**Software Requirements Specification**

**for**

**Adaptive Traffic Management System**

**Prepared by:**

**Manjiri Nerurkar**

**Vaishali More**

**Neha Shinde**

**Aditi Yadav**

**Department of Computer Engineering, VIIT, Pune**

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**Table of Contents**

[**Introduction    3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.l4hg7ar7to8t)

[**Purpose    3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.3znysh7)

[**Document Conventions**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.wa4owabox7ga) [**3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.vbvs5nt8qedy)

[**Intended Audience and Reading Suggestions    3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.y7dzcrsffqi6)

[**Product Scope    3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.ggra98xejz1o)

[**References    3**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.akcp52xikncg)

[**Overall Description    4**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.yufqs4vciawm)

[**Product Perspective    4**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.2s8eyo1)

[**Product Functions    5**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.tjapuc21j5xt)

[**User Classes and Characteristics    5**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.nogkv62ym6gv)

[**Operating Environment    5**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.lrbiazjiqzvm)

[**Design and Implementation Constraints    6**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.98sdz7kc7rab)

[**Assumptions and Dependencies    6**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.ek04qj7383lg)

[**External Interface Requirements    6**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.ayb3agrhvvas)

[**User Interfaces    6**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.2jxsxqh)

[**Hardware Interfaces    7**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.k4qrs7knu8ni)

[**Software Interfaces    7**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.4w8zs4ypgq6p)

[**Communications Interfaces    7**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.sp4kt0ipsncz)

[**System Features    7**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.c0fk475og7e)

[**System Feature 2 (and so on)    8**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.ynjz1dff2njv)

[**Other Nonfunctional Requirements    8**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.3whwml4)

[**Performance Requirements    8**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.2bn6wsx)

[**Safety Requirements    8**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.861afe502k7f)

[**Security Requirements    9**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.tslv44u2upyi)

[**Software Quality Attributes    9**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.jgwdzqj2dgdc)

[**Business Rules    9**](https://docs.google.com/document/d/1HygdQZyi2Q_gW1t-MZBBxOtC66mqBYTA-FoDD8lK03A/edit?ts=5b993b21#heading=h.2zlbp8jrk7dy)

# Introduction

## Purpose

India is a developing country. The GDP annual growth rate of India has increased from 6.9% in 2013 to 7.3% in 2014 according to the World Bank Data. This proves that the economy of India has improved and raised the standard of living of people. Increase in personal vehicles comes with the development of a country, parallely . This has led to rise in congestion, in large cities. That is why we need a better traffic management system.

## Document Conventions

## The document focuses on the high priority requirements which will be implemented for the final deliverable.

## Intended Audience and Reading Suggestions

This document intends the attention of requirements engineer, domain specialist, developer and tester. This document contains the need of product, its development and use. It is recommended to go through overall description to get an overview of this product.

## Product Scope

The purpose of this project is to create a traffic system which is adaptive to present traffic scenario in a lane using Internet of Things. This system will be developed for two lanes. But it will be useful for four lanes also. This system can lead to zero average waiting time situation. Also, congestion lights will be installed on previous intersections. They will give an idea about the traffic ahead to the drivers in the previous intersections. This gives the drivers the choice to change lanes to avoid traffic congestion ahead.

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**2. Requirement Analysis**

* Problems that are intended to solve
* Avoiding the traffic congestion
* Handling unpredictable change in traffic conditions
* Reducing the average waiting time at signals
* Reducing air pollution
* These problems can be solved by developing a traffic system which is adaptive to present traffic scenario in a lane using Internet of Things.
* This system will be developed for two lanes. But it will be useful for four lanes also. This system can lead to zero average waiting time situation. Also, congestion lights will be installed on previous intersections.
* They will give an idea about the traffic ahead to the drivers in the previous intersections. This gives the drivers the choice to change lanes to avoid traffic congestion ahead.

**3. Functional Specification**

## System Overview

Adaptive Traffic Management System is a system which is adaptive to present traffic scenario in a lane using Internet of Things. The number of vehicles in a lane will be counted using camera sensor, which will use image processing. This count will be sent to centralised system (Arduino) with the help of internet. Based on the count and the code dumped in it, the system will decide if the priority should be given to reduce average waiting time or reduce congestion. According to that it will adjust the timer and traffic signal.

* 1. **Details of scenarios**
* Possible user interactions

The users for this system are drivers and authorized generals like traffic police. Their role in this system are explained as follows:

* Drivers
  + To observe the traffic lights
  + To observe the timer
  + To observe the congestion lights
* Authorized Generals
  + To get data from website
  + To monitor traffic using the data
  + To maintain the system from time to time
* Expected messages
* If the performance of Arduino or camera sensor gets hampered due to some hardware failure, in that case this message should be directed to the central system so that the traffic police can take the necessary actions
* Displaying timer at the signal and indication of congestion light at the previous intersection

.

1. **Open Issues**
   * A system can be developed which can mail or notify messages directly to hospital in case if any accident occurs near signal
   * This system will be helpful to identify the robbers(chain snatching).Camera will provide a better surveillance system
   * Vehicles parked in between the road or near footpath, can be easily tracked with the help of the system

**4. External Interface Requirements**

* 1. **User Interfaces**

GUI will be developed using AngularJS and we will use PHP for backend. User Interface will be having the shortcut features to help users have an easy and fast access. Data coming from camera sensor i.e. count of vehicles, unique id of vehicles, type of vehicles will be shown. This will be connected of NoSQL database which will be updated using Tensor Flow API. NoSQL database will be used for the proposed project as it is consisting of multimedia data ( MongoDB 4.0 ). A window will be provided for user to view the live video of traffic signal. User needs to have an account as security of data is first priority.

* Front-end software : AngularJS 6 and Bootstrap
* Back-end software : MongoDB

## Communications Protocols

To notify the user in case any LED light is not working properly, a mail will be sent to the user on the mail account. PHP will use SMTP (Simple Mail Transfer Protocol) for sending mail. SMTP supports SSL and TLS. Attachments can be sent via mail like daily report of hardware performance can be sent. The project will not provide communication among user to user but will have communication between user and hardware.

## Hardware Interfaces

Arduino is a microcontroller that is used to perform a specific set of operations. Arduino will need Windows 10 and Arduino IDE .Operating system is an interface between hardware and IDE. This will help user to perform operations on hardware by developing code for the operations to be performed.

LED lights are used for the traffic signal. They will be controlled by Arduino. Lights will be switched ON and OFF using the code present in Arduino IDE.  LED lights are also used to show the congestion over the lane ahead.

Camera Sensor is used to have a live video access of traffic signal. Tensor Flow API is used where algorithms are applied over the video coming from camera sensor. Data is transmitted to user interface. This helps to identify the density of vehicles. Accordingly it helps in reducing waiting time at traffic signals.

* LED
* Camera Sensor
* Arduino
  1. **Database backend**

The Database intended to be used is MongoDB

**5. Technical Specification**

* 1. **Performance constraints**
* If the performance of Arduino or camera sensor gets hampered due to some hardware failure, the average waiting time calculation will get affected and would show the signal as per sensitivity of the sensor
* System’s overall performance is inversely proportional to congestion of traffic

**2. Memory/OS/Hardware**

* Seven segment
* LED lights
* Arduino
* Camera Sensor
* Operating system: Windows 10

**3. Programming languages and technologies**

* Eclipse IDE oxygen
* Arduino IDE 1.6.8
* PHP 7.0
* Python
* Bootstrap
* AngularJS 6
* Tensor flow

**Appendix : Analysis Models**