Requirement specification for virtual traffic light on Android-based mobile system

1. Introduction

1.1 The objectives

The aim of this project is to construct an application of virtual traffic light based on Android mobile operating system, which is used to replace the physic traffic signals in intersections, address the issue of traffic congestion and decline the accidents on the road.

This document describes the software requirement specification from the functional and non-functional perspective, which instructs programmer to develop the product meeting the criteria from customers and provides the standard for tester to evaluate the quality of the application. Besides, as a project deliverable, it is useful for users to comprehend the product.

1.2 Intended audience

- **Project manager** can understand the requirements then distribute the specific task to developers and testers. This artefact can also assist the project manager to supervise teams and manage the project.
- **System architect** regards this file as a reference to design the system including the components, interfaces, technologies and resources.
- **UI designer** requires this to generate a pleasurable, usable and satisfying user interface since the requirements represent the user preference.
- **Developer** programs the product based on the requirements to keep the development in a correct direction and avoid the inconsistency with customers.
- **Tester** design the test plan and test cases, as well as evaluates the product according to its requirements such as functionality and performance.

1.3 Operating system and required components

The VTL application is intended to be installed in Android-based mobile systems. To ensure the function of this app, it is necessary to invoke the sensor and GPS to acquire the speed, location (including the direction), respectively. In addition, the google map must be invoked for the display on UI. Furthermore, a database such as SQLite is needed to store useful and required information.

2. Users

In this project, the users can be roughly divided into two segments including drivers and pedestrian. If the automatic driving achieved, the users would involve the vehicles, as well. Drivers or vehicles utilize this application to obtain the traffic signal, which assists them to pass the intersection more safely and efficiently. In terms of pedestrian, because of the removal of physical infrastructure, they require the app to provide instruction to across the conjunction.

3. Functional requirements

3.1 Register

For the purpose of maintaining customers, it is essential to develop a register module. When the users start to use the application, they must enter their username, email and set up a password.

3.2 Login

The login module is needed to identify users. Individuals input their account information containing email and password to start using experience.

3.3 Intersection identification

The application should have the ability to identify the upcoming intersection (within 500 meters) and display their location and speed on the screen to remind users.

3.4 Conflict detection

The application is capable to predict and detect the conflict in the upcoming conjunction, which is inferred by the arriving time (distance/speed) to the intersection. If there is any other vehicle arrived at the same time in different directions excluding the opposite, a conflict should be detected.

3.5 VTL leader election

When there is a conflict identified, the system must perform leader selection to ensure the safety on the road. Its core idea is that the closet vehicle to the intersection will function as a VTL leader, which is performed in red light until the leading time (two minutes) is finished or there is no more conflict during its leadership.

3.6 VTL message generation

The leader will instruct and schedule the other vehicles in the same intersection to pass it. More specifically, the cars in the same and opposite direction with the leader will obtain a red light, while others will acquire a green signal. If all cars have passed the intersection within less than two minutes, the vehicles with red light will transform to the green one. In another case, two minutes arrived, there are some vehicles in green lane that have not passed, they will be turned into red light, whereas the original cars with red signals will acquire the green light.

3.7 Leadership handover

Noticeably, when the cars initializing the red signals change their light color, it means that the leader complete its leadership. If there is still conflict, the leader election must be performed again.

3.8 Logout

The user can log out their account whenever they want. Not only can it meet the users' preference, but also it can protect their private information to some extent.

4.Non-functional requirements

4.1 Performance

1) The landing page supporting 5 thousand users per hour with 6 microseconds or less response time in the application, including the rendering of text and images, over an LTE connection.
2) System shall be able to process traffic light signals in 0.1 microsecond or less.

3) The application should be capable enough to handle and instruct 20 million users to pass intersections.

4.2 Compatibility

1) There is no requirement about the portability of different operating systems. In order to maximum the performance of the application, the application is developed in Android native environment, hence it is unnecessary to support various operating platforms.
2) The product should also be interoperable with Android-based smart phones and tablets, such as Samgsung and Huawei.
3) It should be portable to mobile phones with different screen size.

4.3 Availability

1) The application shall achieve 100 hours MTBF (mean time between failure).
2) Unless the system is non-operational, the system shall present a user with notification informing them that the system is unavailable.
3) The online registration system shall permit backing up of the registration database while other registration activities are going on.
4) The system shall be accessible by people who are color blind, to the extent that they shall be able to discern all text and other information displayed by the system.

4.4 Usability

1) The goals are easy to accomplish with few or no user errors.
2) The interface is easy to learn and navigate; buttons, headings and hint messages are simple to understand.
3) The interface appears easy to use, rather than intimidating, demanding and frustrating.

4.5 Security

1) When the password of logging in over three times, it will be locked.
2) Privacy of information including location and the places users often arrive and the export of restricted technologies should be protected to prevent from data leakage.