SBIR Plan

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Project Overview

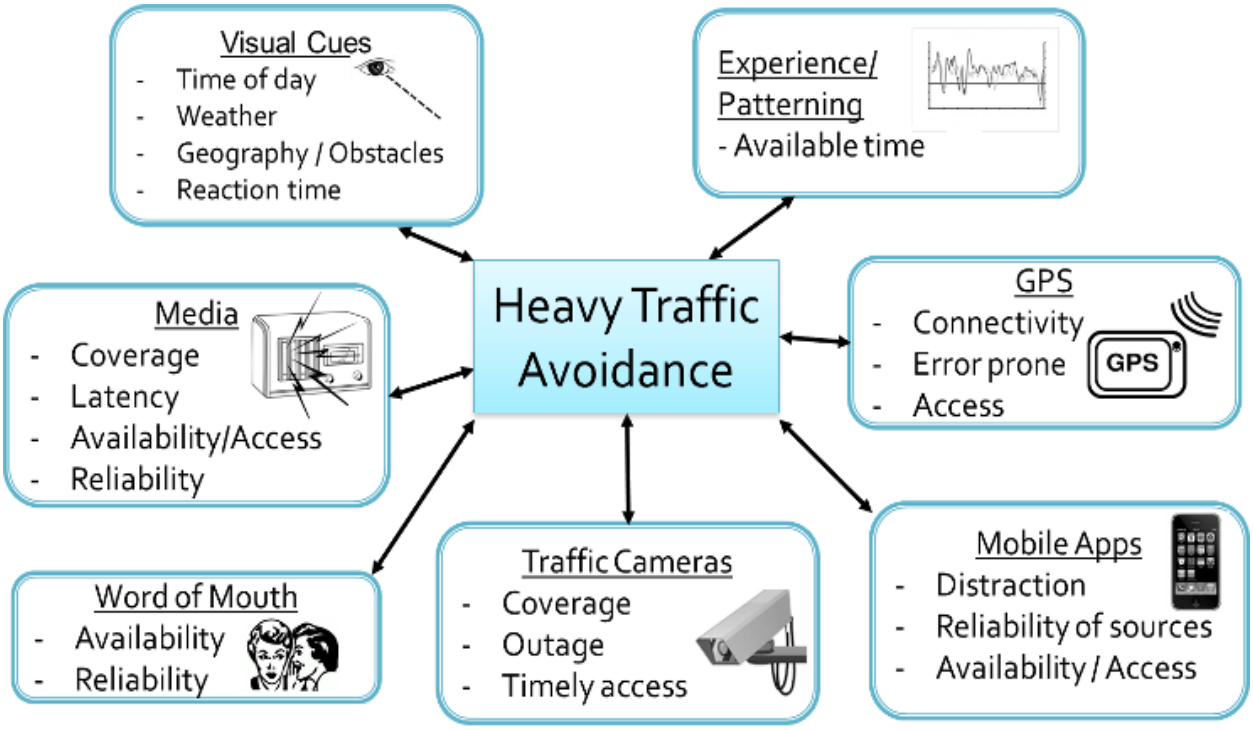
Old Dominion University's CS 410 Blue Team has developed a prospective plan for an innovative traffic update utility to help drivers save time and money on their frequent commutes in a data-efficient and effective manner. As a smartphone app, Traffic Wizard will use an original system called the Virtual Checkpoint System to mark coordinates along roads as points to exchange traffic data with driver phones running the app.

The innovative aspect of Traffic Wizard lies within its method for data distribution and collection through the virtual checkpoints. By systematically reducing the amount of data transmission between driver app and server, the Traffic Wizard system will provide drivers with real-time traffic update and route analysis services with minimal impact to their smartphone battery or data plan.

The main goal is to reduce the commute time for drivers (customers) along their planned route and ultimately save them money (in lost work hours and wasted fuel consumption). The innovative systems described throughout this plan will work in conjunction to achieve this goal.

Problem Summary

Heavy traffic congestion is known problem throughout the world, and recognized as an even worse problem in areas with heavier populations. Heavy traffic occurs due to many factors – and current mitigation methods each have their own faults.



Visual Cues

When a driver sees a disturbance in the flow of traffic, it is usually too late for the driver to make a decision that may help them get home quicker by taking an alternate route. This method becomes easily hindered even more when potential weather, geography, and obstacle occurrences are taken into account.

Media

Radio and television coverage of traffic conditions may be accurate at the time they are announced, but rarely is that information provided at a useful time or in a timely manner. The most success for this method comes from radio broadcasts to reach almost every car, but that same method is notorious for being inaccessible or having poor quality signal to deliver the report.

Word of Mouth

Friends and colleagues can mention their experiences in traffic to a person in order to provide advice on their next travel experience as well. While these opinions may be trusted due to the person providing the information, this delivery of traffic updates is not real-time or timely enough to use as a determination method for choosing the route.

Traffic Cameras

Traffic cameras are very limited in their coverage since there can only be so much area being monitored by video surveillance and still be practical. This technology is prone to outages as well and suffers the same timely delivery issue that other methods share.

Mobile Apps

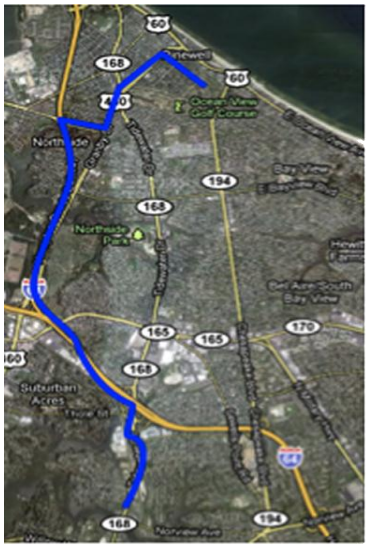
Current mobile apps that are designed to notify driver of traffic are often a cause for distraction, which is very dangerous for a driver on the road. Depending on the developer of the app, the sources of information may not be reliable either and provide less useful information.

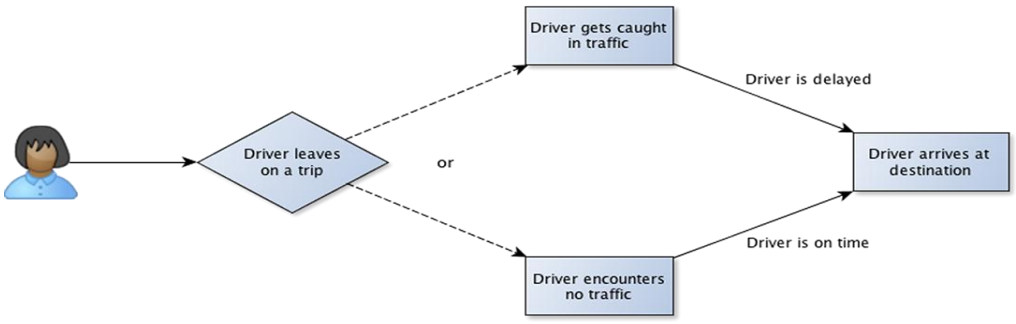
GPS

As a technology that is known to be integrated directly into vehicles, GPS devices are mostly purposed at providing directions instead of accurate traffic updates. These devices are prone to connection errors as well due to factors such as weather conditions or specific locations.

Experience/Patterning

Drivers make a habit of their driving activity of often form an idea of traffic patterns along their usual routes subconsciously (or analytically on purpose). This just relies on the amount of available time by the driver and their ability to estimate traffic on the route they usually take.





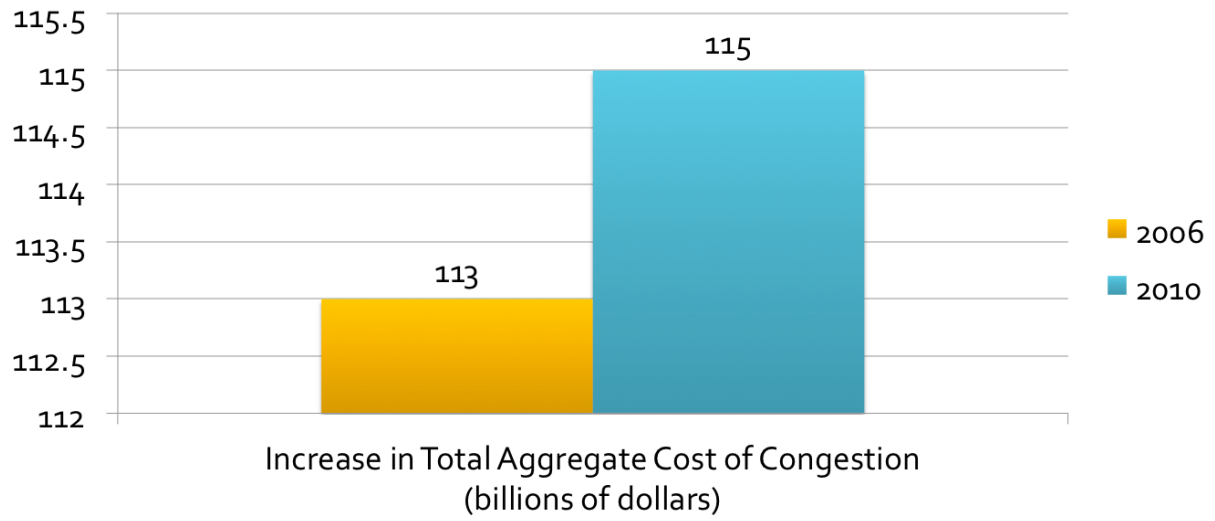
The current way drivers experience their commute typically involves the last traffic update they researched or heard of and their experience with the route to be taken. Their experience with a specific route may lead them to take a certain road, or a last minute check on a traffic status utility (such as the Google Maps feature) may indicate that a certain road is marked as light traffic.

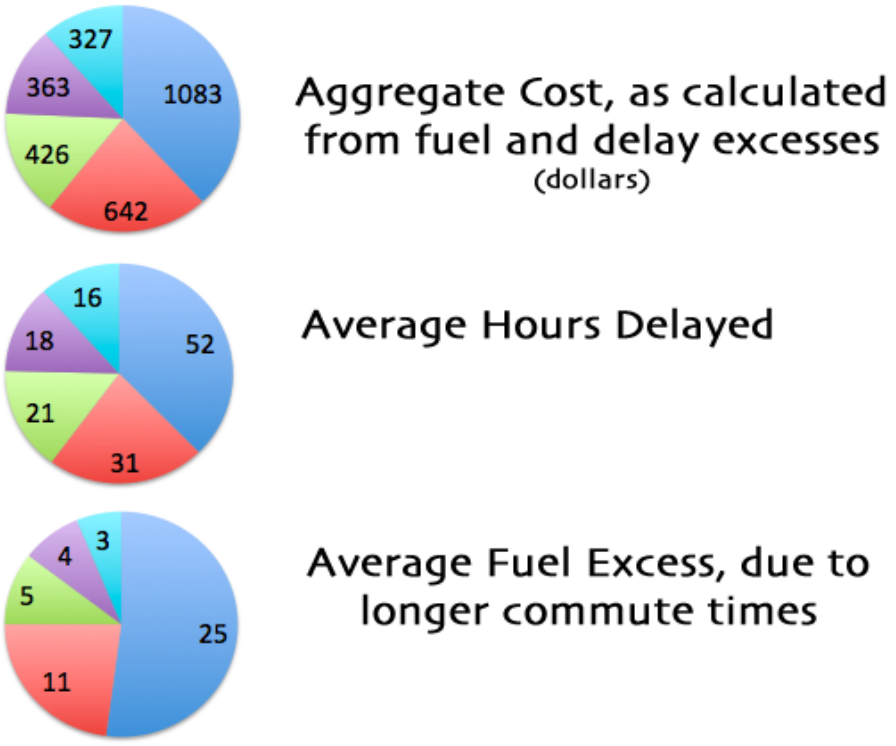
This current process can become invalidated at any point during the journey if an accident were to occur or a serious change in traffic flow along a major artery were to go into effect. In those scenarios, it is possible for the driver to ride straight into the congested area unaware of the new conditions. At this point, the driver is caught in heavy traffic and begins wasting their own time and fuel.

Significance of the Problem

Heavy traffic costs citizens of the United States many dollars and hours. Regions with high populations often tend to have the greatest amount of traffic, which meets logic. In terms of excess commute time, drivers collectively suffer a wait of 4.8 billion hours a year lost in traffic congestion and wastefully consume 1.9 billion gallons a year while waiting in traffic [7]

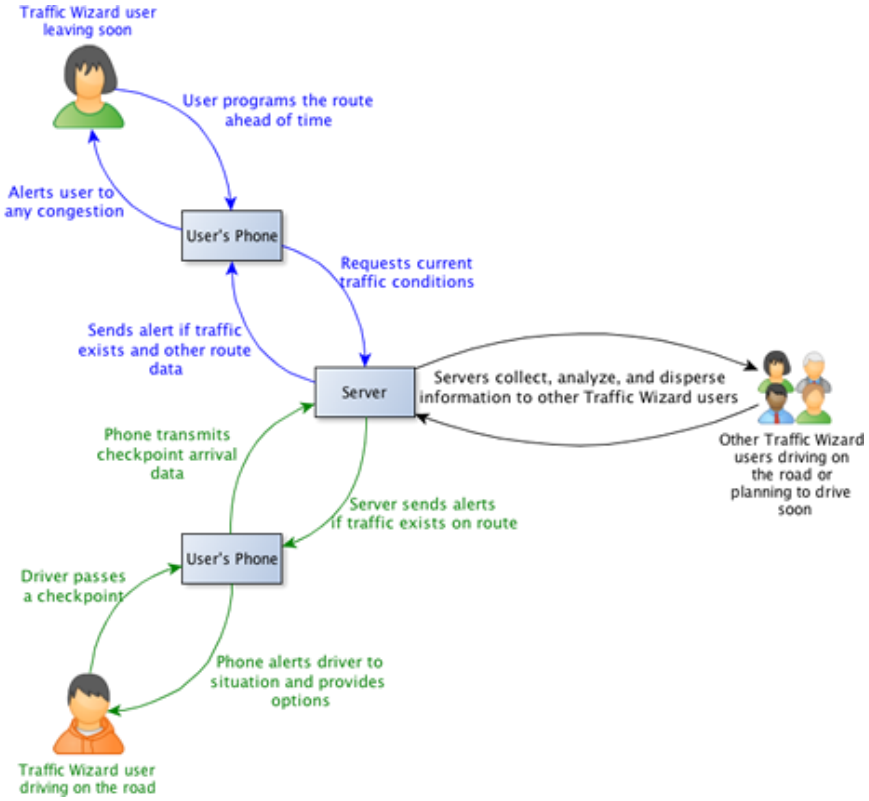
Figures for the amount of delayed hours, excess fuel consumption, and total monetary cost are found in these graphs – which indicate the population areas that endure the highest amount of each of these categories.





Solution

Traffic Wizard will aid drivers in avoiding this unfavorable heavy traffic by providing an efficient means for access traffic updates through a smartphone app. Drivers will be able to create a profile on the app to save and detail their most frequent routes to be stored on the phone and analyzed by the Traffic Wizard server prior to and during travel time.



Before Trip

Drivers who use Traffic Wizard have the ability to store their favorite or frequent routes under their profile. These routes can be detailed to account for what days and times the route is typically travelled and the route itself can be edited to use different road segments as desired. Before a driver goes to take a route on their next scheduled outing, Traffic Wizard will pre-analyze the route and download the updates to the app beforehand, thus providing the driver with an initial idea about what to expect on their route (or decide to take an alternate route).

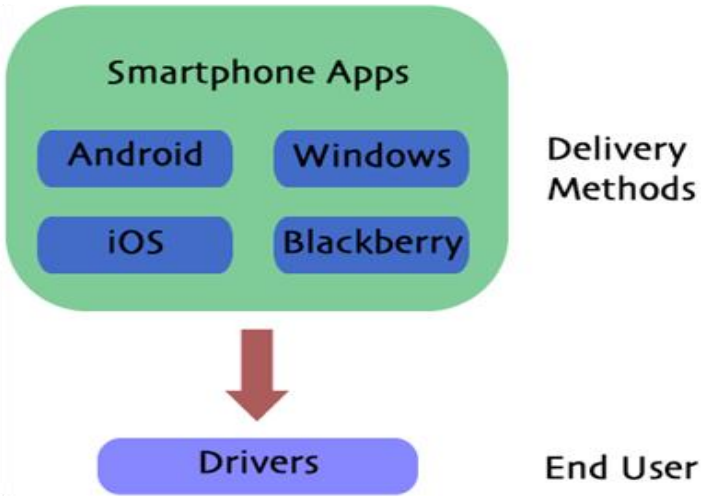
During Trip

As drivers move towards their destinations, they will pass over GPS locations that have been associated as virtual checkpoints and they will upload their travel metadata (such as time, speed, and direction) to the server for analysis. It is at this point that the app will also download any updates to the route ahead if there have been any changes (decided by the server to conserve data usage).

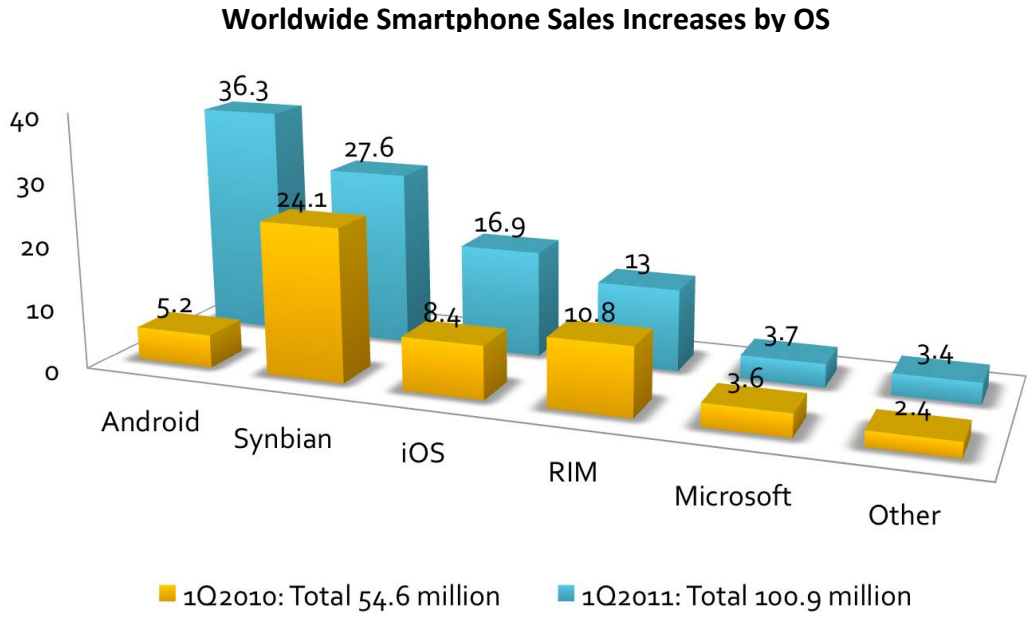
Marketing Plan

Target Market

Our potential customer base is anybody who drives a car and also owns a smartphone or tablet with cellular capabilities. This is an already huge demographic that is growing, and more importantly, remains quite unsaturated at present in terms of traffic avoidance applications. As of 2010, 210,114,939 Americans held drivers' licenses [5], accounting for 87% of the U.S. population over the age of 15 [1].



Meanwhile, smartphone sales have skyrocketed in the past few years. In the U.S. alone, about 95 million units were sold in 2011 [3]. In the end, by 2011, an estimated 35% of U.S. adults 18 and over own and use a smartphone [3], roughly 85 million people.



Price Point

Traffic Wizard will be offered through two distinct versions: a free and a paid version. The free version will provide most of the functionality of Traffic Wizard, but with ads and without the personalized route pre-analysis feature. The paid version of the app will provide all current features and access to future extensions of the program depending on their subscription method. There will be two methods of paying for the full version of Traffic Wizard.

- $4.99 / year – Access to the full version of Traffic Wizard and all features for one year
- $14.99 lifetime – Access to all Traffic Wizard features for life (one-time purchase)

Customer Return on Investment

The customer's return on their investment in Traffic Wizard can be affected by many circumstantial factors. All other things equal, a person that only makes two trips a day, say from home to work and back again, makes a total of 500 trips a year on a 50 week, 5-workday-a-week schedule. If this person lives around an urban area they experience, on average, an opportunity cost of over a thousand dollars each year resulting from their time spent (52 hours) and fuel spent (25 gallons) in traffic—this breaks down to about $2, or 6.24 minutes and about 7 fluid ounces of gasoline. So, there are three ways to analyze it:

- The customer has the free edition, in which case the customer's return on investment is undefined.
- The customer has a $4.99/year subscription, in which case they'd only need to avoid about 16 minutes of traffic per year. Since we are dealing with averages, we can assume that if Traffic Wizard helped the user avoid just one instance of extraordinary congestion in a year, their investment would be returned.
- The customer has a $14.99 lifetime subscription, which by the above data means in order to equal the amount of money they paid for Traffic Wizard, they would need to avoid 45 minutes of traffic for the rest of their life; again, avoiding one unusually heavy congestion incident could make up for the entire cost.

Company Return on Investment

Our profit will be what is left over after paying resource and staffing costs per year, plus overhead costs. Obviously, expansion to new regions gives us access to more potential customers, but it also raises our operating cost. In addition, as we expand to lower and lower population areas, the amount of new possible customers will diminish, and therefore so will our profit margin. Ongoing strategic business and marketing research and campaigns will help us to achieve the optimum balance between customer exposure and operational cost.

Our yearly operational costs are the cost of workstations needed per region (W) times the amount of regions we currently serve (n), plus the amount of servers needed for each of those regions (S) times n. In addition, we have the regional staffing requirements (R) times number of regions and central staff (C).

$$\text{Profit} = \text{Revenue} - [n*(W+S+R)+ C]$$

Per the Staffing and Resource Plans, W+S+R = $458,500 per year (specific resource and staffing requirements plus 40% overhead), and C = $225,400, also including the 40% overhead, and presumably remains constant irrespective of expansion. So only the cost of workstations, servers, and regional staff can affect profit coming from new regions. After Hampton Roads, we will immediately scale upwards to the cities with the largest populations. Here are the current top five [8], along with accumulating totals as we would expand to two through six new areas:

Regions	New Region	Population	Regional Operational Cost	Total Population Exposure*
2	New York City	8,175,133	$917,000	9431415
3	Los Angeles	3,792,621	$1,375,500	13224036
4	Chicago	2,695,598	$1,834,000	15919634
5	Houston	2,099,451	$2,292,500	18019085
6	Philadelphia	1,526,006	$2,751,000	19545091

*population of new area plus previous areas plus 1,256,282 for Hampton Roads [4]

Assuming all our customers purchased yearly subscriptions at $5 each, the following table shows how many customers would need to be reached at each level of expansion to offset the costs of operation:

Regions	New Region	Yearly Regional Operational Cost	# of yearly customers needed	% of total population
2	New York City	$917,000	183,400	1.94%
3	Los Angeles	$1,375,500	275,000	2.07%
4	Chicago	$1,834,000	366,800	2.30%
5	Houston	$2,292,500	458500	2.54%
6	Philadelphia	$2,751,000	550,200	2.82%

As we expand to more areas, we need to acquire higher percentages of paying customers to offset the cost of operation. Realistically, many of these users will opt for our free version, which will drive advertising sales to boost our revenue. Additionally, data brokerage to government and private entities could bring in substantial sales, as the volume of data grows and quality of our data mining matures.

Acquiring nearly over 100,000 new customers, even in large metropolitan areas, is no small feat. But with clever advertising it is feasible to gain 8,000 customers a month through the above mentioned venues and social media like Facebook. Since subscriptions would be on a rolling basis, profits would take some time to trickle in, but if advertising is successful, profits could be seen by the end of the first year or possibly sooner.

Competition

	Traffic Wizard	INRIX	TomTom	Sygic	RAC Traffic (UK)	Beat The Traffic
Android Support	x	x		x	x	x
iPhone Support	x	x	x	x	x	x
Real-time Traffic Updates	x	x	x	x	x	x
Accident Notification	x	x			x	x
Time Predictions	x	x	x	x		x
Turn-by-turn GPS Directions			x	x		
Traffic Camera Viewer						x
Virtual Checkpoint System	x					
Personalized Travel Profile	x					
Price	**Free** **$4.99/yr** **$14.99**	Free $24.99	*$49.99 - $119.99 $9.99 w/WEBFLEET	*$14.99 - $69.99 *€9.99 - €19.99/yr	Free £0.69	Free $3.99
*Price dependent on country						

Competitors of Traffic Wizard have been analyzed for their respective features, platform offerings, and price points. While some competitors do offer quality products, each of them have aspects that could use improvement. The universal fault of every smartphone app that uses a smartphone's processing power heavily is the amount of battery drain that occurs during app use. Network and data usage is another factor of a similar respect, in that nearly all apps suffer from too much data exchange – which in turn puts a large dent on customer data plans.

Traffic Wizard's main innovations, compared to competitors, are the Virtual Checkpoint System and the utility for drivers to store their frequent routes under a travel profile. The profile utility is fairly standard in that it simply allows users to detail their main travel routes – but these stored routes (along with days and times they are travelled) are sent for analysis to the server for pre-analysis before travel time automatically for the driver's benefit.

The Virtual Checkpoint System (VCS) is the system that will effectively deliver the traffic updates to drivers and gather their travel metadata – all with a minimal effect on data usage and battery to an extent. Since travel data and updates are only exchanged as a driver passes a checkpoint – their phone only needs to submit data to the server after certain points during travel (as opposed to the typical time frame for refreshing updates, which can easily use the network for unnecessary updates if there have been few to no changes in conditions).

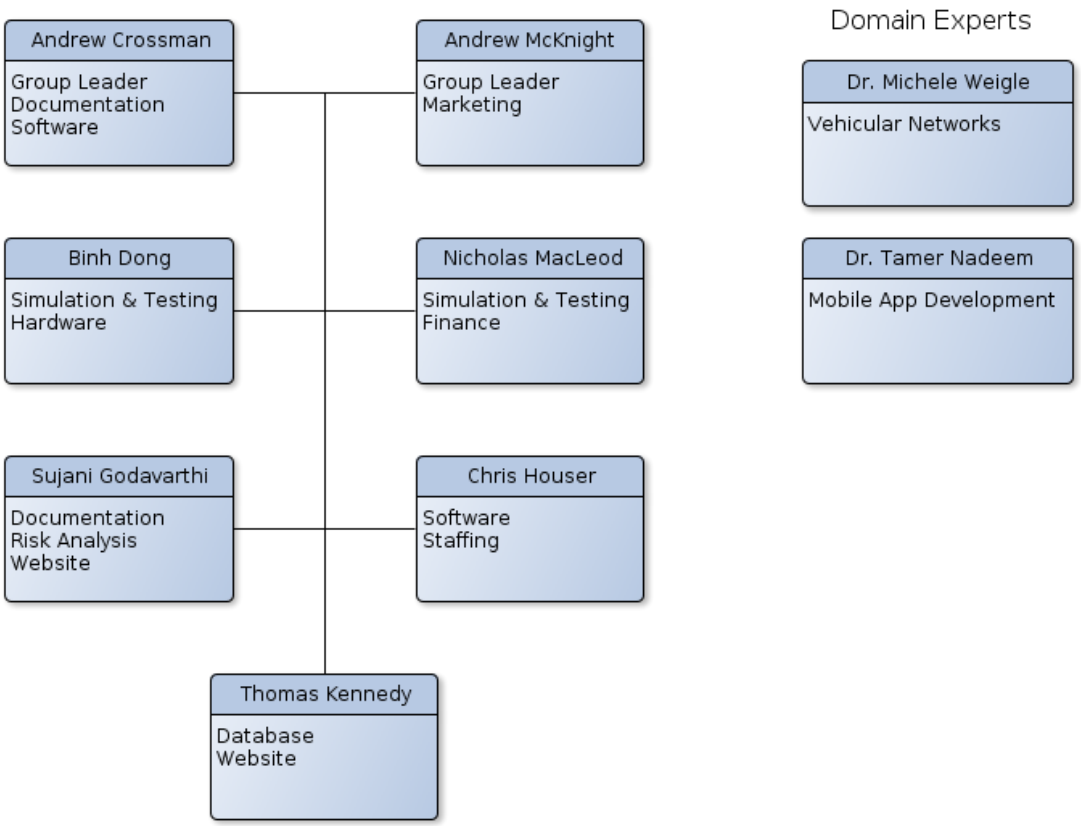
Management and Organization Plan

Project execution will be performed according to the standards established by the planning documents. These documents consist of the Management Plan, Marketing Plan, Funding Plan, Staffing Plan, Resource Plan, and the Risk Management Plan. Together, these plans will outline how the Traffic Wizard project will be conducted.

Tool Utilization

The primary communication method between members of Team Blue is email messaging, with versioning for attachments of presentation content that gets sent out to each team member to later be discussed during each weekly meeting. Other technologies used are a common graph editor, yEd, to create diagrams for presentations and Microsoft Office programs (e.g. Word, Powerpoint) to create other deliverables.

Team Organization



This outlines Team Blue for CS 410, including the domain experts that were consulted by interviews for information and inputs about Traffic Wizard concepts and ideas. Each team member role has its own specific responsibilities.

Group Leader

- Andrew Crossman
- Andrew McKnight

The group leaders, Andrew Crossman and Andrew McKnight, represent the project managers for Traffic Wizard. The group leaders are responsible for managing Team Blue and monitoring progress and development while ensuring communication and coordination within the team. Typically, the group leaders handle organizing the major presentable material and meetings.

Documentation Specialist

- Andrew Crossman
- Sujani Godavarthi

Documentation specialists are responsible for ensuring document-type deliverables are consistent and presentable. Traffic Wizard plans are among these documents, and are managed by the documentation specialists.

Marketing Specialist

- Andrew McKnight

The marketing specialist handles all research in terms of customer identification and market analysis. Promotion and marketing for Traffic Wizard itself is also handled by the marketing specialist, along with organization of marketing campaigns.

Software Specialist

- Andrew Crossman
- Chris Houser

The software specialists are responsible for design and analysis of the approach for implementation of the software components for Traffic Wizard. Software specialists are considered experts in terms of software development and work closely with the simulation and database specialists within the team. To ensure proper functionality of Traffic Wizard, more members of the team will be involved in software development (as computer science professionals) as needed.

Simulation and Testing Specialist

- Binh Dong
- Nicholas MacLeod

Much of Traffic Wizard's innovations rely on thorough simulation and testing before they can be considered effective. The simulation and testing specialists have the responsibility of ensuring that the current version of the project is being properly simulated to demonstrate its functionality as well as testing all aspects of operations (concerning the mobile app and the server infrastructure).

Hardware Specialist

- Binh Dong

The hardware specialist is responsible for research on necessary hardware to initialize the Traffic Wizard project. As the project expands, the hardware specialist will be responsible for determining the required hardware to maintain network operations and ensure server scalability. These requirements will be defined per Traffic Wizard operating region.

Website Specialist

- Thomas Kennedy
- Sujani Godavarthi

The website specialists handle all aspects of the CS 410 Team Blue website that represents the Traffic Wizard product. This includes uploading all files relevant to the project as well as styling of the page. As new material is created to demonstrate progress on the project, the website specialists ensure that this content is available through the group website.

Risk Analysis Specialist

- Sujani Godavarthi

The risks analysis specialist is the team member who continuously assesses the risks of Traffic Wizard throughout the phases. Risks are analyzed through a risk matrix to visually represent the impact and probability of each determined risk – which is handled by the risk specialist.

Finance Specialist

- Nicholas MacLeod

The finance specialist is responsible for detailing the budget for Traffic Wizard in its respective phase. These details are found in the Funding Plan, which is handled by the finance specialist. Costs of hardware resources and staffing are analyzed within this document.

Staffing Specialist

- Chris Houser

The staffing specialist is responsible for the budget and hiring of employees to work on the project. Details for the expected hiring patterns are listed in the Staffing Plan – which is organized by the staffing specialist.

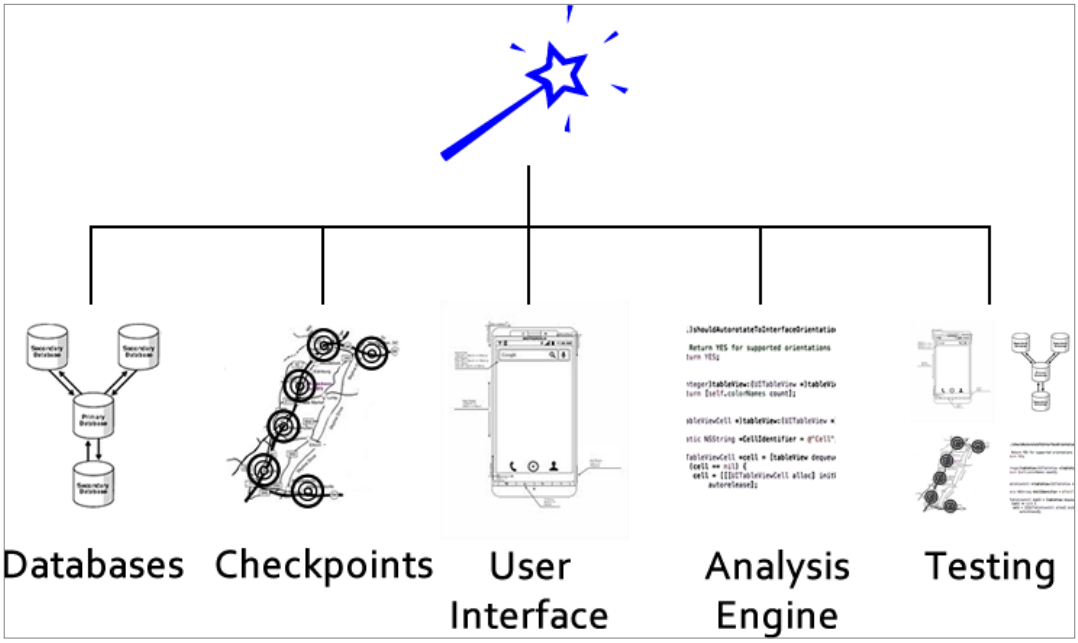
Database Specialist

- Thomas Kennedy

The database specialist maintains all aspects of the Traffic Wizard databases. These responsibilities include monitoring database activity and ensuring that the system is operationally stable.

Development and Milestones

Software Milestones (Phase 2)

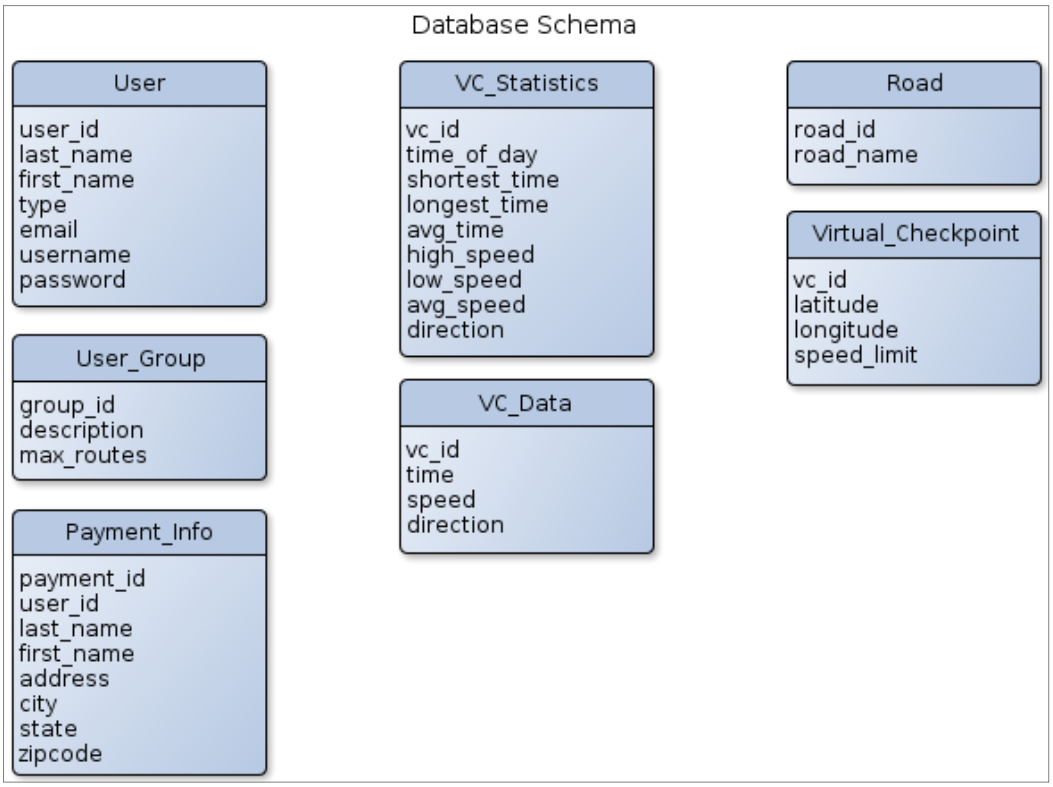


Databases

The Traffic Wizard development process will be comprised of five milestones. The Database milestone will involve implementing all required databases and refining the designs of aforementioned databases where necessary. Three databases will be implemented, a speed limit database, a customer database, and a route/checkpoint database.

Traffic Wizard will utilize an external speed limit database. Speed limit data is publicly available; access to this database will be limited to retrieving speed limits for the Virtual Checkpoint System (VCS)—which will be explained in the next milestone. The frequency at which the speed limit data must be retrieved will be determined during the development process.

The customer and route/checkpoint databases will be implemented and maintained by the Traffic Wizard team. A schema for the aforementioned databases is described in the figure listed below.



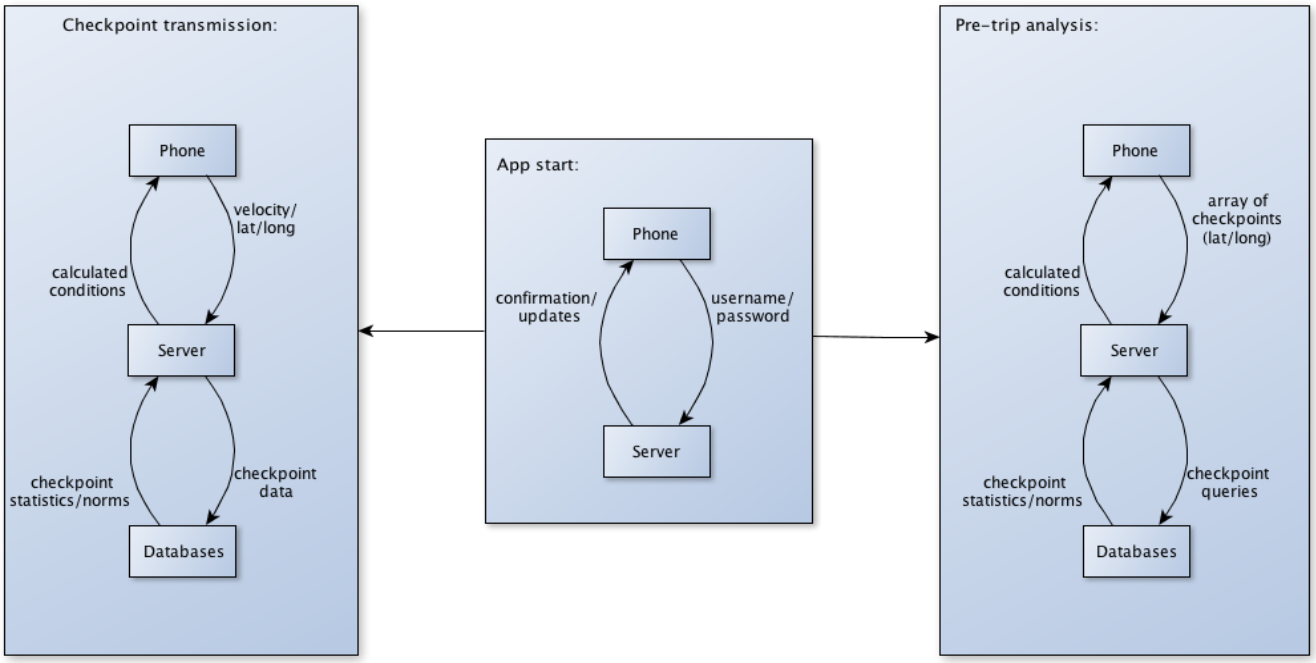
The customer database will contain login information, customer types, and payment information. The Traffic Wizard servers will utilize this database when a customer logs into the Traffic Wizard application, when a customer modifies his or her subscription, or when a new user registers.

The route/checkpoint database will require the most development time. This database contains information for every checkpoint-- latitude, longitude, and speed limit-- and data for each checkpoint. The data to be stored include time, speed, and direction. Statistics are calculated from the collected data, and then stored in the database.

Checkpoints

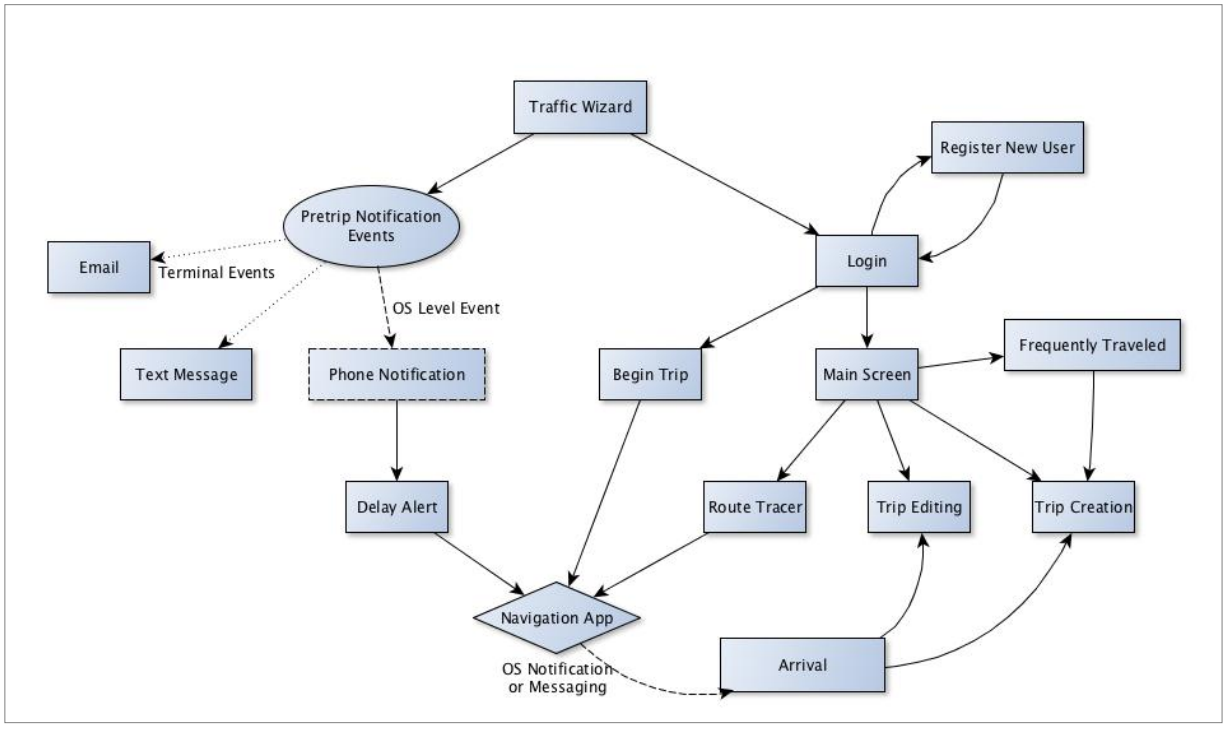
Virtual Checkpoints are latitude longitude locations. When a driver passes a checkpoint, the Traffic Wizard application uploads position and velocity data. The time elapsed since the previous checkpoint is also uploaded. This information is collected from all smartphones passing the checkpoint, analyzed by the Traffic Wizard servers, and returned to the application as traffic data.

Virtual checkpoint activity for pre-trip analysis and real-time updates during travel is illustrated in the data flow diagram below.



User Interface

GUI Site Map



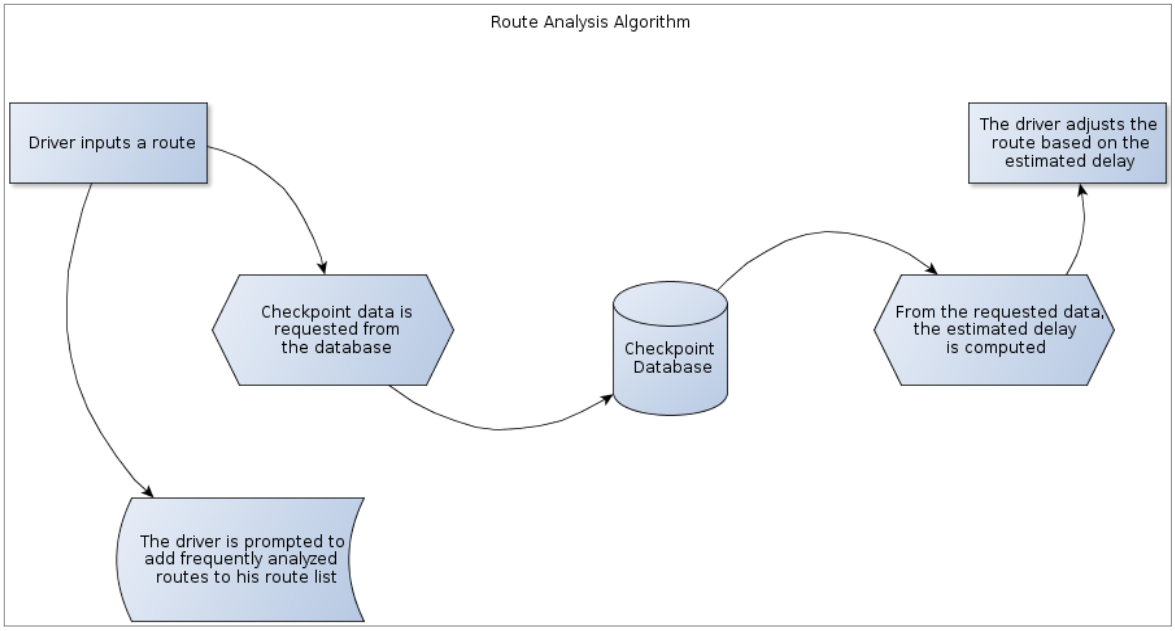
The Traffic Wizard smartphone interface will necessitate the development of a multitude of screens. The first screen is presented upon initialization of the smartphone application. An Existing user enters his or her login credentials on this screen; a new user selects “register as a new user”.

The registration screen collects a user's name, email address, desire username, and desired password. This data is encrypted and sent to the Traffic Wizard customer database.

Once a user has logged in, he or she is presented with a menu. From this menu a user is able to edit a route, create a new route, or view traffic conditions along a route. When the user begins his trip the phone transfers him or her to a navigation screen. This navigation screen displays traffic data at each checkpoint along the current route. Upon completion of a trip the driver is presented with the option to save modifications to the traveled route.

The Traffic Wizard application includes a delay notification feature. Before a user's departure, the Traffic Wizard application will poll the Traffic Wizard servers for delay information. If a delay is found along the user's route, he user is notified through a text message, email, or phone notification. The user is presented with alternate routes. If an alternate route is selected, the application collects traffic data for the modified route.

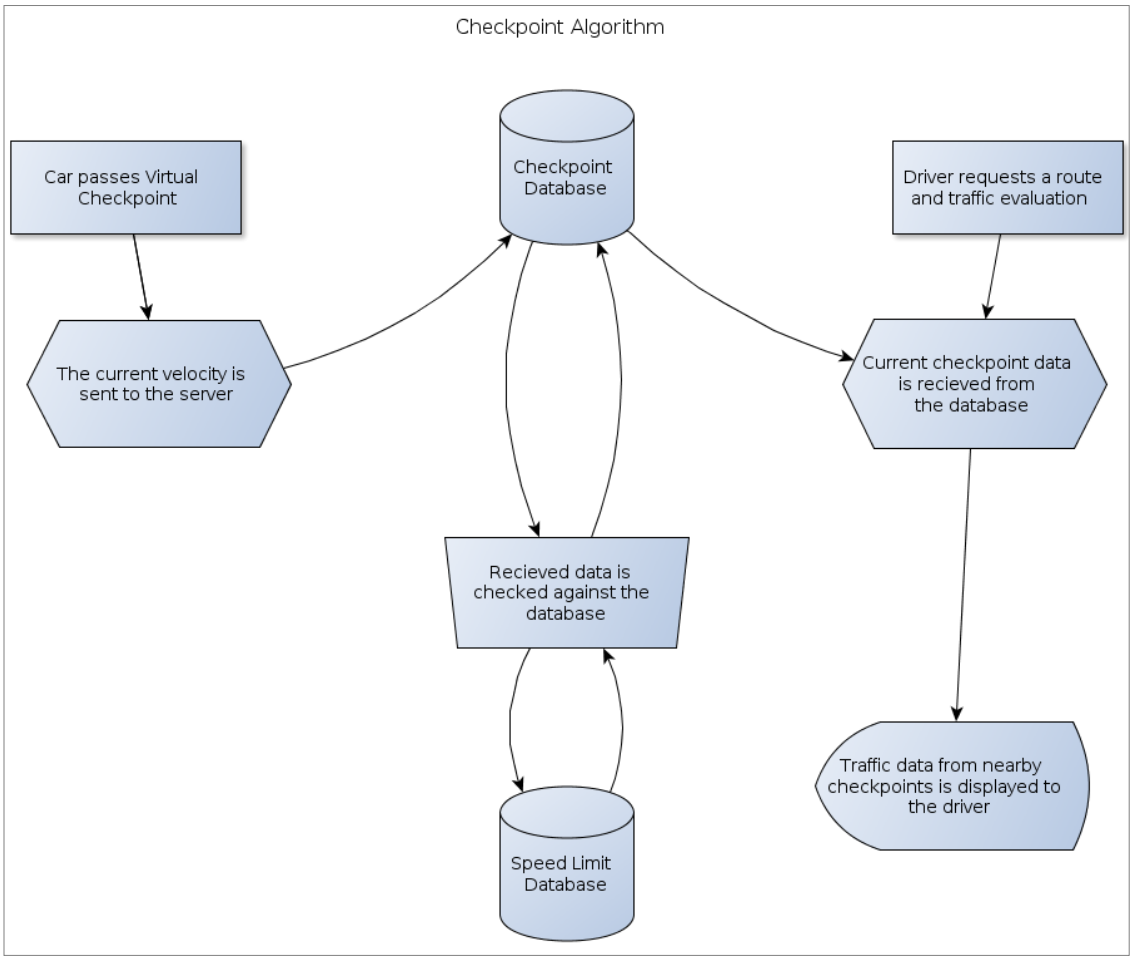
Analysis Engine / Route Analysis Algorithm



There are two fundamental algorithms to be developed as part of Traffic Wizard-- the route analysis algorithm and the checkpoint algorithm. The route analysis algorithm is responsible for route planning and aggregating traffic data from the checkpoints along the route. The driver inputs a route into the Traffic Wizard smartphone application.

Upon entry of this route, the driver is prompted to add the route to the list of frequently traveled routes—this occurs locally on the driver's smartphone. The smartphone application requests traffic data from checkpoints along the route. This request is handled by the Traffic Wizard servers, which query the checkpoint database. The estimated delays due to traffic congestion are computed by the server and forwarded to the driver's smartphone. The driver is presented with the option to revise his or her chosen route.

Checkpoint Algorithm

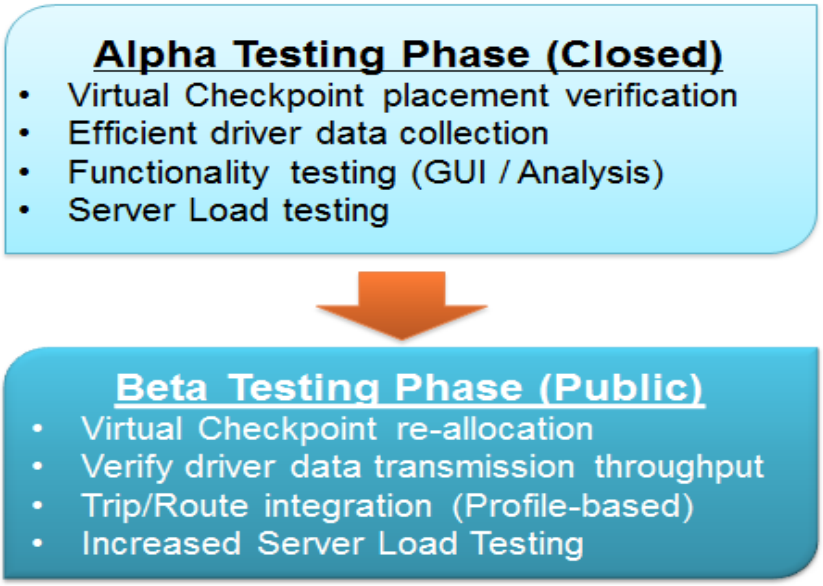


The second algorithm, the checkpoint algorithm, updates traffic data on the Traffic Wizard servers and the Traffic Wizard application. Periodically the Traffic Wizard application will check the smartphones position against a list of checkpoints-- which are stored locally on the smartphone. When the application determines a checkpoint has been passed, the current velocity is sent to the server.

The server submits the velocity data to the checkpoint database to be validated. The database validates the data, and inputs the speed limit and direction data into the database. Updated checkpoint data is pushed to the smartphone application. Upon the request of the driver, traffic data--from checkpoints in the vicinity-- is presented to the driver.

Testing

Traffic Wizard testing will be split into two phases. The first phase is a closed alpha test. The second phase is an open beta test. The alpha test will be limited to algorithm verification, functionality testing, and server load testing.



The Virtual Checkpoint System will be tested, the initial placement of the checkpoints will be analyzed, where necessary modifications in checkpoint position will made. Further testing of checkpoints will occur during beta testing. Data collection will be refined throughout the testing period; methods such as compression will be explored. Various network algorithms will be tested for reliability, throughput, and scalability.

Preliminary testing of the smartphone interface and the analysis engine will be conducted. The interface will be tested for stability and core functionality. The analysis engine will be evaluated based on data throughput, latency, and data accuracy.

Load testing of Traffic Wizards servers will be conducted during this phase. The scalability, reliability, and configuration of the servers will be evaluated. All necessary improvements will be made before the open beta test.

Following the alpha test improvements to the Traffic Wizard Servers and Traffic Wizard application will be made. A more developed system will be evaluated during the open beta test phase.

The Virtual Checkpoint System (VCS) will be re-evaluated during the beta test-- the focus is on the dynamic re-allocation of checkpoints. The VCS will modify the position of existing checkpoints and add new checkpoints. This re-allocation will occur during changes in traffic congestion.

The throughput of driver data will be evaluated; the incoming data must be evaluated expeditiously to maintain accurate traffic data. The transmission of traffic data sent from the Traffic wizard servers to drivers will be evaluated. Methods for minimization of data transmission and processing will be evaluated during this phase.

The route and route profile system will be incorporated into Traffic Wizard and tested for accuracy. The ability of the servers to handle the additional load will be evaluated with emphasis on the analysis of traffic data and the throughput of aforementioned data.

Funding Plan

Phase 1

For this phase of the project, the Traffic Wizard team will apply for funding from the Department of Transportation SBIR program, with the understanding that up to $100,000 may be made available to us.

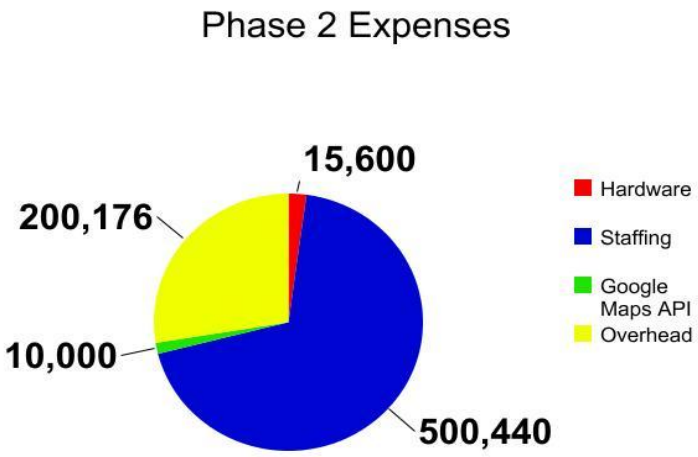
Resource	Amount
Hardware	-$13,600.00
Staffing	-$86,400.00
SBIR Grants	$100,000.00
Balance	$0.00

The hardware cost includes 6 workstations, 6 Android phones, and 2 servers. The staffing cost covers the salary of our programmers, manager, and contractors over the course of Phase 1. We plan to conduct this phase from within ODU, which will also alleviate any building costs.

Phase 2

After successfully completing Phase 1, the Traffic Wizard team will become eligible to receive up to $750,000 more in SBIR funding. Phase 2 is centered entirely around creating a functional prototype and development.

Resource	Amount
Hardware	-$15,600.00
Staffing	-$500,440.00
Google Maps API	-$10,000.00
Overhead	-$200,176.00
SBIR Grants	$750,000.00
Balance	$23,784.00



The hardware cost consists of 6 workstations, 6 Android phones, and 3 servers. Overhead has also been added due to the fact that at this point Traffic Wizard will move to its own offices.

Phase 3

Traffic Wizard will launch to the public directly after Phase 2 for virtually no cost as it will go directly to the App Store. Phase 3's cost will be entirely on maintenance of the project. The following projections are for the loans necessary to cover the salary costs of employees until the project becomes profitable enough to pay back the loans and related expenses. We also plan to sell collected impersonal traffic data to various organizations to help alleviate costs as well.

Resource	Amount
Staffing	-$316,200.00
Hardware	-$4,000.00
Business Loans	$220,200.00
Data Collection	$100,000.00
Balance	$0.00

Detailed Staffing Chart

Overall staffing for all phases is outlined in the following table. Some staffing requirements will be per center as Traffic Wizard expands its operations.

Phase	Position	Number	Rate	Hours	Gross Total
1	Project Manager	1	$35.00	600	$28,000.00
1	Software Engineer	3	$27.00	1350	$36,450.00
1	Database Developer	1	$25.00	400	$10,000.00
1	Web Developer	1	$25.00	278	$6,950.00
1	Database Consultant	1	$100.00	50	$5,000.00
2	Project Manager	1	$42.00	1780	$74,760.00
2	Software Engineer	4	$34.00	7120	$242,080.00
2	Database Administrator	1	$40.00	1800	$72,000.00
2	Software/Hardware Tester	2	$31.00	1800	$111,600.00
3	Project Manager	1	$45.00	800	$50,400.00
3	Software Engineer	2	$35.00	800	$78,400.00
3	Webmaster	1	$25.00	200	$7,000.00
3	Database Administrator	1	$35.00	400	$19,600.00
3	Tech Support	8	$12.00	6400	$76,800.00
3	Other Staff				$84,000.00

Detailed Resource Chart

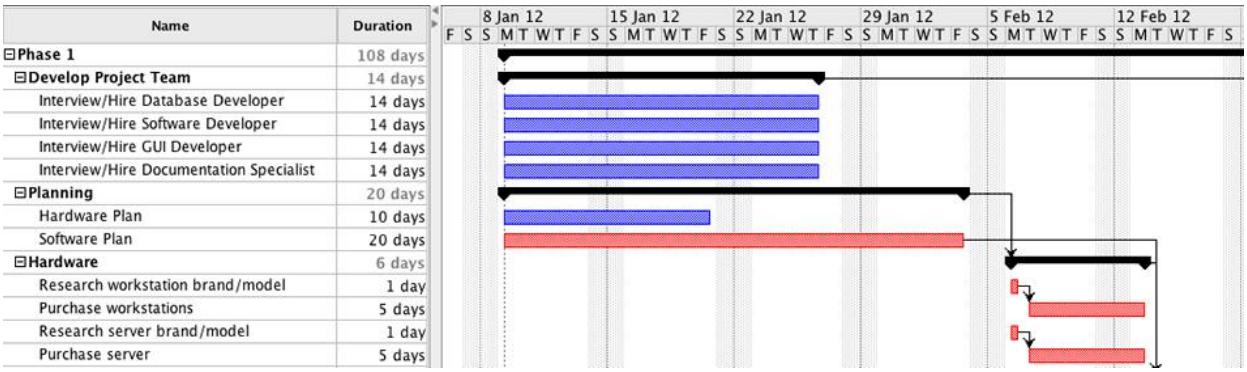
The expected hard and software resources are detailed in the follow table.

Phase	Item	Number	Cost per Item	Total Item Cost
1	Workstations	6	$1,000.00	$6,000.00
1	Android Phones	6	$600.00	$3,600.00
1	Servers	2	$2,000.00	$4,000.00
2	Workstations	6	$1,000.00	$6,000.00
2	Android Phones	6	$600.00	$3,600.00
2	Servers	3	$2,000.00	$6,000.00
2	Google Maps API	1	$10,000.00	$10,000.00
3	Workstations	4	$1,000.00	$4,000.00

Work Breakdown Structure

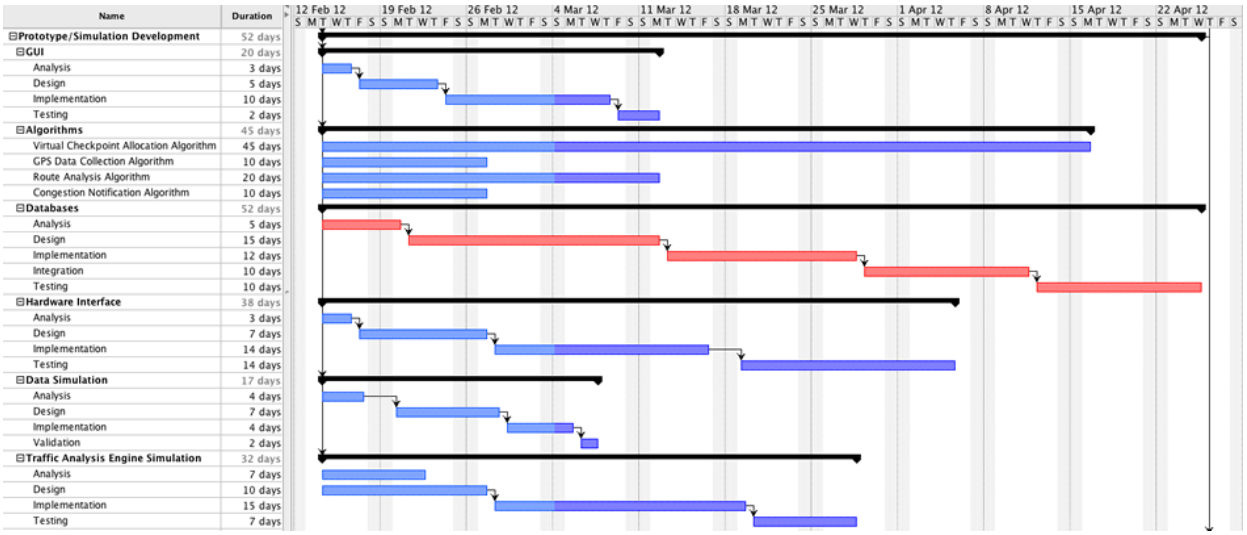
The planned breakdown for the necessary tasks in Phase 1, 2 and 3 is detailed in the work breakdown structure images below. The scheduled work plan will need to be utilized in order to complete the milestones in an efficient manner. Each phase is assigned a work breakdown structure specific to the tasks necessary for that stage of production.

Phase 1 – Project Prototyping



Name	Duration
Phase 1	108 days
Develop Project Team	14 days
Interview/Hire Database Developer	14 days
Interview/Hire Software Developer	14 days
Interview/Hire GUI Developer	14 days
Interview/Hire Documentation Specialist	14 days
Planning	20 days
Hardware Plan	10 days
Software Plan	20 days
Hardware	6 days
Research workstation brand/model	1 day
Purchase workstations	5 days
Research server brand/model	1 day
Purchase server	5 days

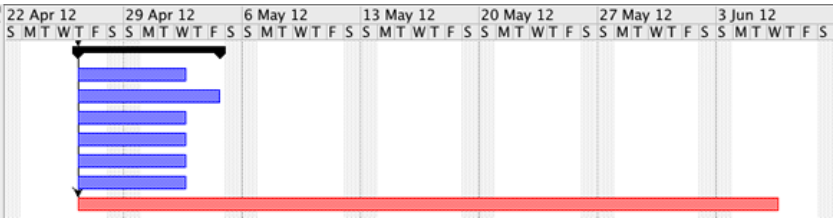
The prototyping stage will require planning for the required resources to build the prototype system.



Name	Duration
Prototype/Simulation Development	52 days
GUI	20 days
Analysis	3 days
Design	5 days
Implementation	10 days
Testing	2 days
Algorithms	45 days
Virtual Checkpoint Allocation Algorithm	45 days
GPS Data Collection Algorithm	10 days
Route Analysis Algorithm	20 days
Congestion Notification Algorithm	10 days
Databases	52 days
Analysis	5 days
Design	15 days
Implementation	12 days
Integration	10 days
Testing	10 days
Hardware Interface	38 days
Analysis	3 days
Design	7 days
Implementation	14 days
Testing	14 days
Data Simulation	17 days
Analysis	4 days
Design	7 days
Implementation	4 days
Validation	2 days
Traffic Analysis Engine Simulation	32 days
Analysis	7 days
Design	10 days
Implementation	15 days
Testing	7 days

Development for the prototype stage includes most software functionality along with simulator engines for creating artificial driver data.

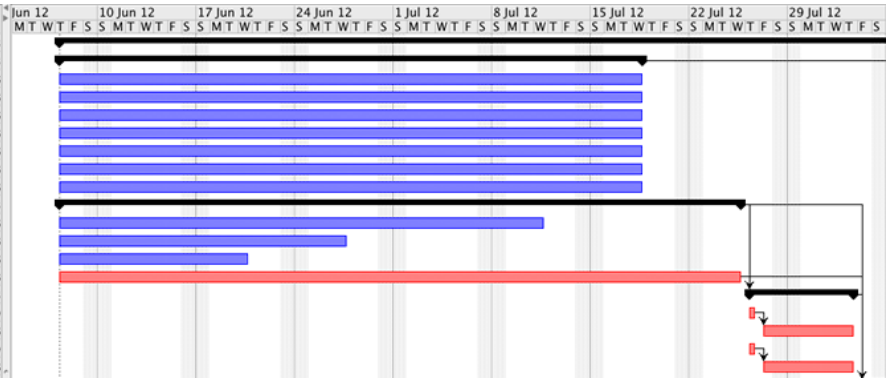
Name	Duration
Documentation	7 days
Database Documents	5 days
Algorithm Documents	7 days
Hardware Interface Documents	5 days
Data Mining Documents	5 days
Traffic Analysis Engine Documents	5 days
GUI Documents	5 days
Prototype Testing	30 days



Documentation for Phase 1 is also a set of assigned tasks.

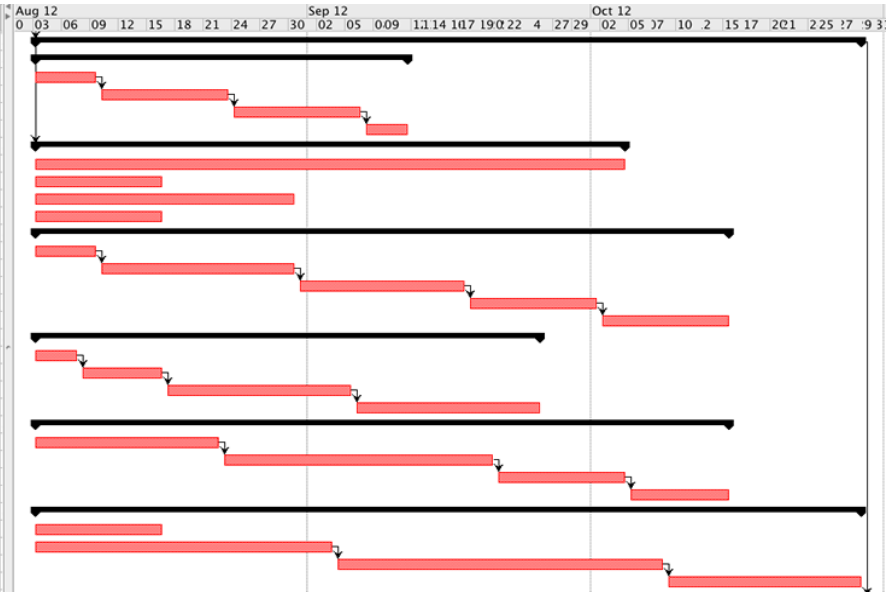
Phase 2 – Project Development:

Name	Duration
Phase 2	297 days
Develop Project Team	30 days
Interview/Hire Webmaster	30 days
Interview/Hire Database Developer	30 days
Interview/Hire Software Developer	30 days
Interview/Hire GUI Developer	30 days
Interview/Hire Reports Expert	30 days
Interview/Hire Marketing Specialist	30 days
Interview/Hire Documentation Specialist	30 days
Planning	35 days
Risk Management	25 days
Support Plan	15 days
Hardware Plan	10 days
Software Plan	35 days
Hardware	6 days
Research workstation brand/model	1 day
Purchase workstations	5 days
Research server brand/model	1 day
Purchase server	5 days



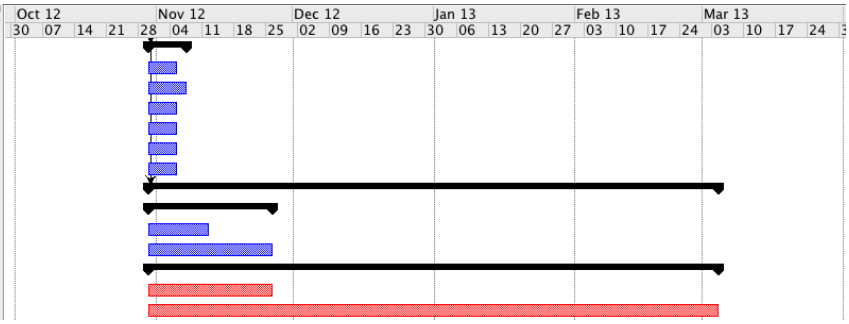
Planning for Phase 2 includes the hiring of a larger team to develop the product as well as preparing plans for production and purchasing required hardware.

Name	Duration
Software Development	62 days
GUI Development	28 days
Analysis	5 days
Design	10 days
Implementation	10 days
Testing	3 days
Algorithm Development	45 days
Virtual Checkpoint Allocation Algorithm	45 days
GPS Data Collection Algorithm	10 days
Route Analysis Algorithm	20 days
Congestion Notification Algorithm	10 days
Database Development	52 days
Analysis	5 days
Design	15 days
Implementation	12 days
Integration	10 days
Testing	10 days
Hardware Interface Development	38 days
Analysis	3 days
Design	7 days
Implementation	14 days
Testing	14 days
Data Mining	52 days
Analysis	14 days
Design	21 days
Implementation	10 days
Testing	7 days
Traffic Analysis Engine	62 days
Analysis	10 days
Design	22 days
Implementation	25 days
Testing	15 days



Development for Phase 2 is the most critical stage in the creation of the Traffic Wizard project. This stage defines the software functionality and brings our innovative concepts to their full scale form.

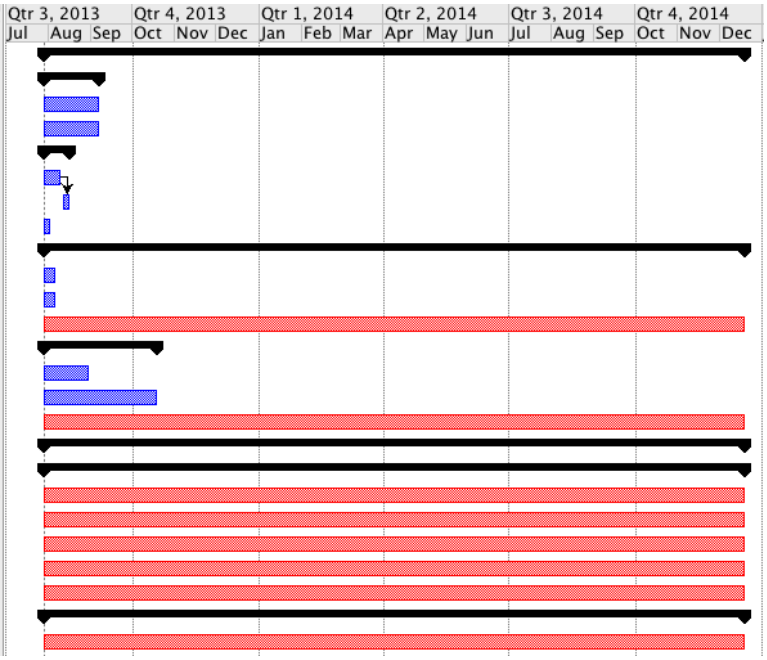
Name	Duration
Documentation	7 days
Database Documents	5 days
Algorithm Documents	7 days
Hardware Interface Documents	5 days
Data Mining Documents	5 days
Traffic Analysis Engine Documents	5 days
GUI Documents	5 days
Testing	90 days
Alpha	20 days
Server Load Testing	10 days
System Functionality Testing	20 days
Beta	90 days
Server Load Testing	20 days
System Functionality Testing	90 days



The testing stage of Phase 2 is also very critical, since this is where the Alpha and Beta testing phases take place. These tests are expected to last up to about 90 days in order to get proper patterning out of the collected data.

Phase 3 – Production and Out-Years:

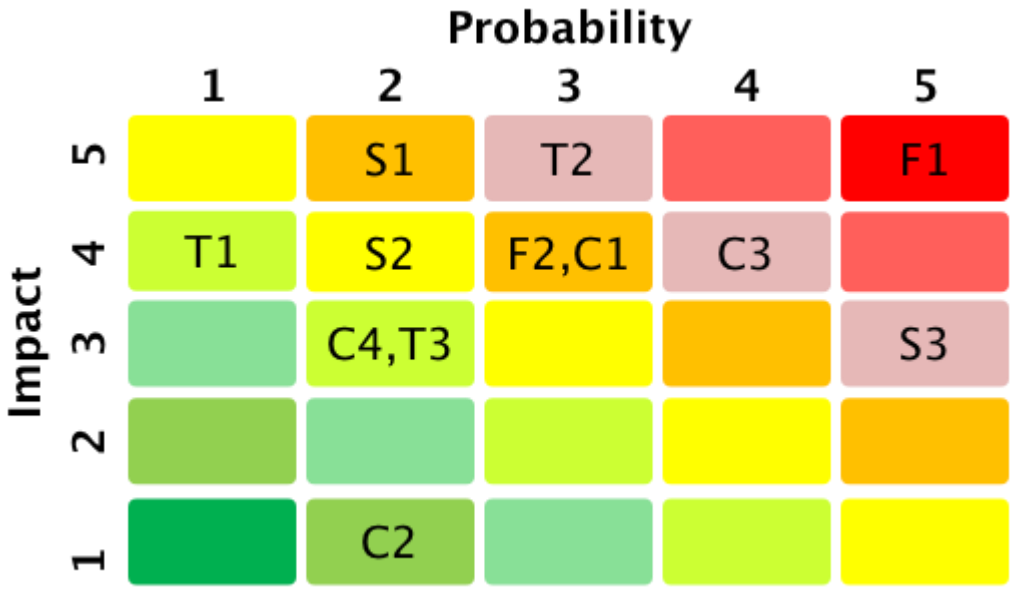
Name	Duration
Phase 3	365 days
Develop Project Team	30 days
Interview/Hire marketing specialist	30 days
Interview/Hire tech support specialists	30 days
Hardware	15 days
Regional requirement assessments	10 days
Purchase additional workstations/equipment	5 days
Purchase additional servers	5 days
Technical Support	365 days
Define procedures	7 days
Specialist training	7 days
Ongoing operations	365 days
Marketing	60 days
Expansion research	25 days
Regional campaigning	60 days
Data Mining	365 days
Out-years Improvement	365 days
Software Maintenance	365 days
GUI	365 days
Algorithms	365 days
Databases	365 days
Hardware Interface	365 days
Traffic Analysis Engine	365 days
Documentation	365 days
User manual refinement	365 days



Phase 3 represents the ongoing maintenance and support of Traffic Wizard. This includes expansion in marketing, growth to other centers, providing support to customers, and fixing any discovered software glitches by releasing patches for the app.

Risk Assessment

Risk management is an essential part of this project as it has the biggest impact on overall project success. It's important to have a good risk analysis in order to analyze all of the major and minor risks to the project. These risks are organized into four categories namely financial risks, customer risks, technical risks and schedule risks. For the mitigation strategy, we will take steps to decrease the severity of the risk and/ or the probability of the risk occurring.



Financial Risks
F1. Customer Investment
F2. Hardware/Software Network Maintenance

Customer Risks
C1. Product Interest
C2. Ease-of-use to Customer
C3. Driver Distraction
C4. Product Accessibility

Technical Risks
T1. Communication Protocol
T2. Server Infrastructure
T3. Hardware Failure

Schedule Risks
S1. Database Design
S2. Application Development
S3. Prototype /Test Phase

Financial Risks

F1. Customer Investment (Probability: 5, Impact: 5)

When developing an application like Traffic Wizard there is always the possibility of not being able to get enough customers to maintain the operations and as a result the impact for this risk is very high. Traffic Wizard cannot succeed if customers do not buy into it. Expenses will be an ongoing process that will depend on marketing, financial decisions and with effective advertising.

In the market, companies like Tom-Tom, INRIX, Sygic, RAC Traffic (UK), Beat the traffic are in demand with their features and Traffic wizard will have to compete for its customers. This is risky but with the component features of Traffic Wizard it won't be difficult. The features that Traffic Wizard offers are the virtual checkpoint system (VCS) and personalized travel profile and no other known companies' competition have these features.

F2.Hardware/Software Network Maintenance (Probability: 3, Impact: 4)

Server infrastructure is subject to few repairs and the network connecting drivers must be maintained properly. Since the foundation of the application lies in drivers' smart phones (as opposed to additional hardware), the probability of this is decreased. There will be hardware and software testing to ensure that the components are working properly and information is received properly to the smart phones.

Customer Risks

C1. Product Interest (Probability: 3, Impact: 4)

The price of our app is a major risk. Firstly, the cost of the product needs to be able to turn a profit for the business. Secondly, the product needs to be competitive in the market in order to attract potential customers. If the product cost is too low we may not have enough financial to support our Traffic Wizard app. But having the costs too high will not be able to attract enough customers to purchase the app. By setting the price to be standard with other companies that are in competition with effective marketing will be useful.

C2. Ease-of-use to Customer (Probability: 2, Impact: 1)

The smart phone app can be customized according to the requirements of the driver. The features inclusive are personalized Smartphone application for traffic updates, user profile system for storing frequent routes. They can receive the analyzed stored routes before or during the travel time which shows the accurate travel information. With the virtual checkpoint system, the driver can receive efficient data exchange. It's low in cost, easy installation of the product into driver smart phones.

C3. Driver Distraction (Probability: 4, Impact: 4)

Interaction with the app while driving is a high distraction risk and in turn may cause accidents. Since, Traffic Wizard's purpose is to provide notifications about traffic jams, accident spots this will save the time of the driver. With alpha and beta phases of testing, a suitable way is required to reduce the distraction of the app. This can be mitigated with a minimalistic interface that assists the driver with little to no physical interaction with the device.

With the personalized travel profile, the information is automatically updated and alert notifications are received depending on the frequency of time being set. This feature will help the driver to be alert and not use the smartphone all the time while driving.

C4. Product Accessibility (Probability: 2, Impact: 3)

Not every driver has a smartphone to access and download the app. The smartphone market has been well analyzed and is expected to grow immensely. According to the market, worldwide sale of the smartphone in the year 2010 are $54.6 million dollars but increased drastically in the year 2011 to $100.9 million dollars. In 2010, 298 million smart phones were sold worldwide, up from 175 million in the year 2009, for a growth rate of 70% and the biggest growers were android suppliers. [2]

About 118 million smart phones were sold in the year 2011. An estimation of smartphone sales will rise to 982 million in the year 2015. [3] According to the data shown, there will be less probability and impact of the risk of drivers having a smartphone.

Technical Risks

T1. Communication Protocols (Probability: 1, Impact: 4)

Communications between a device and the cloud are designed to occur within small time frames. With cloud designing, providing software, data access, storage services which can handle massive information and information sent to the smartphones. Latency will negate the usefulness of traffic data. Virtual Checkpoints can be dynamically relocated with respect to roads and traffic patterns. Traffic Wizard's virtual checkpoint system will assist with efficient information exchange.

T2. Server Infrastructure (Probability: 3, Impact: 5)

The configuration and design of the server infrastructure must be able to compile and distribute data to connected drivers. The server will have to be efficiently scalable in design. Traffic Wizard is expected to hold the potential to connect with manufacturer telematics to assist with future scalability.

T3. Hardware Failure (Probability: 2, Impact: 3)

A hardware failure of an application device can cause problems. The probability is less, which depends on the issues with the hardware problem, and the impact will continue until the hardware problem is solved.

The inevitable risk of technical issues due to hardware failure will be present in Traffic Wizard's operations. Sensible upkeep and maintenance should prove to mitigate this factor.

Schedule Risks

S1. Database Design (Probability: 2, Impact: 5)

Traffic Wizard database will maintain databases on speed limit and will updated through the connections sent to the app. The database schema consists of user, profile of the user, payment information, statistics of the route, time and location and virtual checkpoint information.

Traffic Wizard's virtual checkpoint system will require initial latitude and longitude information to observe and use as virtual checkpoints in critical areas. This is necessary to act as the foundation for traffic analysis. The impact for this risk is high because there's a lot of information that needs to be stored and accessed. The information should be secure for security reasons for the driver profiles.

S2. Application Development (Probability: 2, Impact: 4)

Implementation and development of the app may be delayed due to various reasons. The impact is high as to problems occurring in the stage of the development. The best practices will be provided in the software development process, which will help mitigate these issues in functionality.

S3. Prototype / Testing Phase (Probability: 5, Impact: 3)

This phase is heavily dependent on the quality of execution of the product. Without the proper development there is high risk in the testing phase and can erupt many problems. Design issues must be resolved in this stage and the program must be proven to work. The testing are two types namely alpha and beta testing. The alpha testing is interaction of the driver profile, server and functionality testing. With the beta testing, virtual checkpoint re-allocation is tested, verification of the data transmitted to the driver and checking the functionality of the server.

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