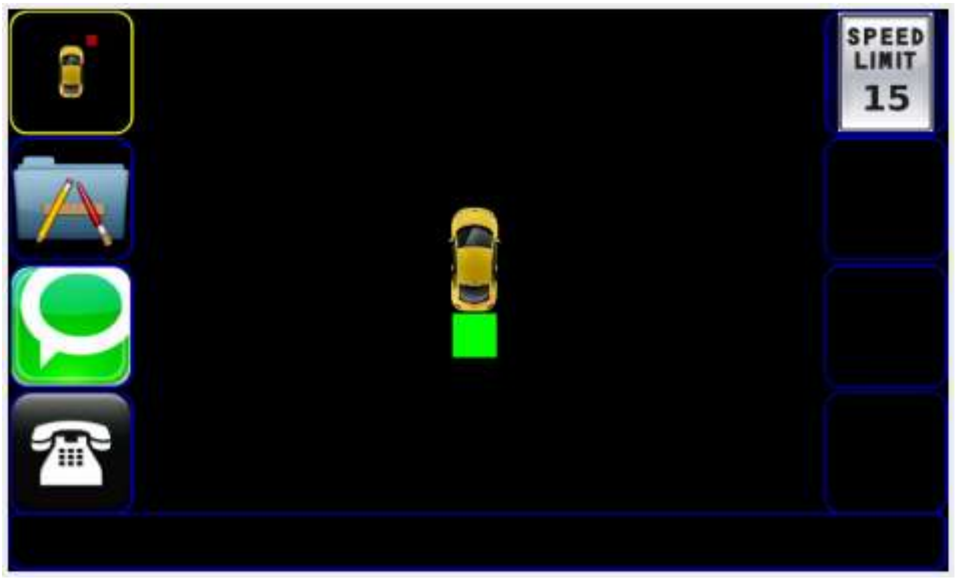


Figure 6: Fine Context Application

Description:

With the ever increasing volume of traffic, it is important for a driver to know his/her location with respect to other vehicles. This becomes increasingly important during hazardous weather conditions and rush hour. The Course/Fine Context applications allow for visual representation of the car's context; where there are in relation to other cars on the road; with a series of red flashing squares representing neighboring vehicles.

How It Works:

The Course/Fine Context applications are a core part of the VIS system. When a vehicle receives data from a neighboring vehicle it performs the following operations to visualize its neighbor on the screen:

1. Gets its current latitude, longitude, and heading, as well as the neighboring vehicle's latitude and longitude. Note: The latitudes, longitudes and heading are taken from the vehicle's context.
2. Calculates the bearing and distance from itself to its neighbor. The formula for calculating bearing is:

$$\theta = atan2(\sin(\Delta long) * \cos(lat2), \cos(lat1) * \sin(lat2) - \sin(lat1) * \cos(lat2) * \cos(\Delta long))$$

where θ represents the direction (in compass degrees).

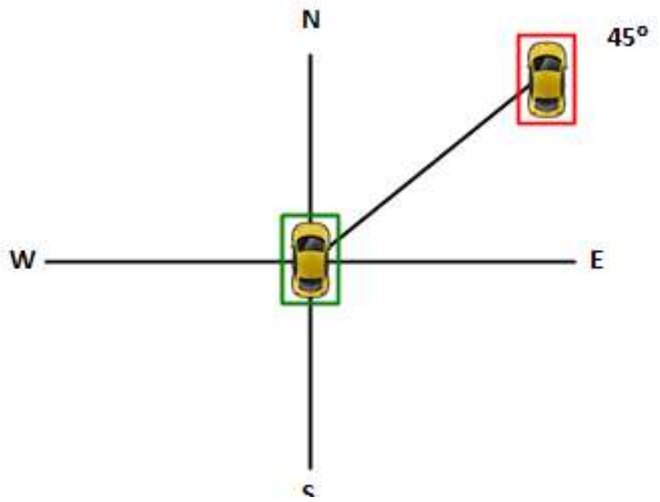


Figure 7: Bearing between two vehicles.

The 'Haversine' formula, which calculates great-circle distances between the two points, is used to determine the distance between the two vehicles. The formula is as follows:

$$R = earth's\ radius\ (mean\ radius = 6{,}371\ km)$$

$$\Delta lat = lat_2 - lat_1$$

$$\Delta long = lat_2 - lat_1$$

$$\Delta long = long_2 - long_1$$

$$a = \sin(\Delta lat/2)^2 + \cos(lat_1) * \cos(lat_2) * \sin(\Delta long/2)^2$$

$c = 2 * atan2\left(\sqrt{a}, \sqrt{(1-a)}\right)$

$d = R * c$

3. Determine which location on the screen should blink.
   The Course Context screen has 8 possible locations and the Fine Context has 24 locations as seen below:

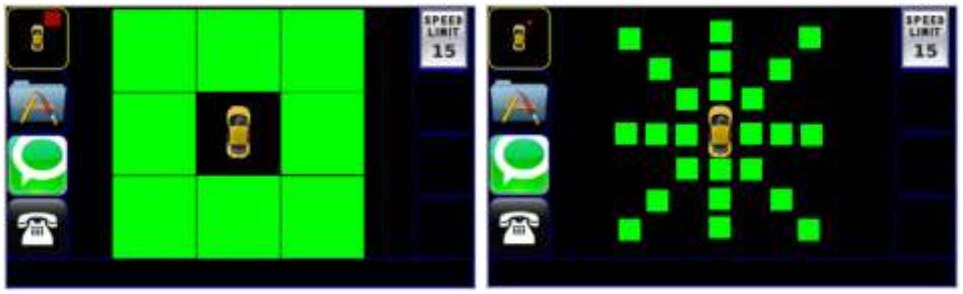


Figure 8: Course and fine context blinking locations.

Each location is given a number as seen below corresponding to the square blinking locations on the screen and it is assumed that the local vehicle is heading north.

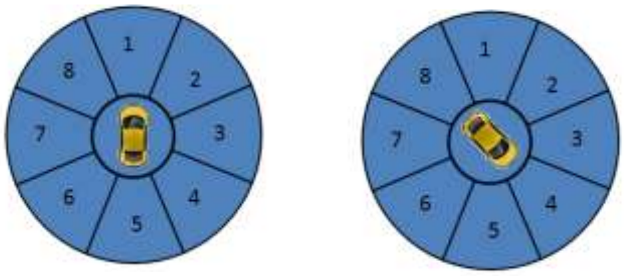


Figure 9: Vehicle rotation example.

If the local vehicle is indeed heading north, then a car directly in front of it (bearing in the range 337.5 to 22.5 on a compass) would be in position 1 and square 1 should blink. However, if the local vehicle was instead heading southeast (as seen in Fig. 9) and a vehicle was directly in front of it, position 4 should blink on the screen.

Note: The square that should blink depends on the heading of the local vehicle, NOT the heading of the neighboring vehicles.

4. Blink the selected square.
   Once the proper square is selected, the location to blink is stored in the local hash table of that neighboring vehicle. Every 500ms, the GUI thread checks all the vehicles in the local hash context for this location information. It then generates a list of squares that should be turned green, and proceeds to do so. The same process repeats indefinitely.

The only difference between the Course and Fine Context applications is the number of squares. The Course Context has 8 locations, while the Fine Context has 48. Since the Fine Context squares are smaller, it is able to represent vehicles that are farther physical distance away.

3.6 VOIP Call

3.6.1 Navigation Instructions

Application Icon →VOIP Call Icon

VOIP Call Application Screen:

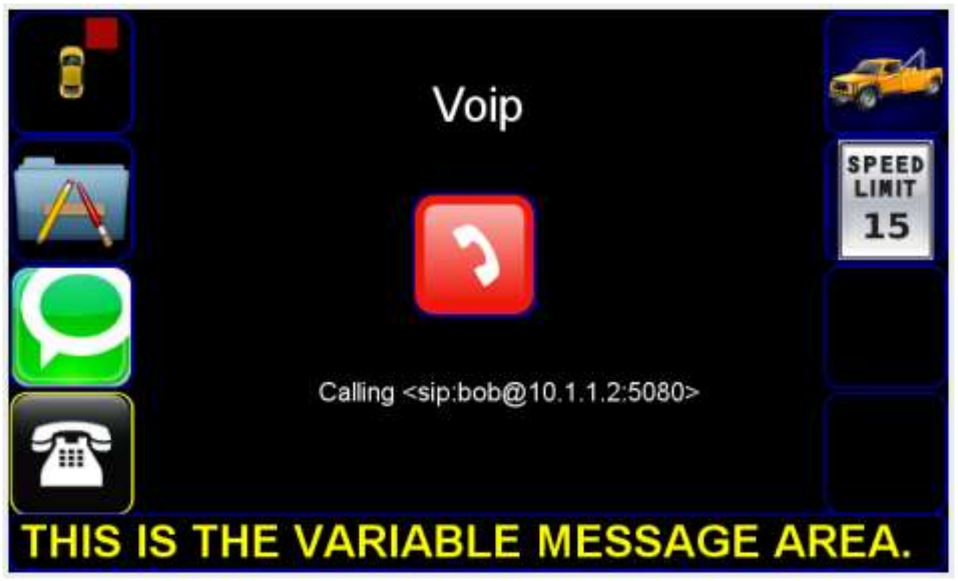

Voip
SPEED LIMIT 15
Calling <sip:bob@10.1.1.2:5080>
THIS IS THE VARIABLE MESSAGE AREA.

Figure 10: VOIP Call Application

Description:

In the case of an emergency, having a way to call for help is essential. The VOIP Call application allows the system to send and receive calls to registered IP addresses which could for example be that of a dispatch center.

How It Works:

When the user clicks the "call" button on the application, the system uses MjSip (open source java-based implementation of a SIP stack available at www.mjsip.org) to initiate a connection between the caller and the callee. Once the connection is established, the voice data is processed with Java Media Framework (JMF).

3.7 School Bus Alert

3.7.1 Navigation Instructions

Application Icon → School Bus Icon

School Bus Alert Application Screen:

School Bus:

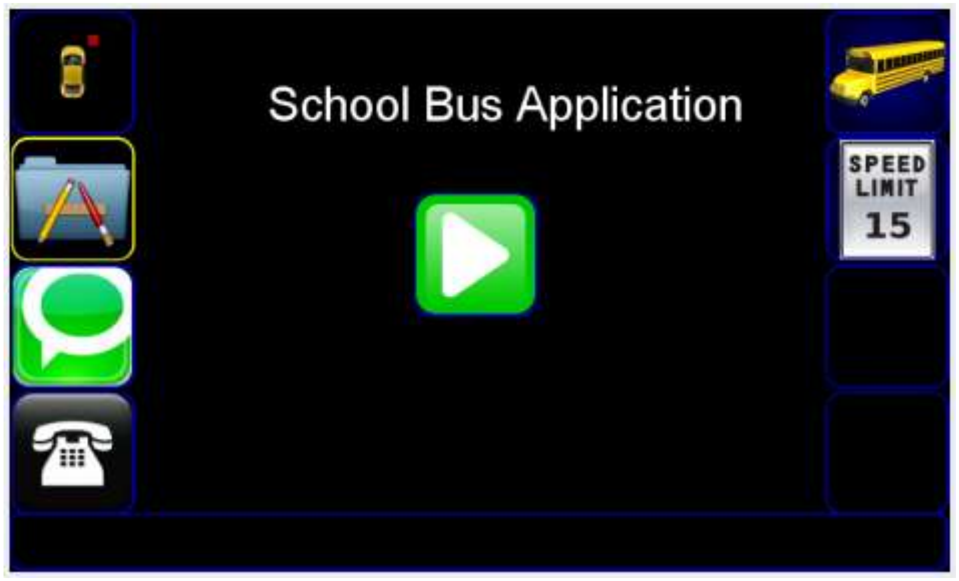


Figure 11: School Bus Application

Description:

School buses make frequent stops to pick up and drop off children. The purpose of the School Bus Alert application is to make drivers aware that there is a school bus in their area and remind them to watch out for children crossing the road.

How It Works:

The School Bus Alert application is very similar to the Smart Cone Application in that when the green go button is pushed, the vehicle type is changed from a standard vehicle to a school bus. This information is propagated to the vehicle's neighbors. The vehicle type remains "school bus" until the stop button on the application is pressed. When the application is running, neighbors will see a vehicle of type school bus in their context and display a school bus icon in the alert area.

3.8 Police Car/Ambulance/Fire Truck Alert

3.8.1 Navigation Instructions

Application Icon →Police Car/Ambulance/Fire Truck Alert Icon

Police Car/Ambulance/Fire Truck Alert Application Screen:

Police:

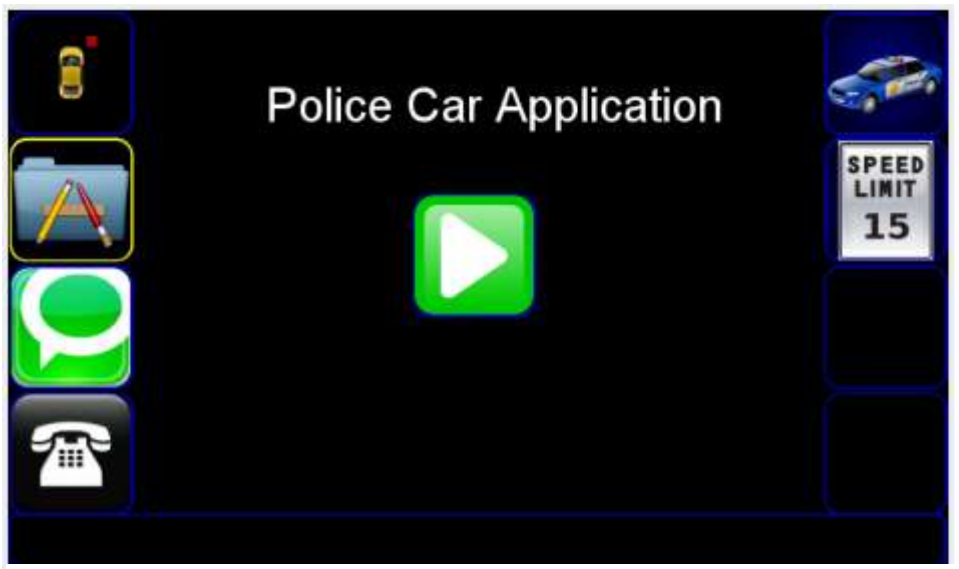


Figure 12: Police Car Application

Ambulance:

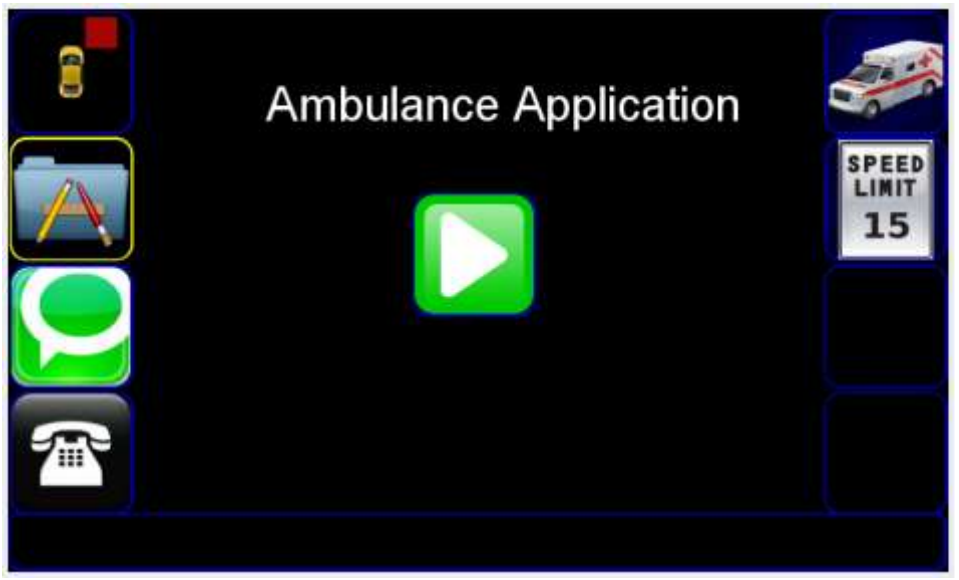


Figure 13: Ambulance Application

Fire:

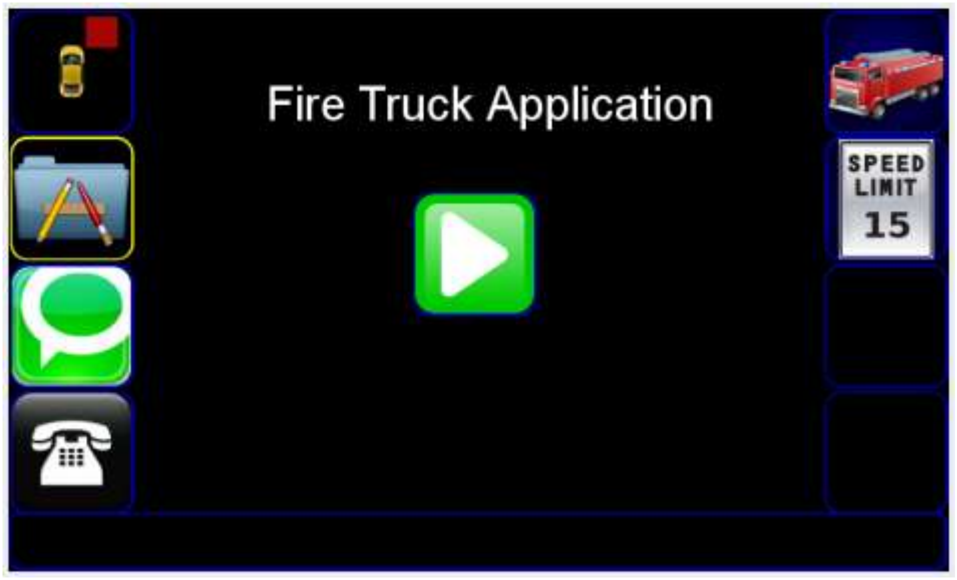


Figure 14: Fire Truck Application

Description:

When there is an accident, fire, or any other event that requires emergency personnel, response time is critical as seconds can save lives. The purpose of the Police Car, Ambulance, and Fire Truck Alert applications is to alert the driver that one of these vehicles is approaching and proper protocol should be followed as is the law of the state. In Michigan for example, the driver should slow down, pull over and stop while these vehicles pass.

How It Works:

The Police Car/Ambulance/Fire Truck Alert applications are very similar to the Smart Cone and School Bus Applications in that when the green go button is pushed, the vehicle type is changed from a standard vehicle to a police car, ambulance or fire truck. This information is propagated to the vehicle's neighbors. The vehicle type remains the specified type until the stop button on the application is pressed. When the application is running, neighbors will see a vehicle of type police car, ambulance or fire truck in their context and display the associated icon in the alert area.

3.9 Tow Truck Alert

3.9.1 Navigation Instructions

Application Icon → Tow Truck Alert Icon

Tow Truck Alert Application Screen:

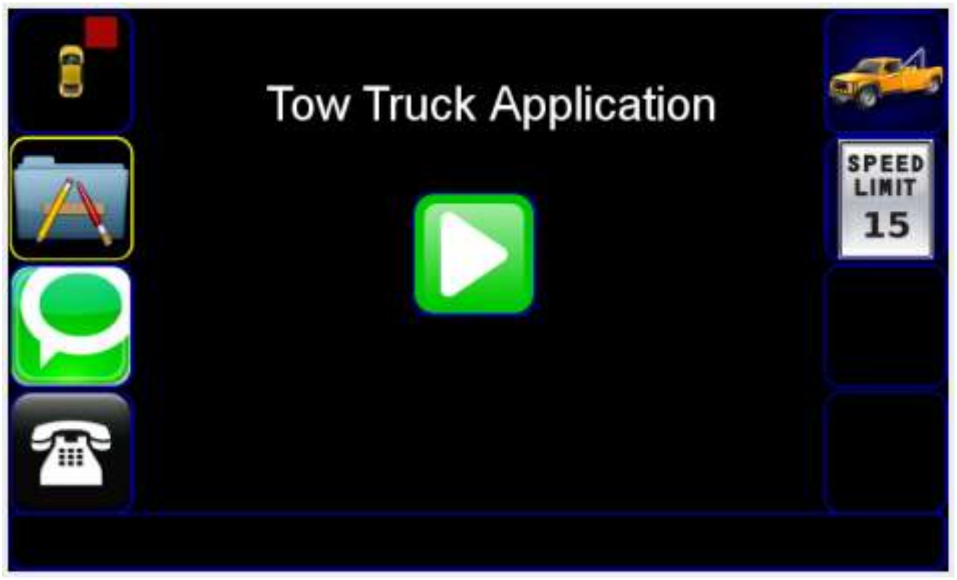


Figure 15: Tow Truck Application

Description:

When a Tow Truck is called to the scene of an accident or other related event, it is often the case that a partial lane blockage will follow while the truck maneuvers the disabled vehicle into proper position. These lane blockages can be hazardous to other drivers, especially during times of high traffic or sharp and windy roads. The sooner that other driver can know about the Tow Truck, the more time they have to react and reduce speed or change lanes. The Tow Truck application is used to alert drivers to the above mentioned situations.

How It Works:

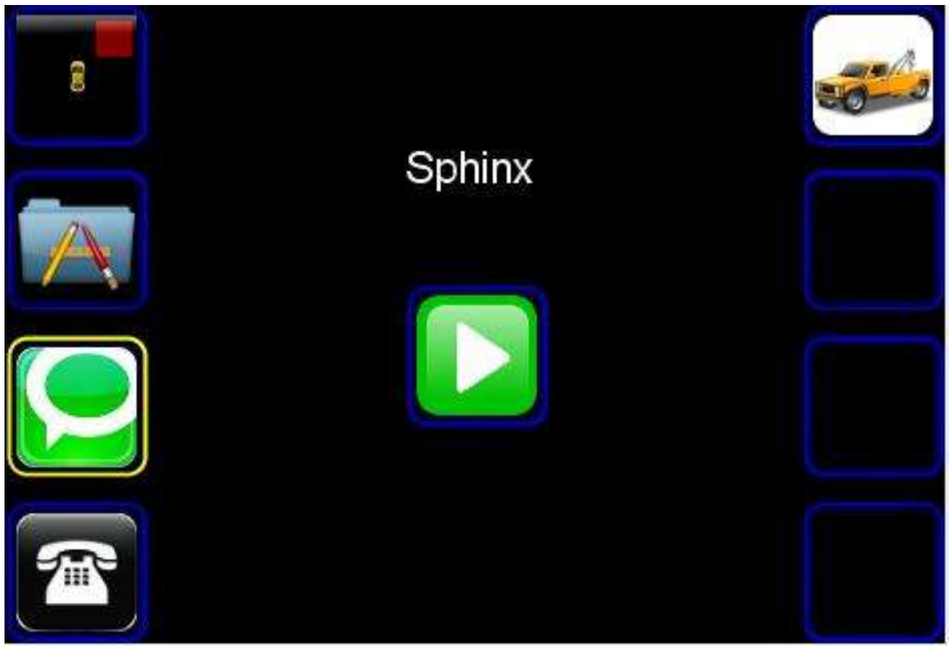
The Tow Truck application is very similar to the Police Car/Ambulance/Fire Truck Alert in that when the green go button is pushed, the vehicle type is changed from a standard vehicle to a tow truck. This information is propagated to the vehicle's. The vehicle type remains “tow truck” until the stop button on the application is pressed. When the application is running, neighbors will see a vehicle of type tow truck in their context and display the associated icon in the alert area.

Sphinx

3.9.2 Navigation Instructions

Application Icon → Sphinx Icon

Sphinx Application Screen:



Description:

Hands free operation is critical when it comes to software running in vehicles. The fewer things that a driver has to control create a safer environment for everyone. The integration of Sphinx, a speech recognizer developed by the Sphinx group at Carnegie Mellon University, allows the driver to switch between screens using simple single word voice commands.

<u>How It Works:</u>

When the user clicks the start button on the application, the system activates Sphinx4 and waits for the user to speak one of the recognized words. When the system hears a word that it knows, the main screen is changed to screen associated with that word. Sphinx continues to operate until the user clicks the stop button. Currently, the system uses the following words to change between the main application screens:

<u>Words</u>	**<u>Screen</u>**
application	Application
course	Course Context
fine	Fine Context
call	VOIP Call

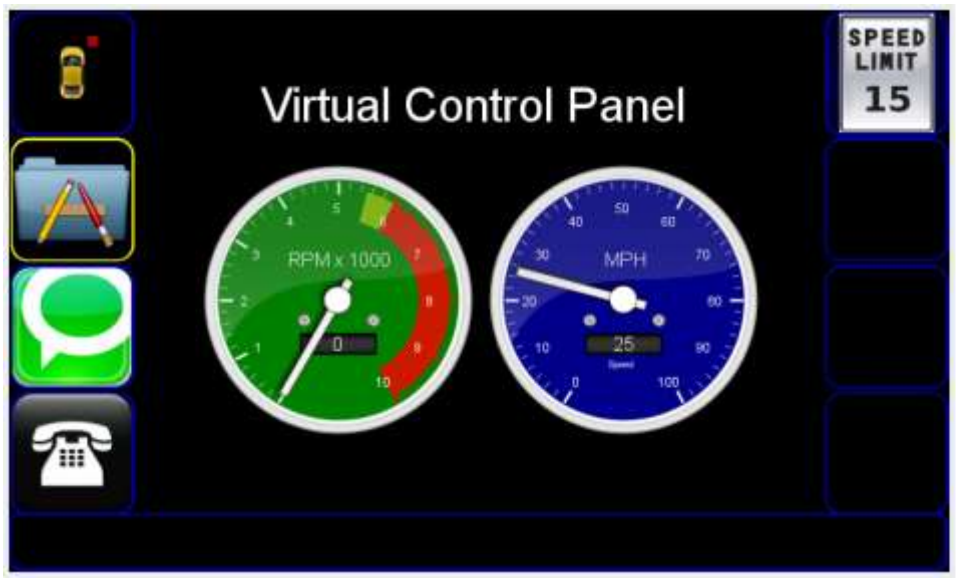
voice	Sphinx

3.10 Virtual Control Panel

3.10.1 Navigation Instructions

Application Icon → Control Panel Icon

Control Panel Application Screen:



Description:

Gauges are essential in vehicles today because the supply the driver with important information such as speed and engine RPMs. In the case the gauge failure, the Control Panel application is able to step in as a backup gauge system.

How It Works:

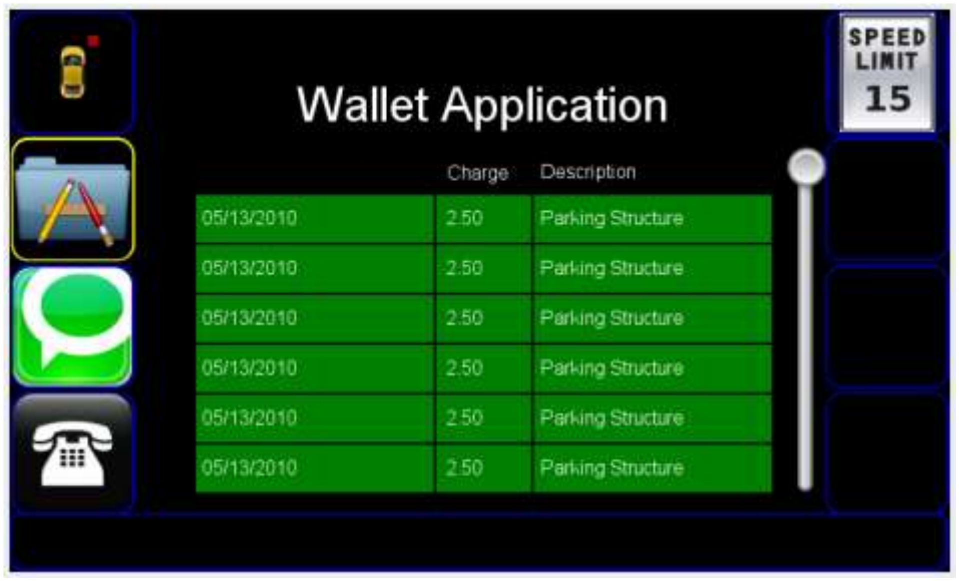
The Virtual Control Panel application uses the OBD system of the car to obtain engine RPM and vehicle speed data. The obtained data is then used to move the gauge needles to the appropriate spot on the gauge and also displays the data in a textbox on the gauge for easy viewing. Not only does this application offer a backup gauge system, but it also demonstrates how the AGORA system pulls data from the car OBD computer.

3.11 Wallet Application

3.11.1 Navigation Instructions

Application Icon → Wallet Icon

Wallet Application Screen:



Wallet Application

	Charge	Description
05/13/2010	2.50	Parking Structure
05/13/2010	2.50	Parking Structure
05/13/2010	2.50	Parking Structure
05/13/2010	2.50	Parking Structure
05/13/2010	2.50	Parking Structure
05/13/2010	2.50	Parking Structure

Figure 18: Wallet Application

Description:

Today there are many scenarios where a driver may need to pay for services during a trip. For example, they may encounter toll roads or parking garages that require payment. The Wallet Application is used to automatically charge a credit card for these types of services.

How It Works:

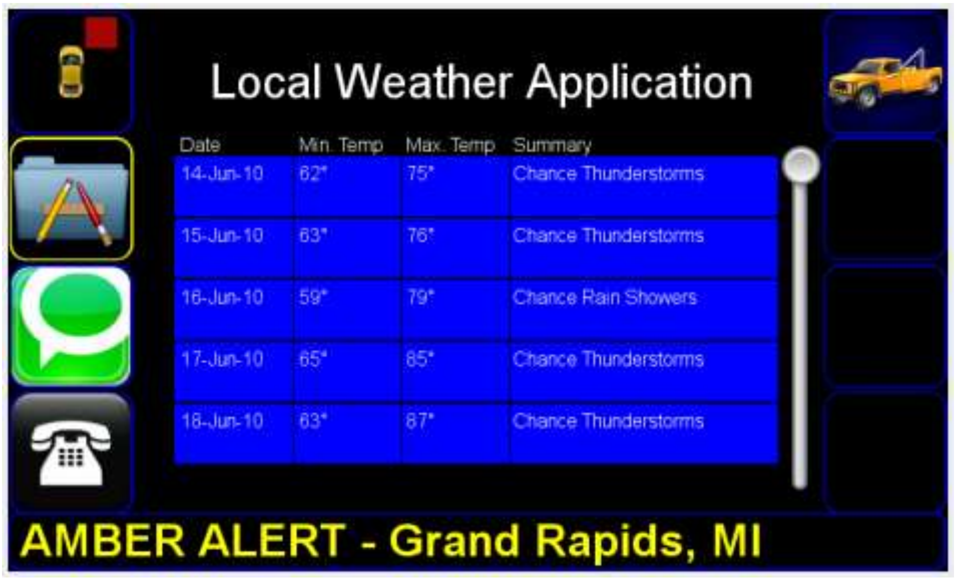
The Wallet Application uses the GPS coordinates of a car and compares them to the known locations of parking garages, toll roads, etc. The locations of these entities are stores in an XML file generated by the external Charge Point Capture Utility. Along with the GPS coordinates of the entity, additional information such as the charge amount is stored. When a vehicle passes one of these stored location points it is charged the specified amount and a row is generated on the Wallet Application screen with the date, price and description of charge.

3.12 Local Weather Application

3.12.1 Navigation Instructions

Application Icon → Weather Icon

Local Weather Application Screen:



Local Weather Application

Date	Min. Temp	Max. Temp	Summary
14-Jun-10	62°	75°	Chance Thunderstorms
15-Jun-10	63°	76°	Chance Thunderstorms
16-Jun-10	59°	79°	Chance Rain Showers
17-Jun-10	65°	85°	Chance Thunderstorms
18-Jun-10	63°	87°	Chance Thunderstorms

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Figure 19: Local Weather Application

Description:

Weather can often cause problems for drivers, especially when severe storms are threatening. The Local Weather application allows the driver to access the local five day weather forecast with the touch of a button.

How It Works:

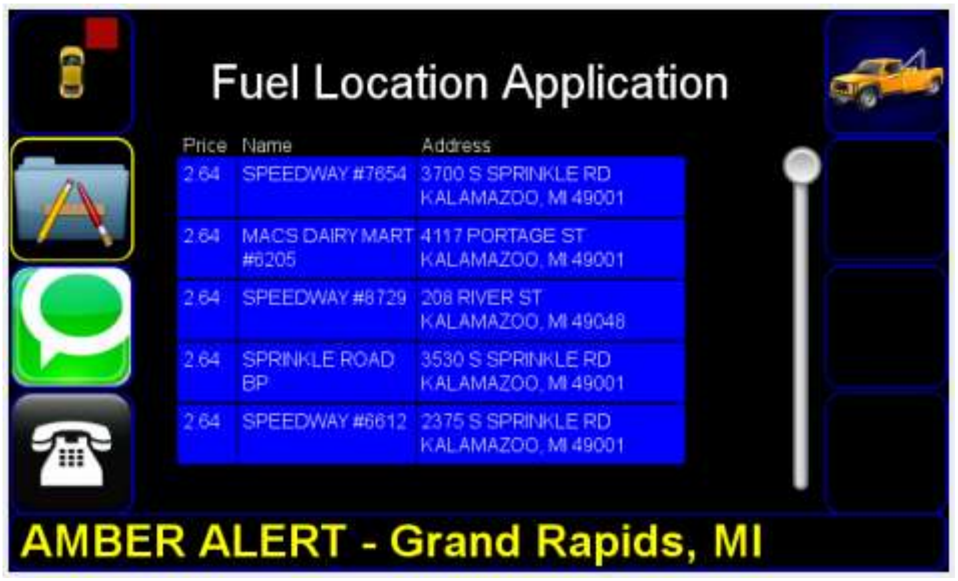
When the Weather Application icon is selected, the application sends a message to the TMC containing the current latitude and longitude of the vehicle taken from the GPS. The TMC then uses a web service to return the five day forecast to the vehicle. Each day of the forecast is given a row of the table with the column values of date, low temperature, high temperature and summary.

3.13 Fuel Location Application

3.13.1 Navigation Instructions

Application Icon → Fuel Gauge Icon

Fuel Location Application Screen:



Fuel Location Application

Price	Name	Address
2.64	SPEEDWAY #7654	3700 S SPRINKLE RD KALAMAZOO, MI 49001
2.64	MACS DAIRY MART #6205	4117 PORTAGE ST KALAMAZOO, MI 49001
2.64	SPEEDWAY #8729	208 RIVER ST KALAMAZOO, MI 49048
2.64	SPRINKLE ROAD BP	3530 S SPRINKLE RD KALAMAZOO, MI 49001
2.64	SPEEDWAY #6612	2375 S SPRINKLE RD KALAMAZOO, MI 49001

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Figure 20: Fuel Location Application

Description:

With fuel prices on the rise, it is often nice to know where the fuel can be found. The Fuel Location application offers this service with the touch of a button.

How It Works:

The Fuel location is very similar to the Local Weather Application. When the fuel gauge icon is selected, the application sends a message to the TMC containing the current latitude and longitude of the vehicle taken from the GPS. The TMC then uses a web service to return the five cheapest gas stations in the area. Each station is given a row of the table with the column values of price, name of the station, and address.

3.14 Vehicle Tracking Application

3.14.1 Navigation Instructions

Application Icon → Configuration Icon

VehicleTracking Application Screen:

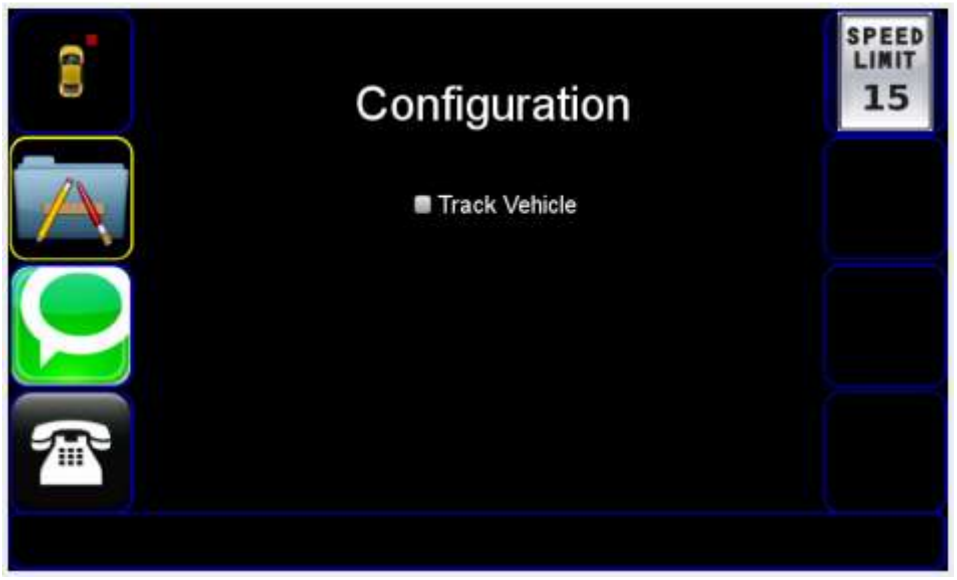


Figure 21: Configuration Application

Description:

Vehicle tracking can help people be aware of where their vehicles are at all times. Applications like this are especially useful for parents who wish to track the locations of their new teenage drivers.

How It Works:

When the Track Vehicle check box on the Configuration page is checked, the vehicle continually sends its latitude and longitude to the TMC in a message. The TMC is then able to track the vehicle visually using Google Maps.

Note: As some people may see vehicle tracking as an invasion of privacy, it is easily disable by unchecking the Track Vehicle check box.

3.15 Safety Lock Application

Safety Lock Application Screen:

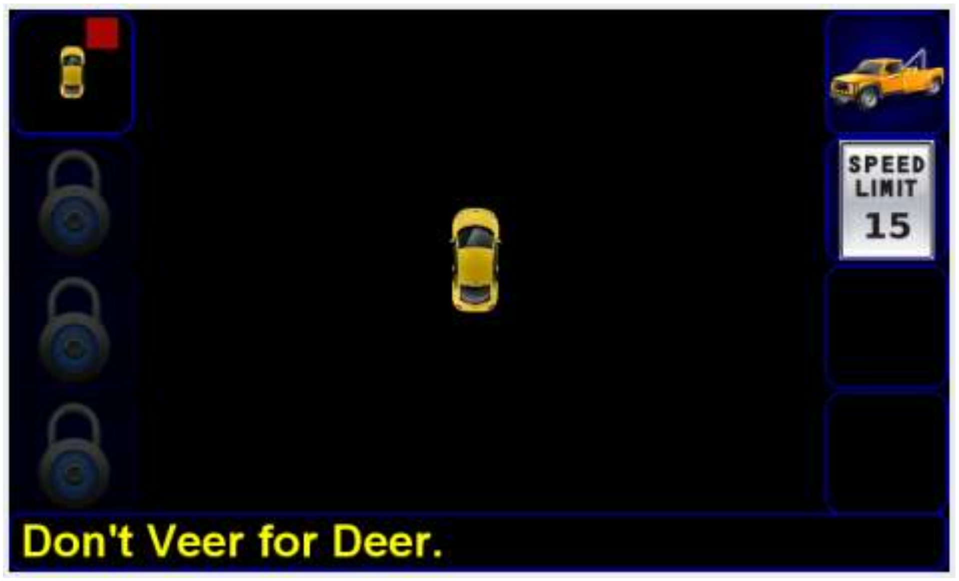


Figure 22: Safety Lock Application

Description:

Distracted driving has very serious consequences for both drivers and other vehicles. By using the Safety Lock application, which is a core system application, a driver is able to focus on only the necessary set of applications.

How It Works:

The Safety Lock application uses the OBD to gather data about a vehicle's speed. If the vehicle is in motion for more than 5 seconds, the AGORA software will return the driver to the Course Context screen and lock all other applications until the car is again at rest. When the car does again return to a standstill, the applications will unlock and the driver will be able to navigate to the other applications as usual.

3.16 Variable Message Sign (VMS) Application

VMS Application Screen:

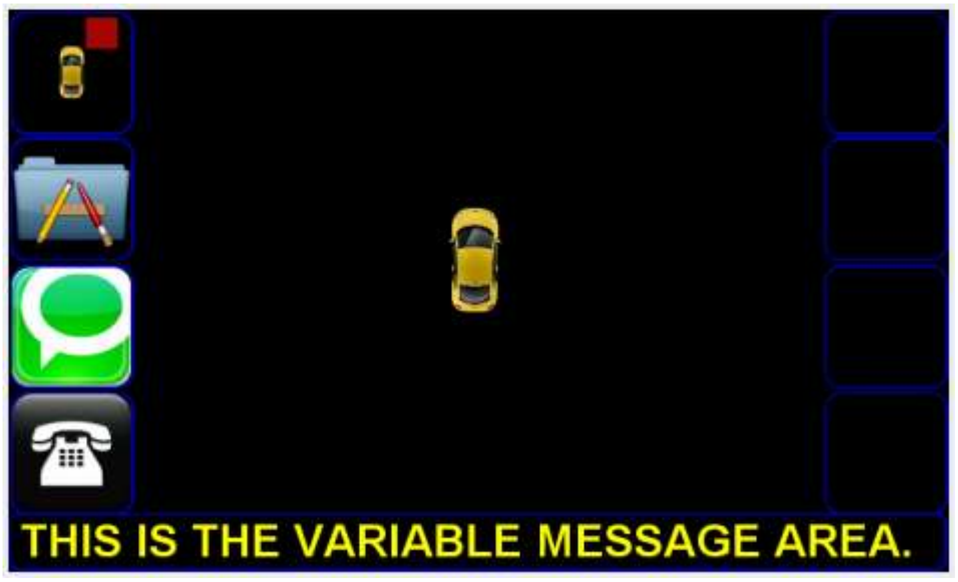


Figure 23: VMS Application

Description:

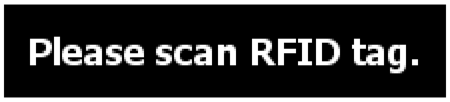
Large Variable Message Signs have been showing up along the highways in the recent years. The AGORA VMS application brings the messages inside the vehicle and allows for custom messages to be delivered to specific areas quickly and easily.

How It Works:

The VMS application is a core application of the AGORA system. It continually contacts the TMC with latitude and longitude data from the GPS system. The TMC then determines which messages in its database should be delivered to the vehicle based on geographic location. The returned messages have priorities that determine how long they should be displayed on the screen. Additionally, an audio cue is played when new messages arrive at the vehicle. This application allows for important information to be quickly and easily distributed to all vehicles.

3.17 RFID Driver Restriction Application

RDIF Driver Restrction Application Screen:


Please scan RFID tag.

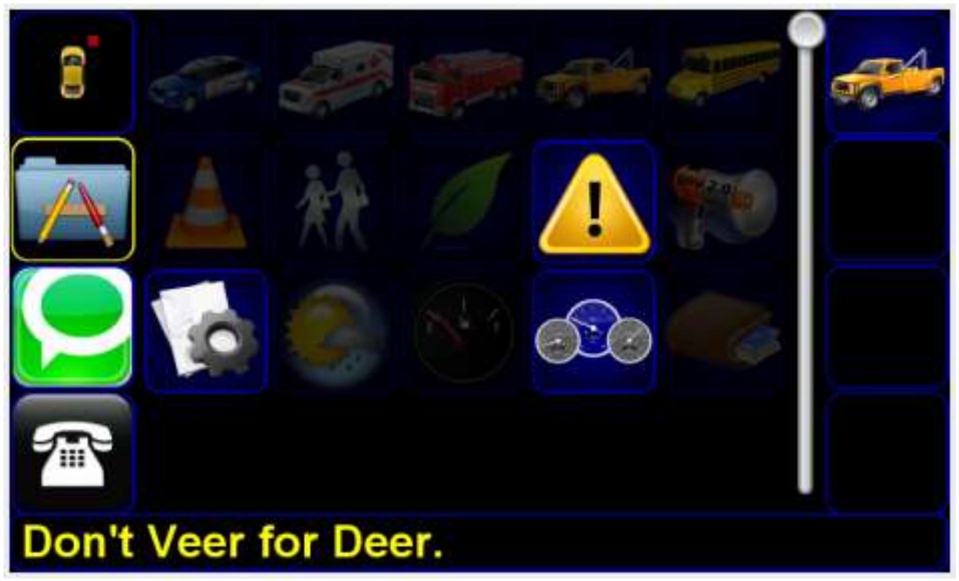

Don't Veer for Deer.

Figure 24: RFID Application

Description:

Due to driving inexperience, young drivers should be given limited functionality on the AGORA system. At the same time, an older more experienced driver may be able to handle the full application set and still drive safely. The RFID Driver Restriction application is able to distinguish between the two drivers with simply a key fob scan.

How It Works:

The RFID application uses and RFID tag reader from Phidge.com to positively identify a driver by swiping a simple key fob. The data read from the key fob is transmitted to the TMC where processing takes place and a restriction type (access level) is returned. Once the AGORA system receives the restriction type, the appropriate application set becomes available for the identified driver. The system then starts up as usual with only the selected applications active. These restrictions will remain in effect until the system is restarted and a new driver swipes their RFID key fob.

It is convenient to have such a system installed in all VIS; however it can also be made optional and VIS will still work with all application enabled. This is done through configuration in the ApplicationSetting.properties file by setting HAS_RFID key to true\false.

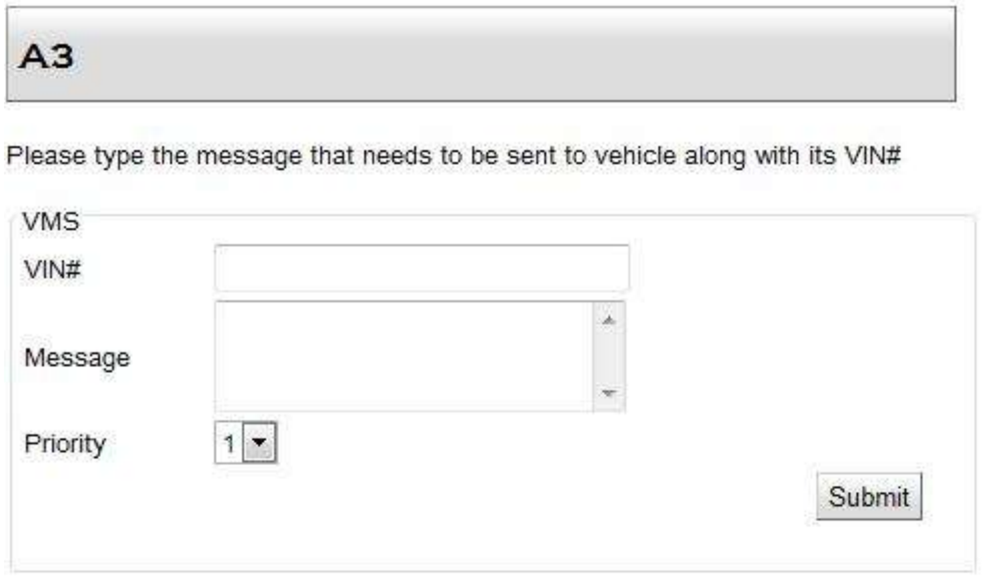
3.18 TMC

3.18.1 A3

3.18.1.1 Navigation Instructions

URL: http://10.2.2.3:8080/tmc-web-ui/A3.html

3.18.1.2 Application Screen:



A3

Please type the message that needs to be sent to vehicle along with its VIN#

VMS

VIN#	
Message	
Priority	1

3.18.1.3 Description

A3 application allows user to send messages to vehicles. These messages can be sent to individual vehicles or can be broad casted to all the vehicles in the vicinity.

3.18.1.4 How it works

Application takes

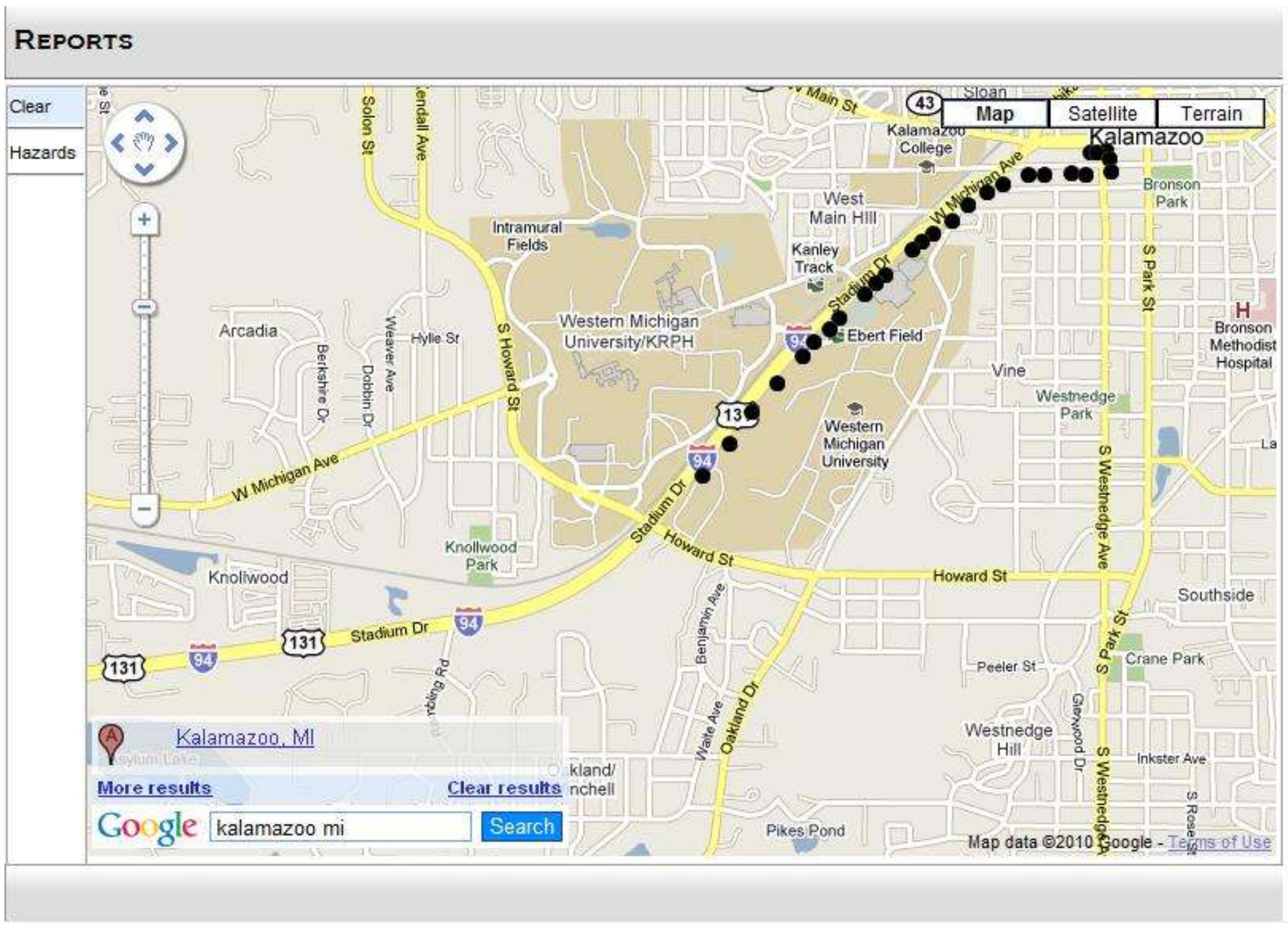
- VIN# or if left blank it works in broadcast mode,
- Message to be sent
- Priority which determine the amount of time that this message will be displayed on the screen

3.19 Tomographic Reports

3.19.1 Navigation Instructions

URL: http://10.2.2.3:8080/tmc-web-ui/TomographicReports.html

3.19.2 Application Screen:



3.19.3 Description

Tomographic reports are generated for the hazards that are around given geographic area. Report generator takes the visible section on the screen and generates the report for either all the hazards or individual hazards.

3.19.4 How it works

In the Hazards menu user can either select one among following options

- Ice condition
- Pot holes
- Road kill
- Foggy
- Animal

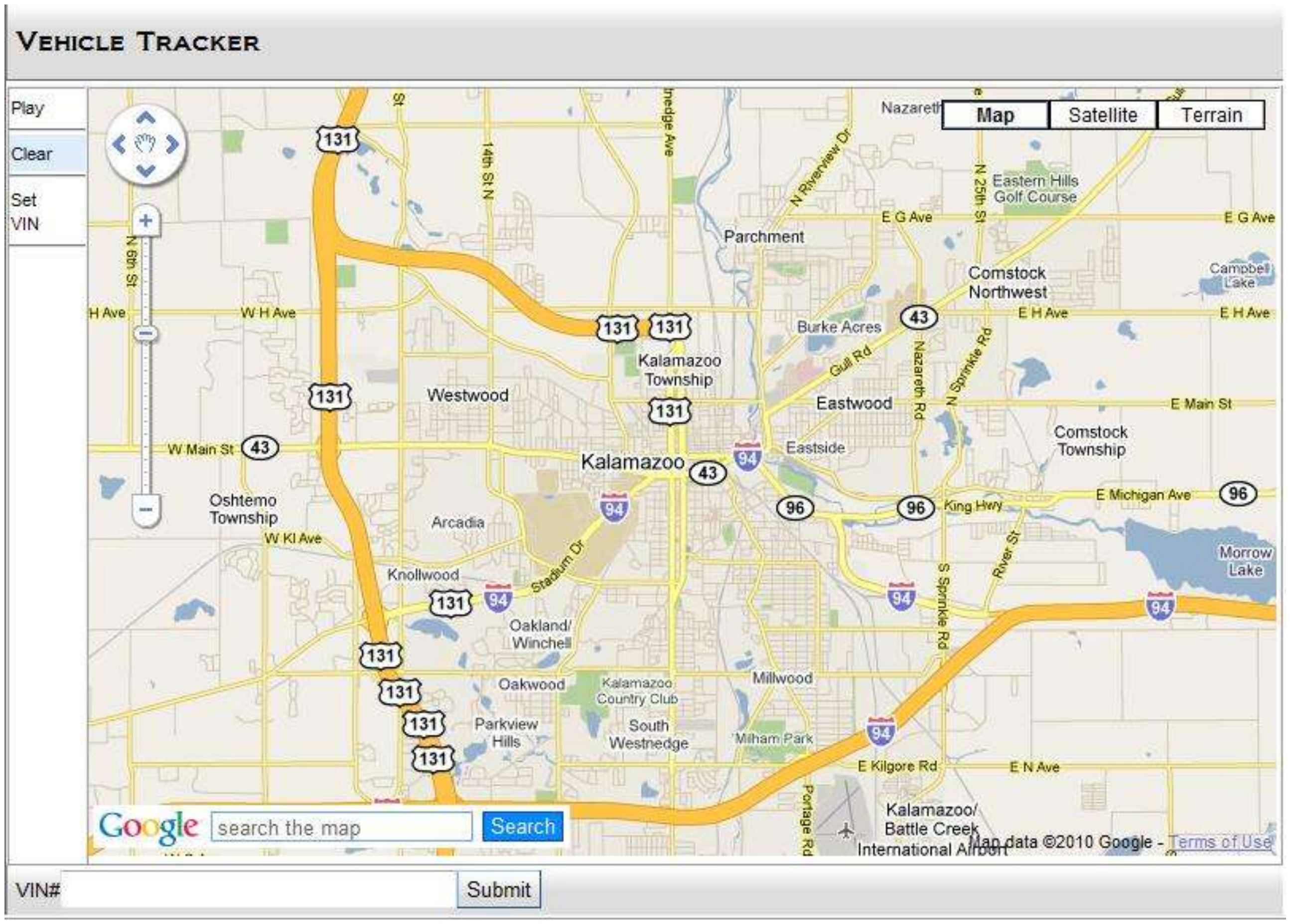
- Accident

3.20 Vehicle Tracker

3.20.1 Navigation Instructions

URL: http://10.2.2.3:8080/tmc-web-ui/VehicleTracker.html

3.20.2 Application Screen:



3.20.3 Description

Vehicle tracker application tracks the movement of a given vehicle.

3.20.4 How it works

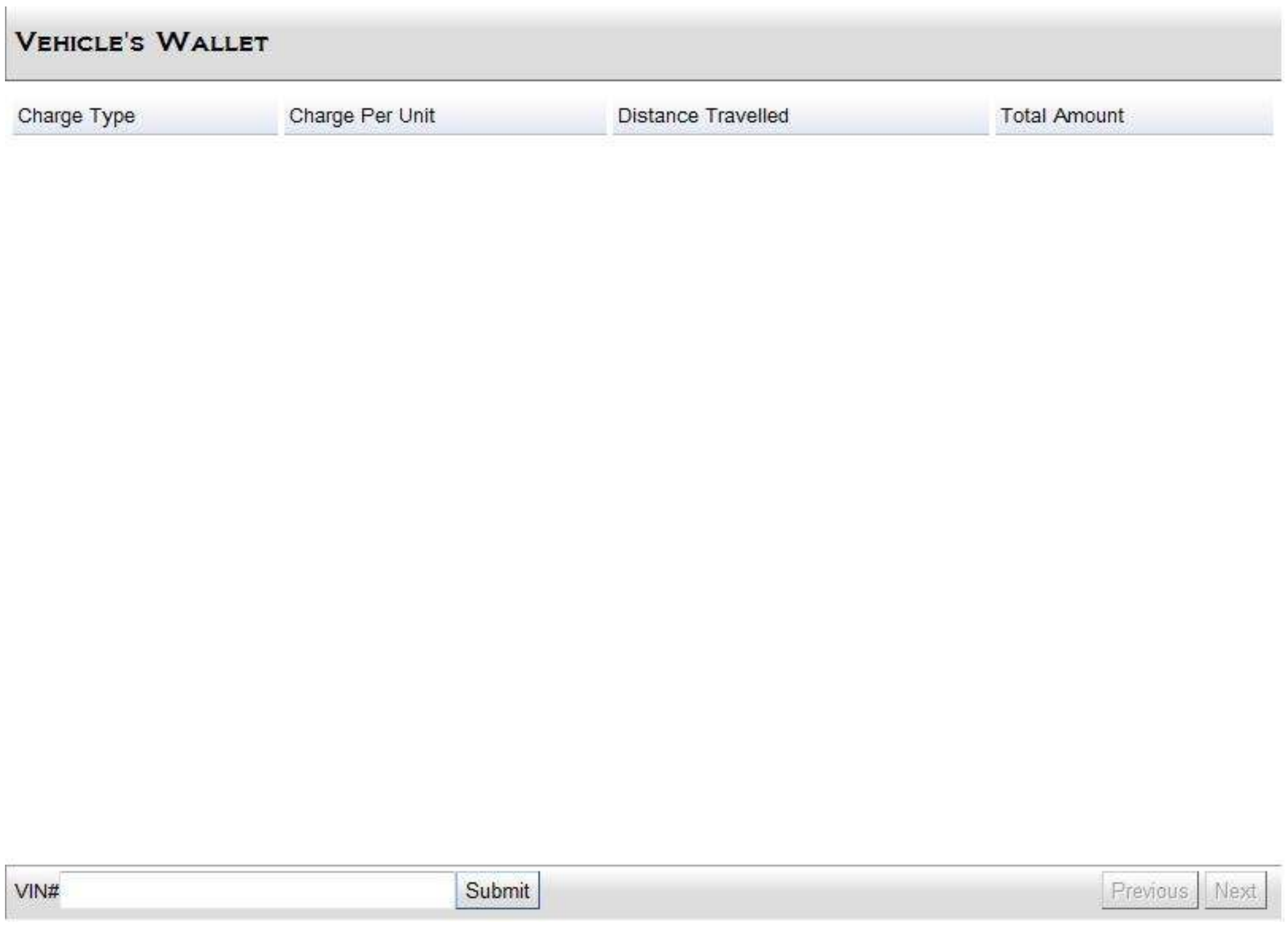
Enter the vehicle's VIN# and select the menu option to track vehicle's movement.

3.21 Vehicle Wallet Viewer

3.21.1 Navigation Instructions

URL: http://localhost:8080/tmc-web-ui/VehicleWalletViewer.html

3.21.2 Application Screen:



3.21.3 Description

Vehicle wallet report is summary\history report for all the toll charges.

3.21.4 How it works

Enter VIN# for the vehicle, whose toll history should be generated.

Appendix A: Glossary

MDOT – Michigan Department of Transportation
OBE – On-Board Equipment
RSE – Road-Side Equipment
TMC – Traffic Management Centers
A3– Advisory Alert Application
LSA – Life Safety Application
VIS – Vehicle Integrated Software
OSIL- Operating System Isolation Layer
OS- Operation System
CAL- Communication Abstraction Layer
DSRC- Dedicated short range communications