Vehicle Intersection Control

MCMASTER UNIVERSITY

Draft System Requirements

SE 4G06

GROUP 6

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Revisions

Date	Revision Number	Authors	Comments
November 7, 2016	Revision 0	Alex Jackson Jean Lucas Ferreira Justin Kapinski Matthew Hobers Radhika Sharma Zachary Bazen	N/A

Table 1: VIC Table of Revisions

1 Project Drivers

1.1 The Purpose of the Project

The purpose of this project is to create a system that allows autonomous cars to navigate through intersections. This will be accomplished by providing an appropriate order for the vehicles to proceed through the intersection. When multiple autonomous cars arrive at an intersection simultaneously, due to the lack of a decision making protocol, the cars have no way of determining in which order to proceed.

Vehicle Intersection Control (also known as VIC) will allow autonomous vehicles to make navigation decisions at intersections. In addition, VIC will be able to dynamically handle changing scenarios at an intersection without running into deadlock or stalemate situations. To ensure safety, VIC will allow cars to navigate through the intersection only after a unanimous consensus has been made.

The following document will outline the functional and nonfunctional requirements of VIC. Other topics that will be covered pertaining to VIC will include: Scope, Project Drivers, Project Constraints, and Project Issues.

1.2 The Client, the Customer, and Other Stakeholders

1.2.1 Client

Insert Text Here

1.2.2 Customer

Insert Text Here.

1.2.3 Stakeholders

Insert Text Here.

1.3 Users of the Product

Insert Text Here.

2 Project Constraints

2.1 Mandated Constraints

Vehicle intersection control has several mandated constraints tabled below.

MC1	**Remote control cars must be 1/10 scale**

RMC1	The remote control cars must fit the requirements of an existing track that was created for previous capstone projects

MC2	**Remote control cars must be electric**
RMC2	Operating conditions are indoors

MC1	**Remote control cars must be 1/10 scale**
RMC1	The remote control cars must fit the requirements of an existing track that was created for previous capstone projects

MC2	**Remote control cars must be electric**
RMC2	Operating conditions are indoors

MC3	**The cost of the project must not exceed $700 dollars**
RMC3	This is to ensure an off-the-shelf solution can not be purchased. It also ensures the project remains economically feasible

2.2 Naming Conventions and Definitions

2.2.1 Naming Conventions

1. **T#** - Track requirement identification and number
2. **V#** - Remote control vehicle requirement identification and number
3. **IC#** - Intersection control requirement identification and number
4. **MC#** - Mandated project constraints identification and number
5. **RMC#** - Rational for mandated project constraints identification and number
6. **A#** - Project assumptions identification and number
7. **RA#** - Rational for project assumptions identification and number
8. **VIC** - Vehicle intersection control

2.2.2 Definitions

1. **VIC** - The name given to the overall intersection control system

2.3 Relevant Facts and Assumptions

2.3.1 Relevant Facts

- N/A

2.3.2 Assumptions

VIC assumptions tabled below.

A1	**Ideal driving conditions on the track**
RA1	Track is situated indoors

A2	**Intersection is a four way stop**
RA2	Different intersection arrangements beyond the scope of this project

3 Functional Requirements

The requirements for this project are separated into the three main components of the system: the track, vehicle, and intersection controller.

3.1 Track Functional Requirements

T1: The track must have lanes

T2: The track must have an intersection

T3: The track must have an object to indicate stopping at an intersection

3.2 Vehicle Functional Requirements

V1: The vehicle must be able to send and receive signals to and from the system infrastructure

V2: The vehicle must be able to detect lanes and follow them

V3: The vehicle must be able to detect intersections

V4: The vehicle must be able to stop at intersections

V5: The vehicle must be able to navigate through intersections

V6: The vehicle must be able to avoid obstacles

V7: The vehicle must follow the laws of the Highway Traffic act

3.3 Intersection Controller Functional Requirements

IC1: The system infrastructure must be able to detect if there is a car at the intersection

IC2: The system infrastructure must be able to differentiate between autonomous and non autonomous cars

IC3: The system infrastructure must be able to detect when a car has navigated through the intersection

IC4: The system infrastructure must be able to determine the order in which the cars should proceed

IC5: The system infrastructure must be able to signal to the vehicle when it is allowed to go through the intersection

4 Nonfunctional Requirements

4.1 Look and Feel Requirements

4.1.1 Appearance Requirements

- N/A

4.1.2 Style Requirements

- N/A

4.2 Usability and Humanity Requirements

4.2.1 Ease of Use Requirements

- N/A

4.2.2 Personalization and Internationalization Requirements

A: The system must be able to function according to North American road standards

4.2.3 Learning Requirements

- N/A

4.2.4 Understandability and Politeness Requirements

- N/A

4.2.5 Accessibility Requirements

- N/A

4.3 Performance Requirements

- N/A

Please note that the following non functional requirements will be updated as the system is created and data is acquired.

4.3.1 Speed Requirements

A: The system must be able to determine an order and convey it to the vehicle before a soft deadline

4.3.2 Safety-Critical Requirements

A: The system must only signal a car to proceed when the intersection is clear

B: The vehicle must stop within a safe distance of an obstacle

4.4 Precision Requirements

A: The vehicle must not deviate from the lanes more than 1

4.4.1 Reliability or Availability Requirements

A: The system must operate without failure 99% of the time

B: The vehicle system must operate as long as car's internal power supply is charged

4.4.2 Robustness or Fault-Tolerance Requirements

A: In the event of a complete vehicle system failure, the vehicle must come to a stop

4.4.3 Capacity Requirements

- N/A

4.4.4 Scalability or Extensibility Requirements

- N/A

4.4.5 Longevity Requirements

- N/A

4.5 Operational and Environmental Requirements

4.5.1 Expected Physical Environment

A: The track must be 1/10 scale of a real world intersection

4.5.2 Requirements for Interacting with Adjacent Systems

- N/A

4.5.3 Production Requirements

- N/A

4.5.4 Release Requirements

- N/A

4.6 Maintainability and Support Requirements

4.6.1 Maintenance Requirements

- N/A

4.6.2 Supportability Requirements

- N/A

4.6.3 Adaptability Requirements

- N/A

4.7 Security Requirements

4.7.1 Access Requirements

- N/A

4.7.2 Integrity Requirements

- N/A

4.7.3 Privacy Requirements

- N/A

4.7.4 Audit Requirements

- N/A

4.7.5 Immunity Requirements

- N/A

4.8 Cultural and Political Requirements

4.8.1 Cultural Requirements

- N/A

4.8.2 Political Requirements

- N/A

4.9 Legal Requirements

4.9.1 Compliance Requirements

- N/A

4.9.2 Standards Requirements

- N/A

5 Project Issues

5.1 Open Issues

Insert Text Here.

5.2 Off-the-Shelf Solutions

Insert Text Here.

5.3 New Problems

Insert Text Here.

5.4 Migration to the New Product

Insert Text Here.

5.5 Risks

Insert Text Here.

5.6 Costs

Insert Text Here.

5.7 User Documentation and Training

Insert Text Here.

5.8 Waiting Room

Insert Text Here.