Requirements Specification

Traffic Management System

Version: 1

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Version History

Issue	Date	Change
0.1	29/05/2020	Initial Version
0.2	29/05/2020	Added headings for packages, use cases and actors
0.3	30/05/2020	Added detailed use case summaries and diagrams.

1.0 Introduction

This document provides the requirements for a Traffic Management System (TMS). A TMS would be utilized by a city council or authorities department to observe and manage traffic flow in urban regions. The system gathers data from sensors and users and can control the flow of traffic with signals to road signs and lights. It can then automatically assess how traffic flows and adjust its signals to improve efficiency. In this way, road use sees an increase in productivity, emergency events can be handled more swiftly, and the economy as a whole functions more freely.

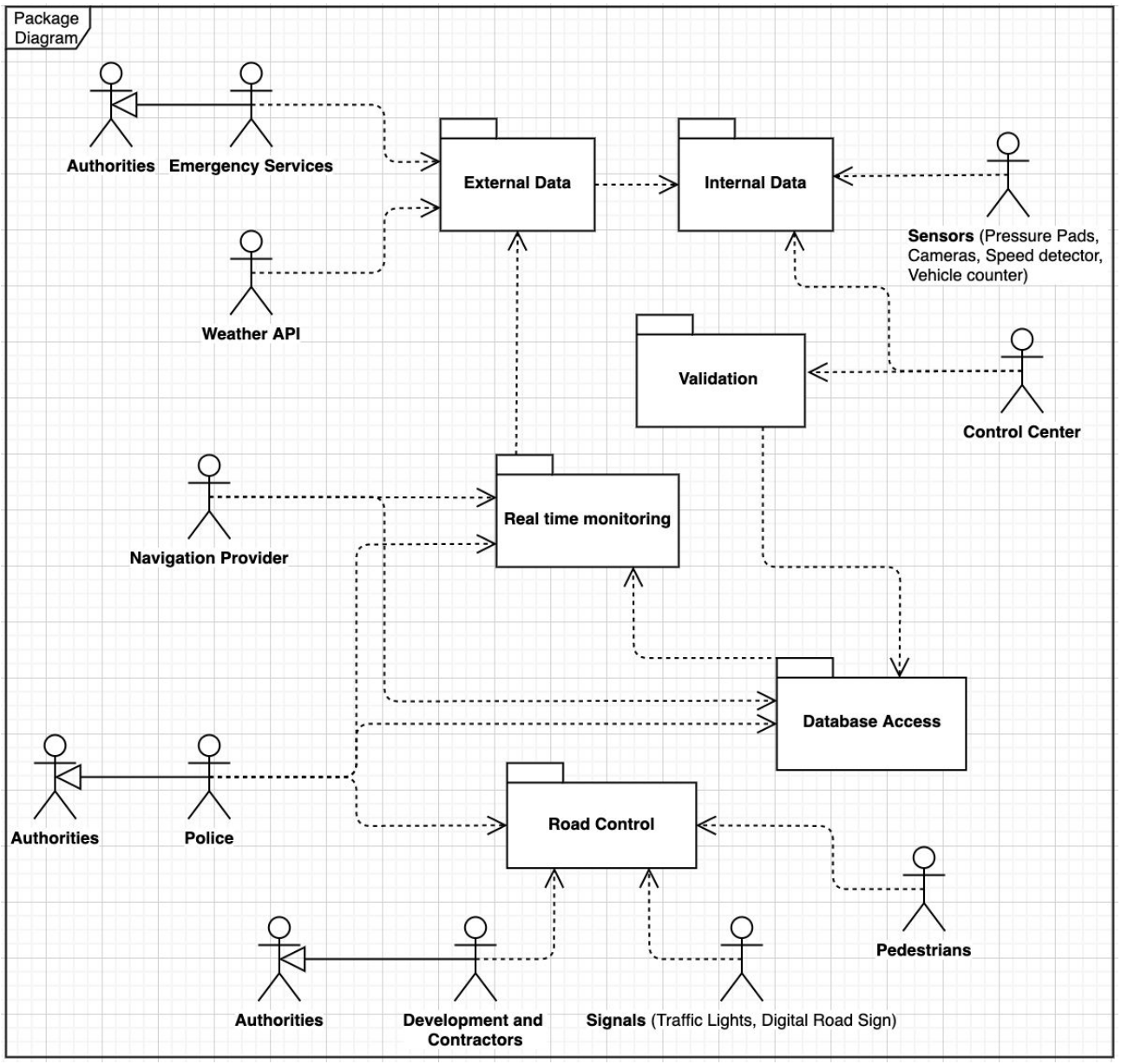
This requirement specification document contains the following:

- use case model that describes the Traffic Management System's functionality,
- actors who will be using the system and what they want to achieve with the system,
- estimates of size of every use case and its priority,
- non-functional requirements,
- risks involved and suggested mitigation strategies.

This information is used to establish a release plan for the staged delivery of the system.

2.0 Use Case Packages

2.1 Package Diagram



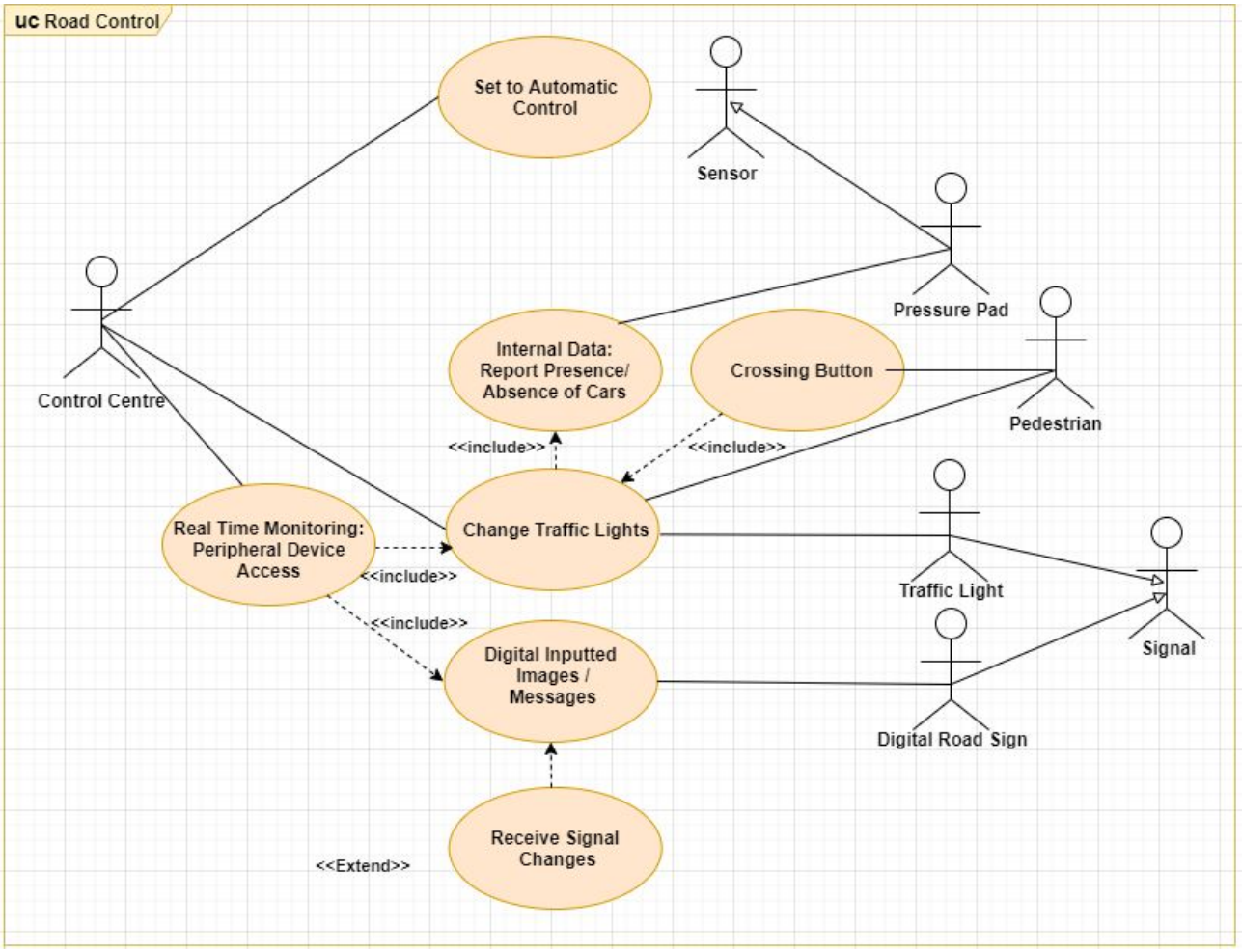
2.2 Package Descriptions

Package Name	Description
Road Control	Changes the status of traffic lights, traffic signs and display video feed from selected cameras.
External Data	Receives external information from third parties such as weather API providers.
Internal Data	Process traffic information using pre-saved data and sensors that are directly connected to the system (peripheral devices) i.e vehicle registration, car count, and the presence/absence of vehicles.
Real Time Monitoring	Monitor traffic in real time using data from a variety of sources and respond to events.
Validation	Validates different users' identities and assigns specific privileges to the accredited users.
Database Access	Provides access to a database of historical data to validated users e.g. navigation providers and town planners.

3.0 Use Case Diagrams

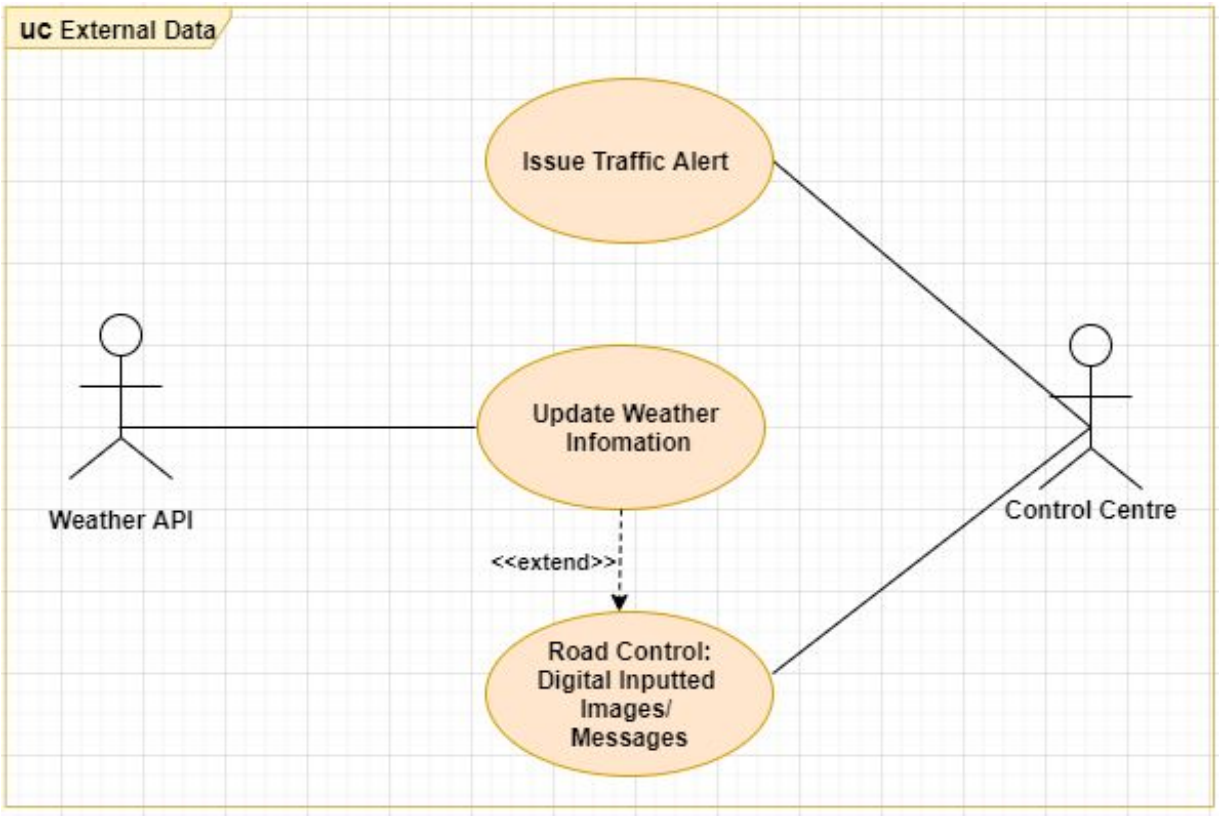
3.1 Road Control

Includes features pertaining to the control of vehicles and pedestrians. Information is gathered from vehicles and pedestrians via *Sensors*. Information is returned via *Signals*.



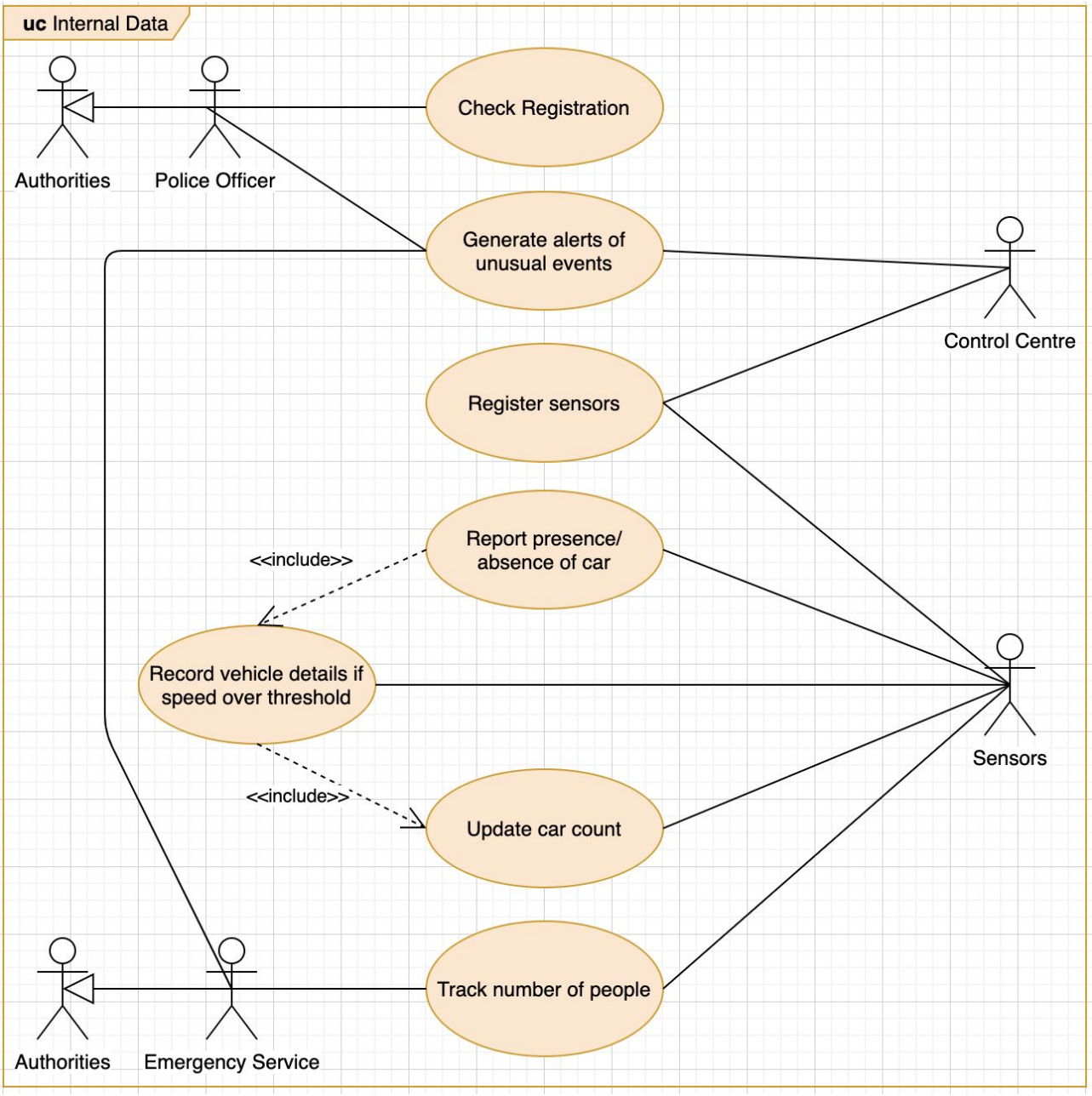
3.2 External Data

This package includes use cases that relate to sources of information outside those directly connected to the TMS system.



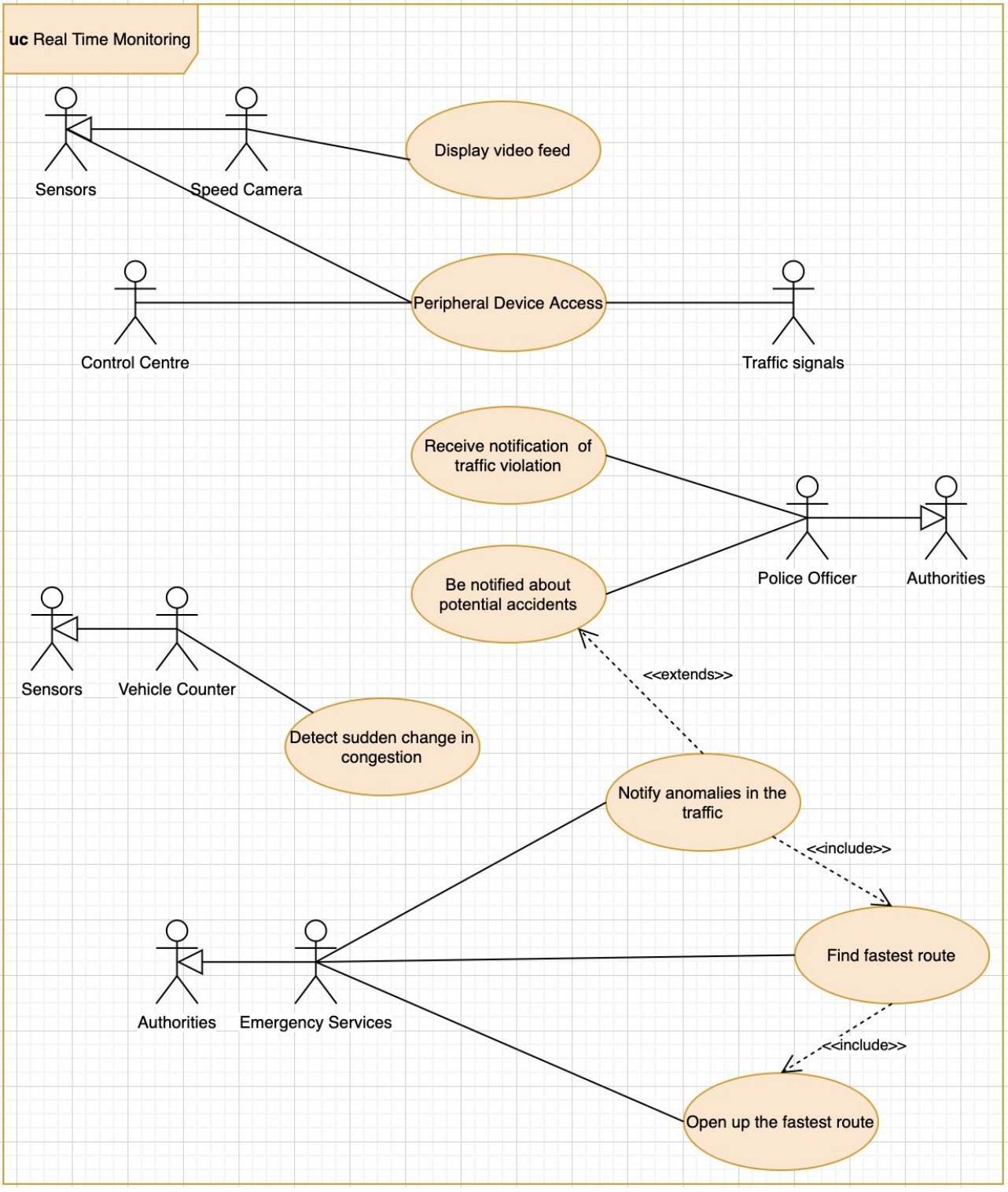
3.3 Internal Data

This package includes use cases that relate to sources of input that fall within the TMS system, in contrast to External Data. This includes any information stored in the database, or information directly from *Sensors*.



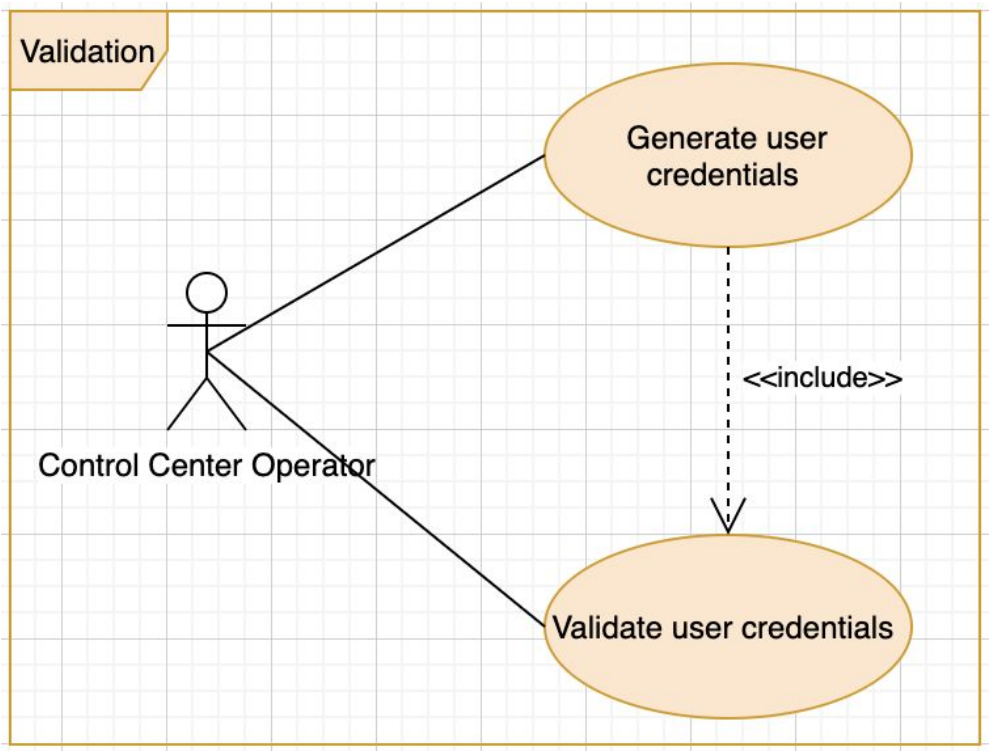
3.4 Real time monitoring

This package includes features pertaining to the instantaneous monitoring of vehicles and pedestrians.



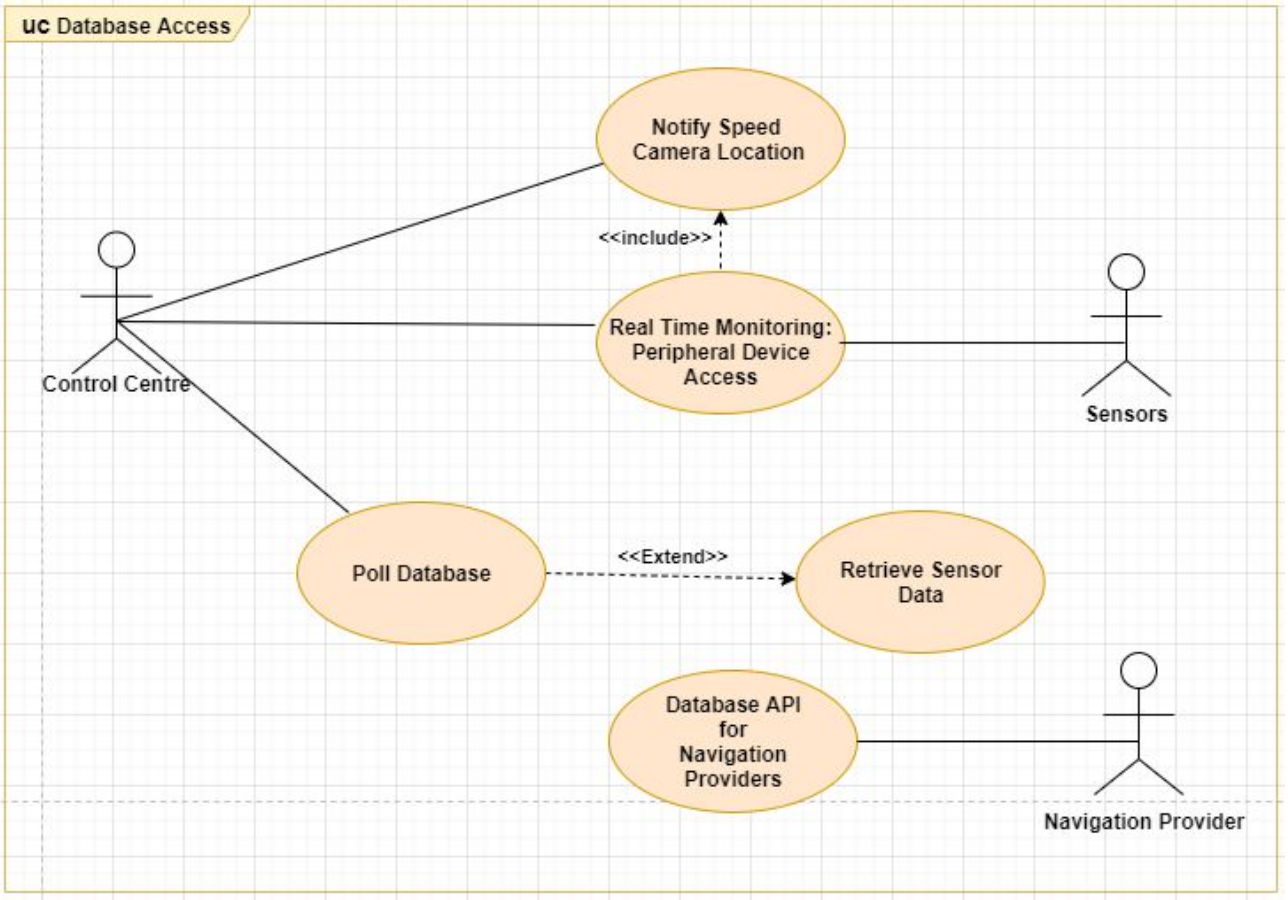
3.5 Validation

This package describes the key security feature, namely, user validation and secure account creation.



3.6 Database Access

This package includes use cases that relate to accessing the database, where historical data from the TMS system is saved.



4.0 Actor Descriptions

Actor Name	Description
Authorities (Police, Emergency Services, Development and Contractors)	Those with privileged access to the system.
Authorities: Police	Routine policing services that pertain to traffic policing.
Authorities: Emergency Services	Police, fire and ambulance emergency services which can access the system to manage emergency situations.
Authorities: Development and Contractors	Responsible for designing and building city roads.
Sensors (Pressure Pads, Cameras, Speed Detector, Vehicle Counter)	Main system inputs for information from roads.
Sensors: Pressure Pad	Detects and reports when there is a vehicle in a particular location.
Sensors: Cameras	Video cameras that are able to provide live feeds and take photographs.
Sensors: Speed Detector	Measures the speed of passing vehicles.
Sensors: Vehicle Counter	Counts and reports the number of vehicles that pass over it.
Signals (Traffic Lights, Signage)	Outputs from the system that can be changed by the system.
Signals: Traffic Lights	Traffic lights at intersections that can be changed by a signal from the system.
Signals: Digital Road Sign	Signage along roads, including speed limit signs and road LED displays, which can display any image.
Weather API	Third party data API with real-time weather information that may affect road conditions.
Navigation providers	Map and navigation providers (navigators, google maps, ways ect.) that may use traffic management data.
Control Centre	Responsible for responding to system alerts, events and issues.
Pedestrians	Pedestrian road users who may wish to request crossing at intersections.

5.0 Use Case Summaries

5.1 Road Control

Use Case	Summary
Change Traffic Lights	Change the status of traffic lights when signal to change is received.
Digital Inputted Images/Messages	Digital road signs will display an inputted image or message.
Crossing button	Register that a pedestrian is waiting for a change of signal.
Set to Automatic Control	Set the traffic management system to automatically change signals in order to optimise traffic flow.

5.2 External Data

Use Case	Summary
Update weather information	Retrieve data from weather API and update weather information
Issue Traffic Alert	Allow the control centre to register traffic alerts to the system.

5.3 Internal data

Use Case	Summary
Update car count	Track number of cars and update the count in the system.
Generate alerts of unusual events	Generating alerts about any unusual events as they happen.
Record details of vehicle if over threshold speed	Recording details of the vehicle if the current speed of the vehicle exceeds threshold speed.
Report presence/ absence of car	Read data from the pressure sensors and report the presence and absence of cars.
Check Registration	Check if the car has up to date registration.
Track number of people	Estimates the number of people present in an area from pedestrian and vehicle movements.
Register Sensor	Add sensor and metadata about the sensor into the system.

5.4 Real time monitoring

Use Case	Summary
Display Video Feeds from Selected Road Cameras	Retrieve real time live video feeds from cameras on the road to check the road status
Peripheral Device Access	A control centre operator can remotely access a sensor or signal device.
Receive notice of traffic violations	Receive notification of traffic violations and identify vehicles that violate traffic laws.
Be notified about potential accidents.	Receive notification of potential accidents/events as they happen
Find fastest path to destination	Find out the fastest route to a destination for police or emergency services.
Notify emergency services when anomaly detected	Send notification with relevant data to the emergency services system on demand.
Open up the fastest routes.	Automatically adjust road signals in order to clear a path to a destination, most likely for emergency services.
Detect sudden change in congestion	Detect and report unusual and sudden changes in the number of vehicles in a stretch of road, these may indicate accidents or malfunctions.

5.5 Validation

Use Case	Summary
Generate User Credentials	Generate credentials that would authorise a user to perform actions.
Validate User Credentials	Check credentials to ensure they are valid.

5.6 Database Access

Use Case	Summary
Poll database	Search database for sensor information.
Database API for Navigation Providers	API for database access to information about congestion, closures, and conditions on the road, for use by Navigation providers.
Notify Speed Camera Location	Provide a registry of locations where speed detectors and cameras are installed (required by law in some locations).

6.0 Use Case Descriptions

6.1 Change Traffic Lights

Version	0.1	**Date**	30/05/2020
Package	Road Control		
Summary	Change traffic lights when signal to change is received.		
Primary Actor	Signal: Traffic Lights		
Secondary Actors	Control Centre		
Inherits	None		
Includes	Report Presence/Absence of cars		
Extension Points	None		
Pre-Condition(s)	The traffic light is registered in the system.		

Typical Scenario

Actor Stimulus	System Response
1. Traffic light turns red after being green for 60s	2. System changes the perpendicular traffic light to green
3. Control Centre selects specific traffic lights to change status	4. System connects to the traffic lights
5. Control Centre confirmed the change of traffic lights	6.1 System checks the new status of the traffic lights 6.2 System changes the traffic lights

Alternative Scenarios

Alternative 1: at step 5 if the control centre does not confirm the change

Actor Stimulus	System Response
	6. The traffic light remains unchanged

Alternative 2: at step 6.1 if the new status of the traffic light is the same as before

Actor Stimulus	System Response
	6.2 The traffic light stay unchanged

Post-Condition(s)	The status of the traffic light is updated

Priority	Must Have
Estimate	1
Author	Cheng Jiang 44916552
Outstanding Issues	
Notes	
Version History	Initial Version

6.2 Crossing Button

Version	0.1	**Date**	03/06/2020
Package	Road Control		
Summary	Change the traffic light to green (when it is safe) after pedestrians push the crossing button.		
Primary Actor	Pedestrians		
Secondary Actors	Signal: Traffic Light, Sensor: Pressure Sensor		
Inherits	None		
Includes	Change Traffic Light, Report Presence/Absence of Cars		
Extension Points	None		
Pre-Condition(s)			

Typical Scenario

Actor Stimulus	System Response
1.1 Pedestrian pushed the a crossing button 1.2 Traffic lights for vehicle crossing is red 1.3 Pressure sensor detects no vehicles on road	2. System changes pedestrian crossing light to green

Post-Condition(s)	The pedestrian crossing light turns green

Alternative Scenarios

Alternative 1: at step 1.2 if traffic light for vehicle crossing is green

Actor Stimulus	System Response
	2. System does not allow pedestrian crossing light to turn green

Alternative 2: at step 1.3 if pressure sensor detects passing vehicles on road

Actor Stimulus	System Response
	2. System does not allow pedestrian crossing light to turn green

Priority	Must Have
Estimate	3
Author	Cheng Jiang 44916552
Outstanding Issue\s	
Notes	
Version History	Initial Version

6.3 Display Inputted Image

Version	0.2	**Date**	29/5/20
Package	Road Control		
Summary	Digital road signs will display an inputted image.		
Primary Actor	Control Centre		
Secondary Actors	Signals: Digital Road Sign		
Inherits			
Includes	Peripheral Device Access		
Extension Points			
Pre-Condition(s)	The Digital Road Sign is registered in the system.		

Typical Scenario

Actor Stimulus	System Response
1. <<Include>> *Peripheral Device Access*.	
3. Control Centre indicates which digital road sign to update.	4. Connects to the selected digital road sign.
5. The Control Centre uploads images.	6. System formats image to fit on digital road signs.
7. Control Centre approves change of image	8. System changes the digital road sign's image.

Post-Condition(s)	A digital road sign will have an updated image.

Alternative Scenarios

Alternative 1: at step 4 if image in incorrect format

Actor Stimulus	System Response
	6. Image rejected and control centre informed.

Alternative 2: at step 6 if control centre doesn't approve image change

Actor Stimulus	System Response
	8. System deletes uploaded images and leaves digital road sign's images unchanged.

Priority	Must have.
Estimate	
Author	Andrew Mylonas - 43168907
Outstanding Issues	
Notes	
Version History	0.1->0.2 Consider image formatting.

6.4 Update weather information from weather API

Version	0.2	**Date**	02/06/20
Package	External Data		
Summary	Receive real time weather information from external weather system such as bureau of meteorology		
Primary Actor	Authorities : Control Center		
Secondary Actors	Authorities : Emergency Services, Authorities : Development & Contractors		
Inherits			
Includes			
Extension Points			
Pre-Condition(s)	Connection required to a reliable third party weather system, if connection is lost with weather API, alert both weather provider and managing team		

Typical Scenario

Actor Stimulus	System Response
1. Traffic surveillance team wants to know the current weather that may not be seen on camera	2. System will show current weather, temperature
3. Traffic signs shows current weather condition	4. System will receive critical weather conditions and output them to traffic signs to notify users
5. Development & Contractors will check weather api to see best time to do their work	6. System will update constructions & contractors, best time to work on certain roads

Post-Condition(s)	Weather information will be saved

Alternative Scenarios

Alternative 1: No weather information at step 2

Actor Stimulus	System Response
	Use another weather api as a backup

Priority	Should Have
Estimate	5
Author	Hyun Jeon 42865320
Outstanding Issues	
Notes	- Use API of Australian Bureau of Meteorology - Construct connection to 3rd party online weather API for backup
Version History	0.1 Initial Version 0.2 Secondary actor added

6.5 Generate Alerts of unusual events

Version	0.1	**Date**	31/05/2020
Package	Internal Data		
Summary	Generating alerts about potential events as they happen.		
Primary Actor	Sensors		
Secondary Actors	Authorities: Police, Authorities: Emergency Services, Control Centre, Signals		
Inherits	None		
Includes	None		
Extension Points			
Business Rules	No alert should be sent for false alarms.		
Pre-condition(s)	The alerts will only be generated if an unusual event occurs.		

Typical Scenarios

Actor Stimulus	System Response
1. Constantly monitor traffic	2.1 Detect an unusual event 2.2 Check sensors for data 2.3 Check signals for data
3.1 Sensors send the data 3.2 Signals send the data	4.1 Verify if the event has actually taken place or not using the data received. 4.2 Gather the information 4.3 Identify event type 4.4 Generate an alert with the details of the event 4.5 Send the alert to the appropriate department.

Post-condition(s)	Alerts have been sent to respective departments.

Alternative Scenarios

Alternative 1: False event identified at step 4.1

Actor Stimulus	System Response
	3.1 Alert not sent 3.1.1 A warning message is displayed on the screen stating “False event identified”

Alternative 2: Incomplete information provided at step 4.2

Actor Stimulus	System Response
	3.2 Not all information received form the sensors and signals. 3.2.1 A warning message is displayed on the screen stating there is “Incomplete information”

Alternative 3: Connectivity issue at step 4.4

Actor Stimulus	System Response
	3.4 Alert not generated 3.4.1 Provide error message to Control Centre

Priority	Must Have
Estimate	8
Author	Bhavita Bhooma (45922756)
Outstanding Issues	
Notes	The potential events that could occur are: - Traffic Violation - Potential Accidents - Detect sudden changes in traffic like congestion - Malfunctioning components (such as Traffic lights)
Version History	Initial Version

6.6 Record details of vehicle if speed over threshold

Version	0.1	**Date**	31/05/2020
Package	Internal Data		
Summary	Recording details of the vehicle if current speed of the vehicle exceeds threshold speed.		
Primary Actor	Sensors: Camera		
Secondary Actors	Police, Control Centre, Sensors: Vehicle Counter		
Inherits	None		
Includes	Update car count		
Extension Points	None		
Business Rules			
Pre-condition(s)	The vehicle should surpass the threshold speed.		

Typical Scenarios

Actor Stimulus	System Response
1. Speed camera continuously monitors vehicle's speed	2.1 The system detects that speed of the vehicle is exceeding the threshold speed. 2.2 Request sensors for data
3.1 Capture image of the vehicle using camera 3.2 Get speed of the vehicle using speed detector	4.1 Record the details of the vehicle in the database 4.2 Send it to the desired department (Police or Control Centre)
5. <<include>> Update car count	6.1 Update the car count in the database

Post-condition(s)	Record the details of the vehicle in the database and send it to the police or control centre for further investigation on breaking the law.

Alternative Scenarios

Alternative 1: No image received by the system at step 4.2

Actor Stimulus	System Response
	4.1 Unable to record details 4.2 An error message is displayed stating "Unable to retrieve data from the sensors"

Alternative 2: Speed detector is unresponsive or not functioning at step 6.1

Actor Stimulus	System Response
	4.1 Unable to record details 4.2 An error message is displayed stating "Unable to retrieve data from the sensors"

Alternative 3: Vehicle counter is unresponsive or not functioning at step 6.1

Actor Stimulus	System Response
	6.1 Car count not updated 6.2 An error message is displayed stating “Unable to update car count”

Priority	Must Have
Estimate	5
Author	Bhavita Bhooma (45922756)
Outstanding Issues	
Notes	- Speed cameras should be checked for maintenance regularly - Vehicle counters should be calibrated and checked for maintenance regularly
Version History	Initial Version

6.7 Update car count

Version	0.2	**Date**	29/05/2020
Package	Internal Data		
Summary	Update the number of cars associated with a location car counting sensor in the system on signal from the vehicle counter.		
Primary Actor	Sensors: Vehicle Counter		
Secondary Actors	Control Centre		
Inherits			
Includes			
Extension Points			
Pre-Condition(s)	The vehicle counter is registered in the system.		

Typical Scenarios

Actor Stimulus	System Response
1. Sensor (Vehicle Counter) records a new vehicle passing.	2. New entry is made in the database with sensor location or ID and timestamp.

Post-Condition(s)	The database information has been updated.

Alternative Scenarios

Alternative 1: Vehicle counter is not registered in the system at step 2.

Actor Stimulus	System Response
1. Sensor (Vehicle Counter) records a new vehicle passing.	2.1 Drop request from vehicle counter 2.2 Generate system alert to Control Centre that unregistered sensor attempted to update information

Priority	Must Have
Estimate	1
Author	Tina Moghaddam, 44348292
Outstanding Issues	
Notes	
Version History	Initial Version

6.8 Register Sensor

Version	0.3	**Date**	31/05/2020
Package	Internal Data		
Summary	Add sensor and metadata about the sensor into the system.		
Primary Actor	Control Centre		
Secondary Actors	Sensor		
Inherits			
Includes	Validate User Credentials		
Extension Points			
Pre-Condition(s)	The sensor is visible on the system network.		

Typical Scenarios

Actor Stimulus	System Response
1. <<include>> *Validate User Credentials.*	
3. The Control Centre wishes to register a new sensor into the system.	4. The system displayed a list of unregistered sensors connected to the network
5. Control centre selects a sensor	6.1 Creates new entry for the sensor 6.2 Displays key:parameter mapping options for operator to fill out
7. Sensor indicates sensor type	8. Highlights compulsory keys for sensor type
9. Control Centre associates sensor keys (location, test-by date or any other desired variable) with a value	10.1 Checks compulsory keys are filled out 10.2 Checks parameter types are valid for key types
11. Control Centre confirms registration	12.1 Adds new sensor to database 12.2 Removes sensor from list of possible sensors connected to the network

Post-Condition(s)	The sensor is registered in the system.

Alternative Scenarios

Alternative 1: Not a valid sensor type at step 8.

Actor Stimulus	System Response
7. Sensor indicates sensor type	8.1. Notify users of compatible sensor types

Alternative 2: Not all entries filled out at step 10.1.

Actor Stimulus	System Response
9. Control Centre associates sensor keys with a value	10.1.1. Notify users that all highlighted fields must be filled out.

Priority	Must Have
Estimate	1
Author	Tina Moghaddam, 44348292
Outstanding Issues	
Notes	
Version History	0.1 Initial Version 0.2 Added sensor actions 0.3 Included validation

6.9 Report Presence/Absence of Cars

Version	0.1	**Date**	30/05/2020
Package	Internal Data		
Summary	Data from the pressure sensors should be read in order to report the presence and absence of cars.		
Primary Actor	Sensor: Pressure Pad		
Secondary Actors	Sensor: Camera, Signal: Traffic Light		
Inherits	None		
Includes	None		
Extension Points	None		
Pre-Condition(s)	The Pressure Pad is registered in the system.		

Typical Scenario

Actor Stimulus	System Response
1. Pressure pad detects pressure changes	2. System records pressure changes into database

Alternative Scenarios

Alternative 1: at step 1 if pressure pad detects a vehicle runs a red light

Actor Stimulus	System Response
Higher than the pressure limit	2.1 System generates alert 2.2 Camera takes photo of the vehicle

Alternative 2: at step 1 if pressure pad detects a pressure value that is higher than the pressure limit

Actor Stimulus	System Response
	2.1 System generates alert 2.2 System notifies police for overloaded vehicles

Alternative 3: at step 2 if pressure pad is not registered in the system

Actor Stimulus	System Response
	2.1 System denies access from pressure pad 2.2 System generates alert

Post-Condition(s)	

Priority	Must Have
Estimate	1
Author	Cheng Jiang 44916552
Outstanding Issues	
Notes	
Version History	Initial Version

6.10 Display Video Feeds from Selected Road Cameras

Version	0.2	**Date**	02/06/20
Package	Road Control		
Summary	Receive real time video feeds from cameras that are installed on the roads and view them		
Primary Actor	Authorities: Control Centre		
Secondary Actors	Authorities: Police		
Inherits			
Includes	Peripheral Device Access		
Extension Points			
Pre-Condition(s)	Connections to cameras are required		

Typical Scenario

Actor Stimulus	System Response
1. Surveillance Team in control center wants to view current road condition	2. System will output and show video feeds from roads
3. Police wants to track location of certain cars	4. System will output real time video of wanted road and track

Post-Condition(s)	Videos are saved and can be viewed later.

Alternative Scenarios

Alternative 1: No camera is working/activated in wanted road at step 1

Actor Stimulus	System Response
	Find nearest road camera and output those camera

Priority	Should Have
Estimate	2
Author	Hyun Jeon 42864320
Outstanding Issues	
Notes	- Connection required to camera and control center
Version History	0.1 Initial Version 0.2 Change in actors

6.11 Peripheral Device Access

Version	0.1	**Date**	29/05/20
Package	Real-time system monitoring		
Summary	The control centre can remote access a sensor or device.		
Primary Actor	Control Centre		
Secondary Actors	Sensors, Signals		
Inherits			
Includes	Validate User Credentials		
Extension Points			
Pre-Condition(s)	The Control Centre Operator has valid credentials.		

Typical Scenario

Actor Stimulus	System Response
1. <<Include>> *Validate User Credentials*.	
3. A Control Centre Operator chooses a Sensor or Signal.	4.1 The peripheral device validates the connection request. 4.2 The peripheral device is connected.
5. Commands are inputted.	6. Commands enacted and output generated.
7. The Control Centre logs out.	8. No further commands accepted.

Post-Condition(s)	

Alternative Scenarios

Alternative 1: at step 4.2 if peripheral device is offline

Actor Stimulus	System Response
	4.2. Informs Control Centre that selected device is unavailable.

Alternative 2: at step 4.1 if the request to connect is invalid.

Actor Stimulus	System Response
	4.1 The device refuses the connection.

Priority	Must Have
Estimate	21
Author	Andrew Mylonas - 43168907
Outstanding Issues	
Notes	
Version History	

6.12 Validate User Credentials

Version	0.1	**Date**	01/06/20
Package	Validation		
Summary	Check credentials to ensure they're valid.		
Primary Actor	Control Centre		
Secondary Actors			
Inherits			
Includes			
Extension Points			
Pre-Condition(s)			

Typical Scenario

Actor Stimulus	System Response
1. Control Centre Operator logs in.	2.1 System validates credentials 2.2 and allows further access.

Post-Condition(s)	Control Centre Operator's credentials have been validated.

Alternative Scenarios

Alternative 1: at step 2 if Control Centre Operator's credentials are invalid.

Actor Stimulus	System Response
	2.2 System does not allow further access.

Priority	Must Have
Estimate	5
Author	Andrew Mylonas - 43168907
Outstanding Issues	
Notes	
Version History	

6.13 Poll database

Version	0.1	**Date**	29/05/2020
Package	Database Access		
Summary	Search database for sensor information.		
Primary Actor	Authorities		
Secondary Actors	None		
Inherits			
Includes			
Extension Points			
Pre-Condition(s)	None		

Typical Scenarios

Actor Stimulus	System Response
1. Authority wants to find sensor information in the database	2. The system displays possible search options, such as datetime, location, alert level.
3. Authority enters search criteria	4. The system returns database entries that meet given criteria.

Post-Condition(s)	The database information is provided to the Authority.

Alternative Scenarios

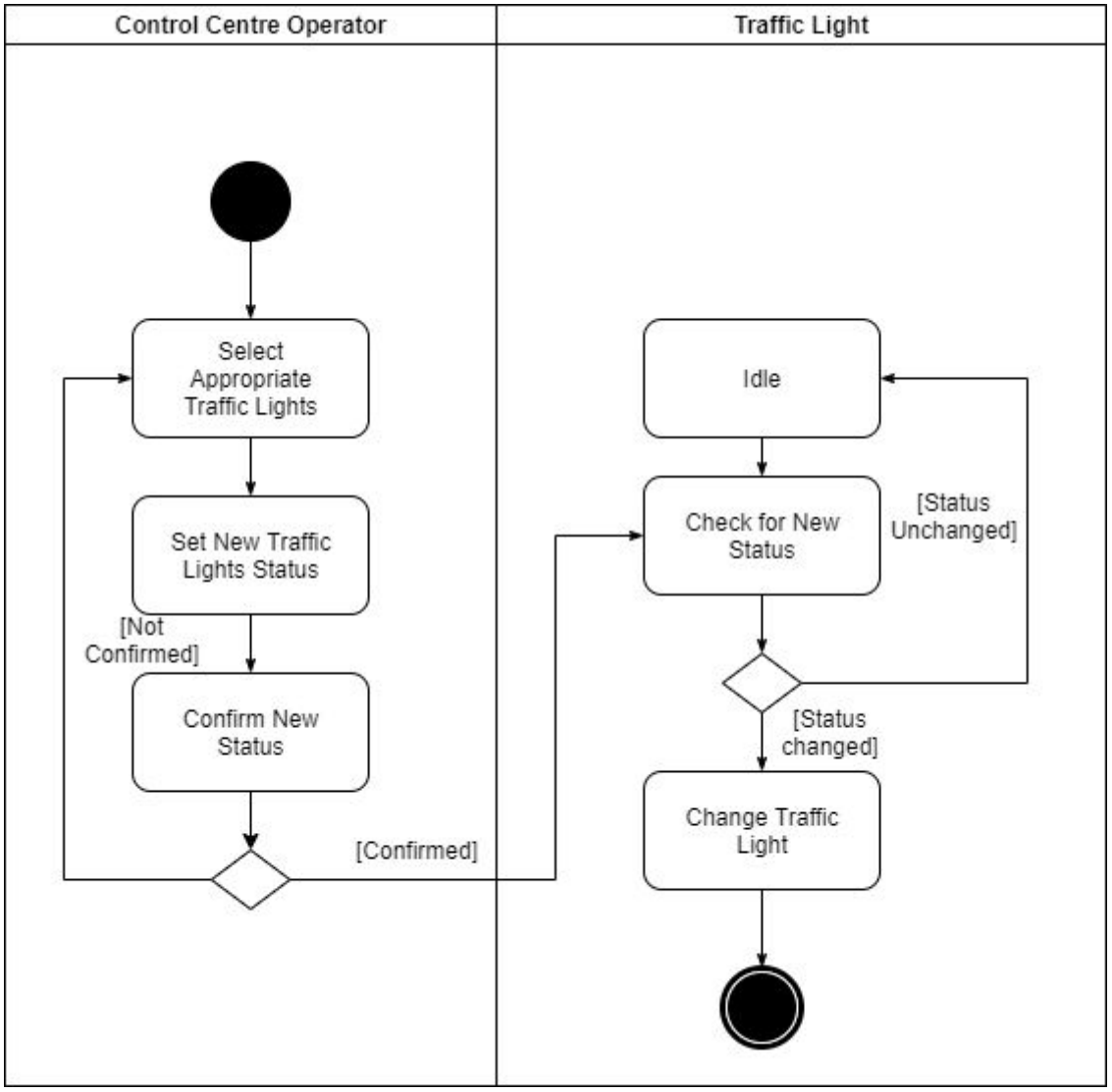
Alternative 1: There are no database entries that meet the search criteria at step 4.

Actor Stimulus	System Response
3. Authority enters search criteria	4.1 No entries are returned 4.2 A message is displayed conveying this to the Authority

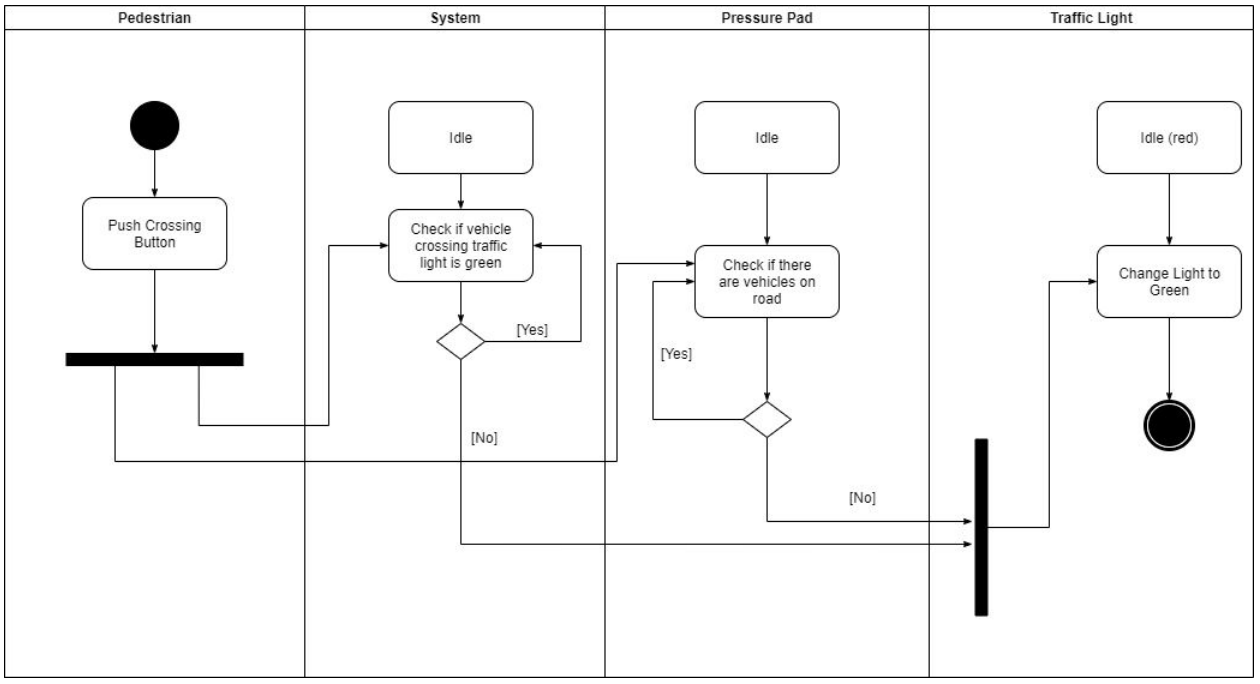
Priority	Must Have
Estimate	2
Author	Tina Moghaddam, 44348292
Outstanding Issues	
Notes	
Version History	Initial Version

7.0 Activity Diagrams

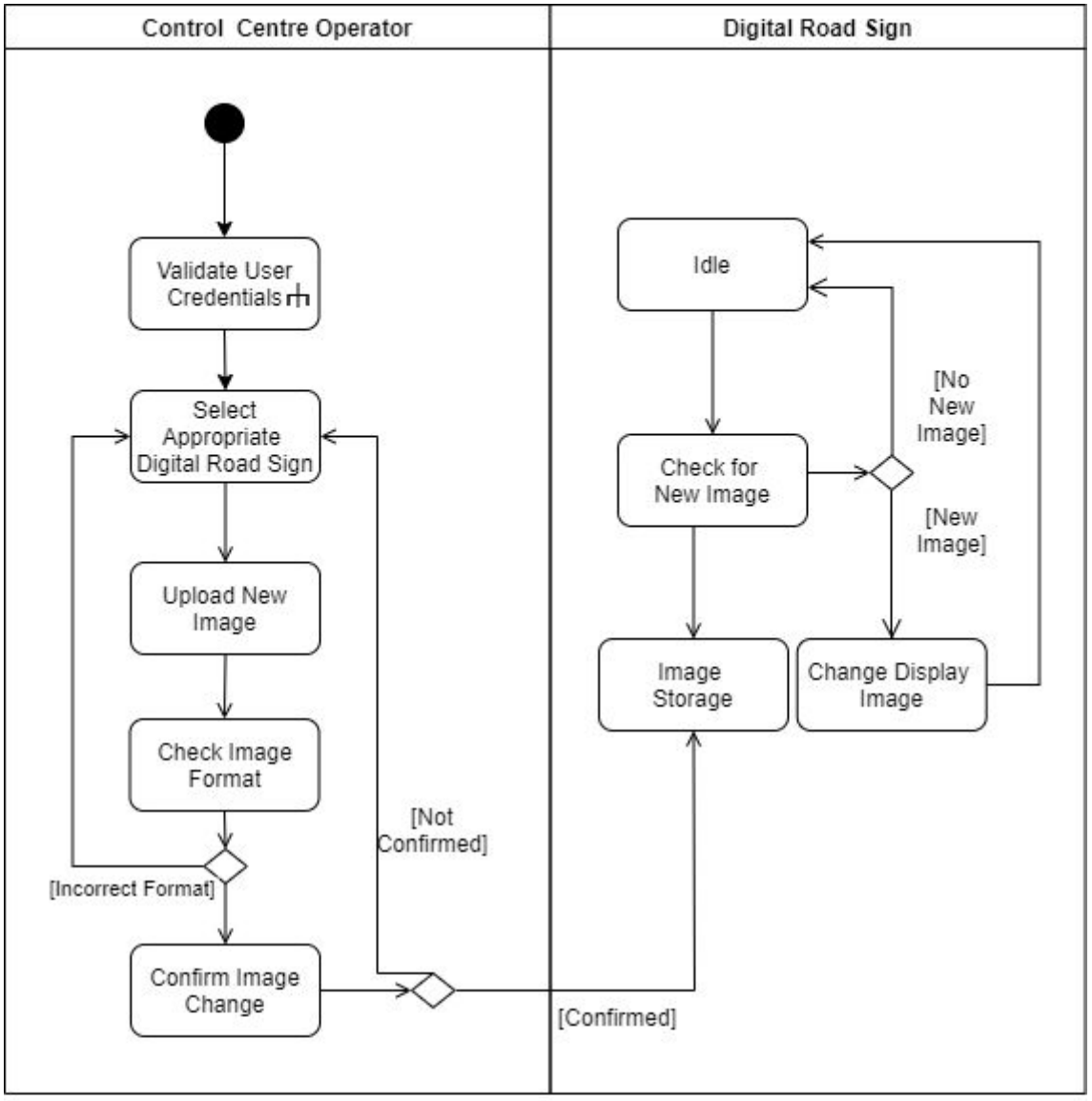
7.1 Change Traffic Lights - Cheng Jiang 44916552



7.2 Crossing Button - Cheng Jiang 44916552

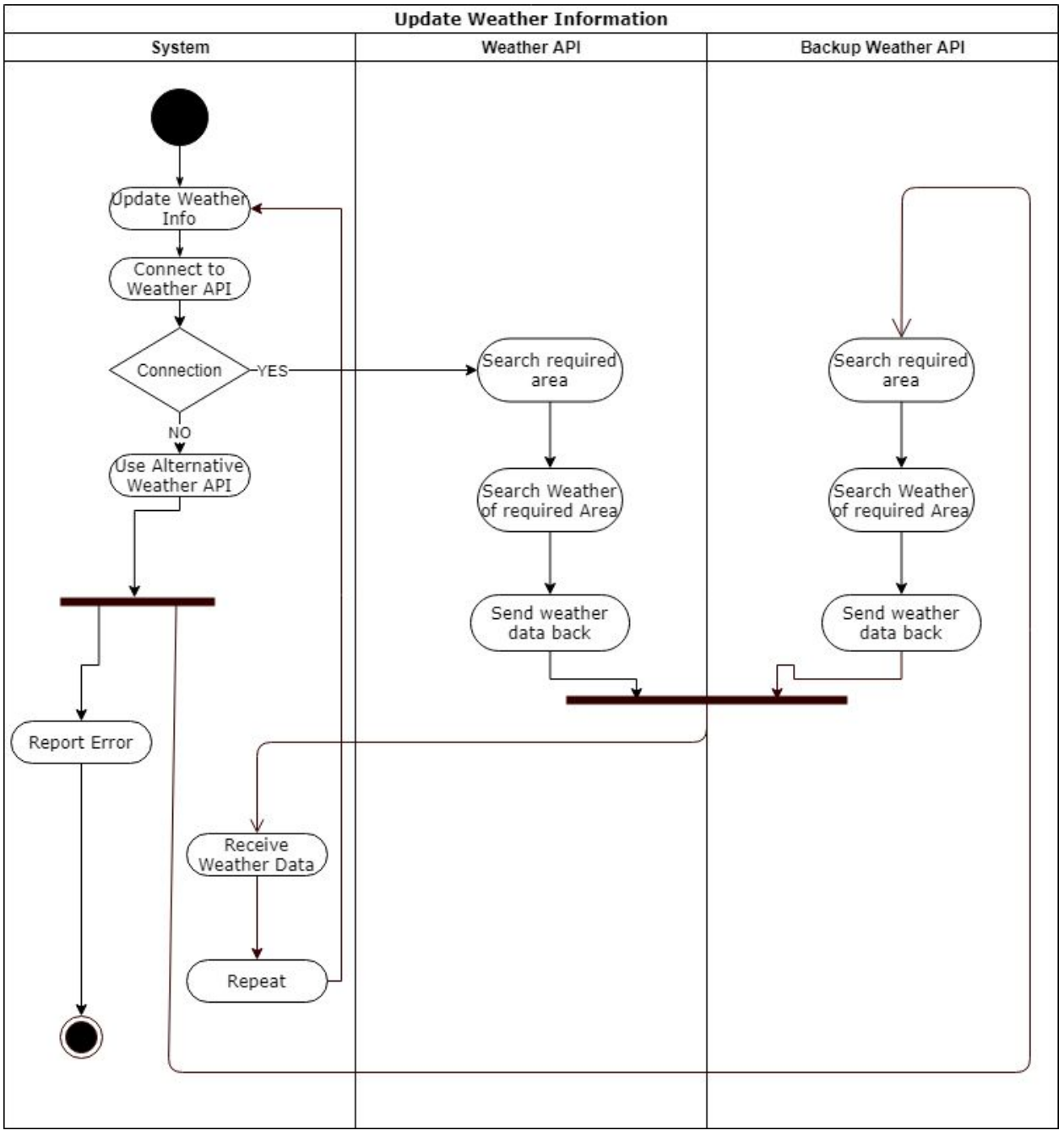


7.3 Changing Road Sign - Andrew Mylonas 4316890

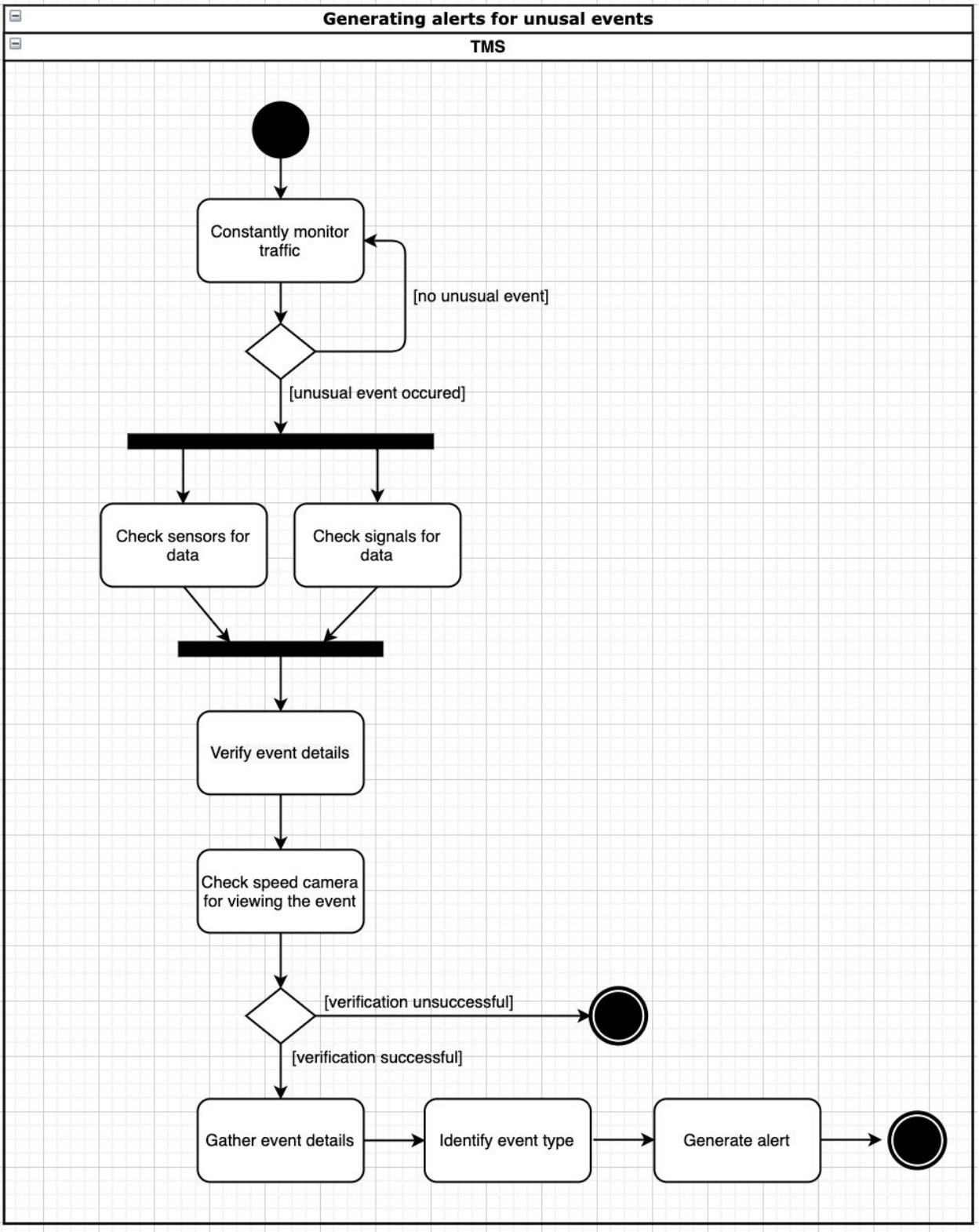


no

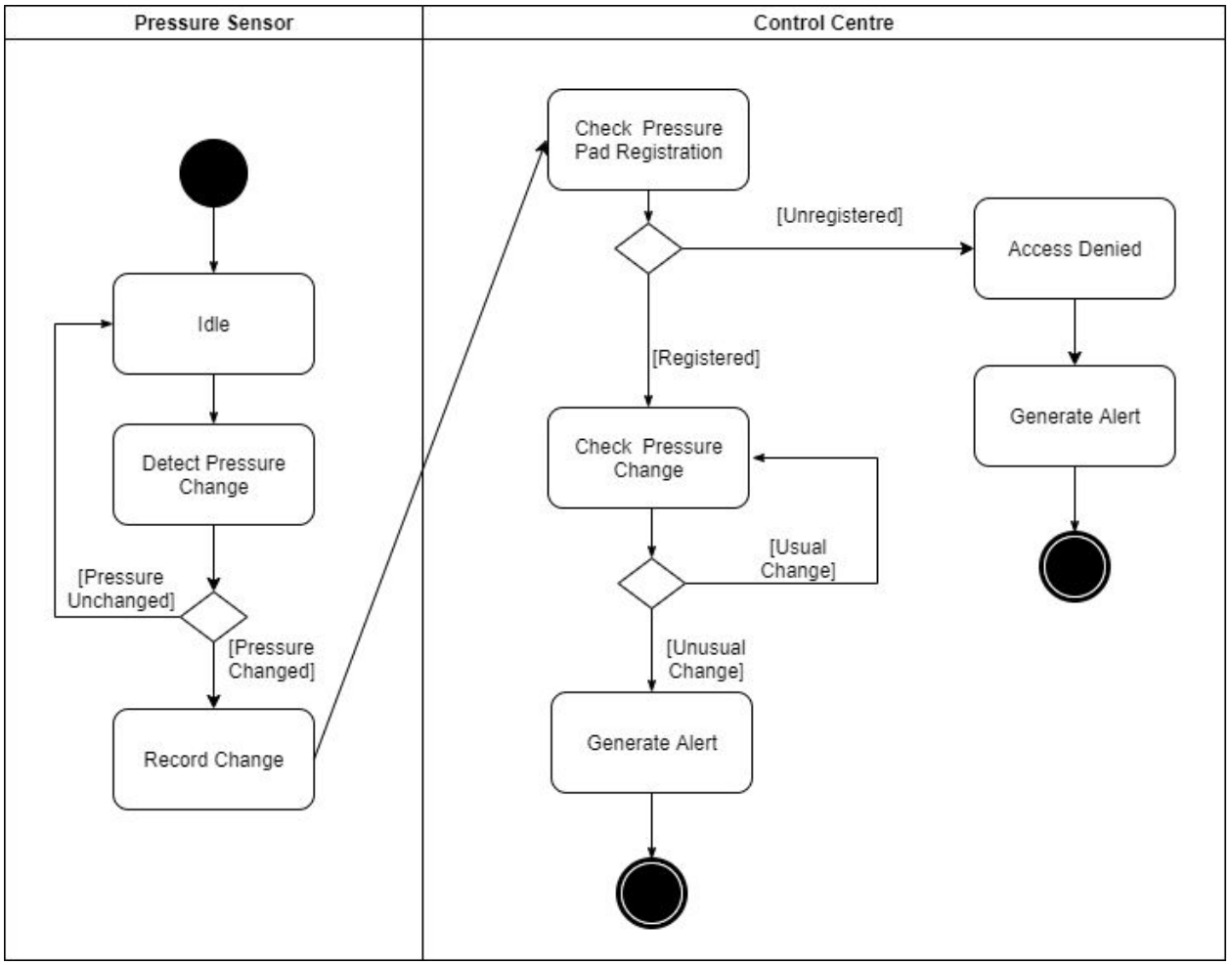
7.4 Update Weather information from weather API - Hyun Jeon 42865320



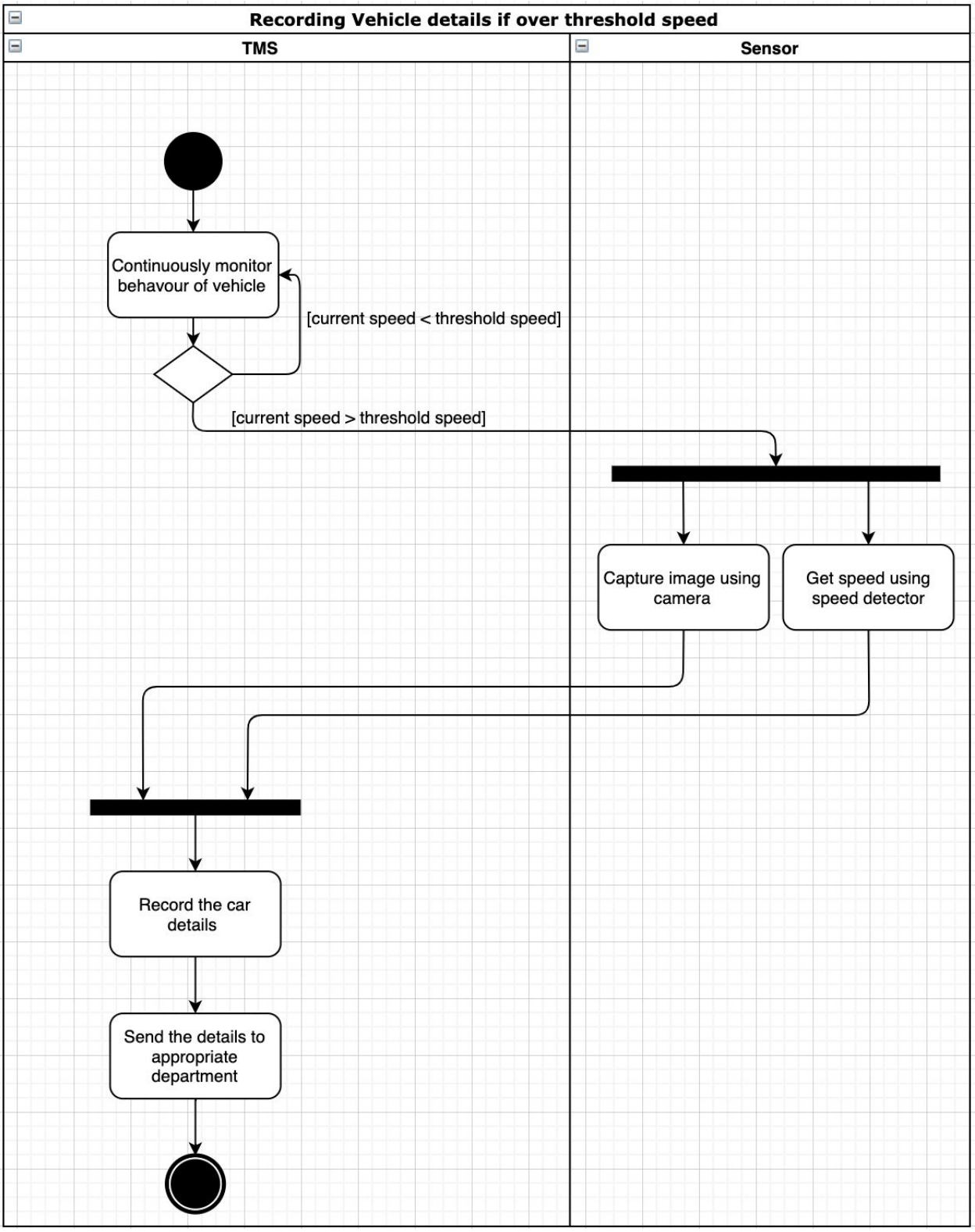
7.5 Generating alerts - Bhavita Bhooma 45922756



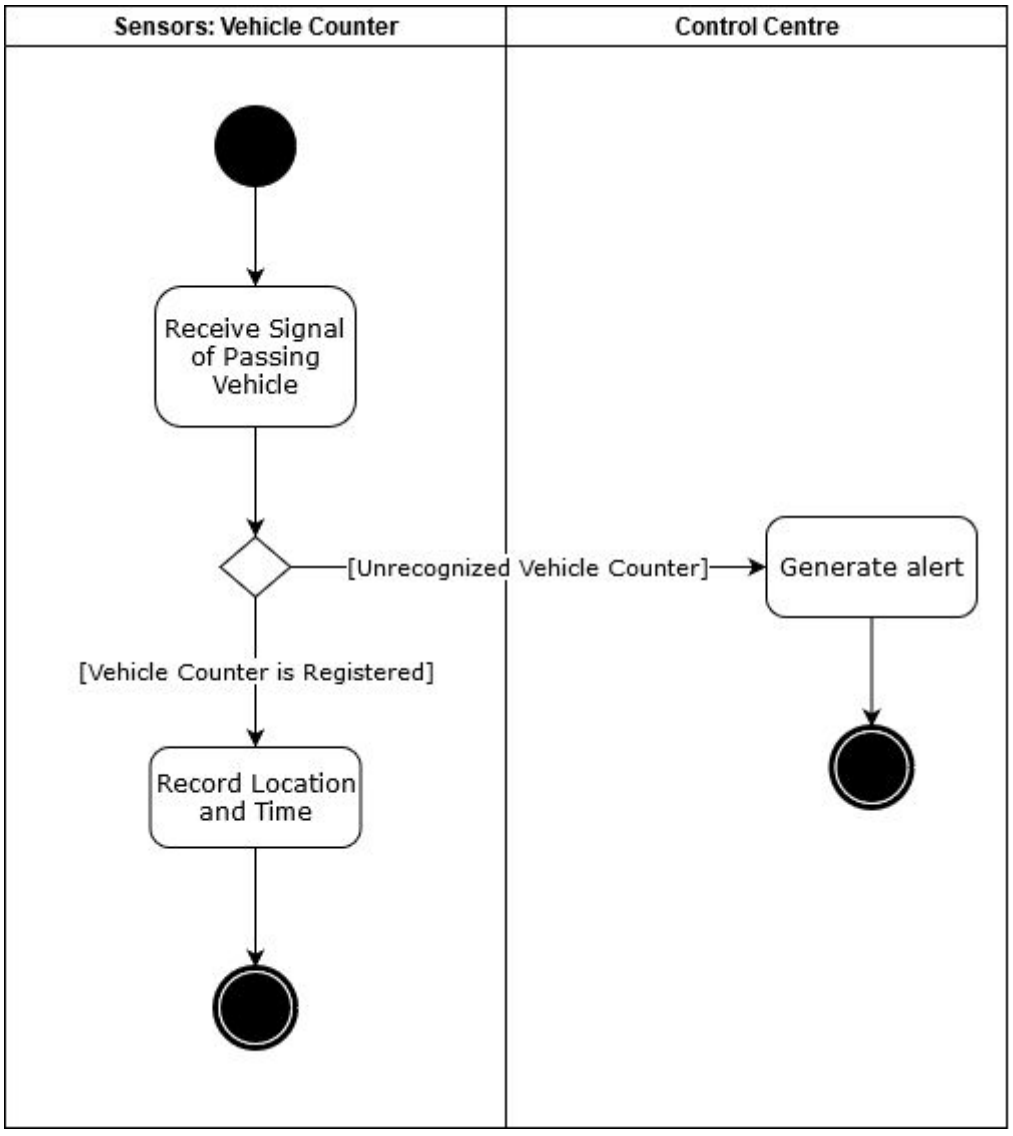
7.6 Report Presence/Absence of Cars - Cheng Jiang 44916552



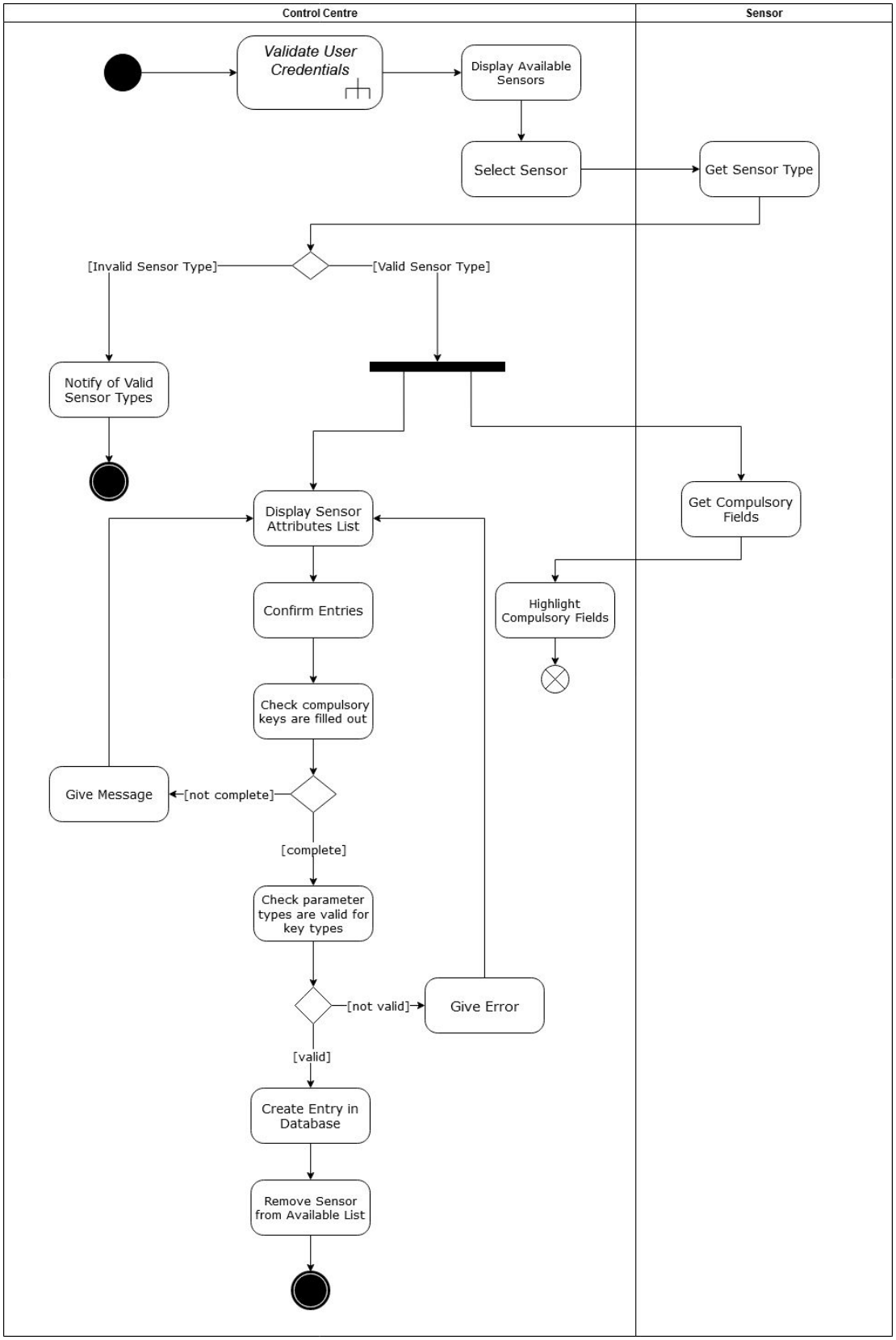
7.7 Record details of the vehicle if speed over threshold- Bhavita Bhooma 45922756



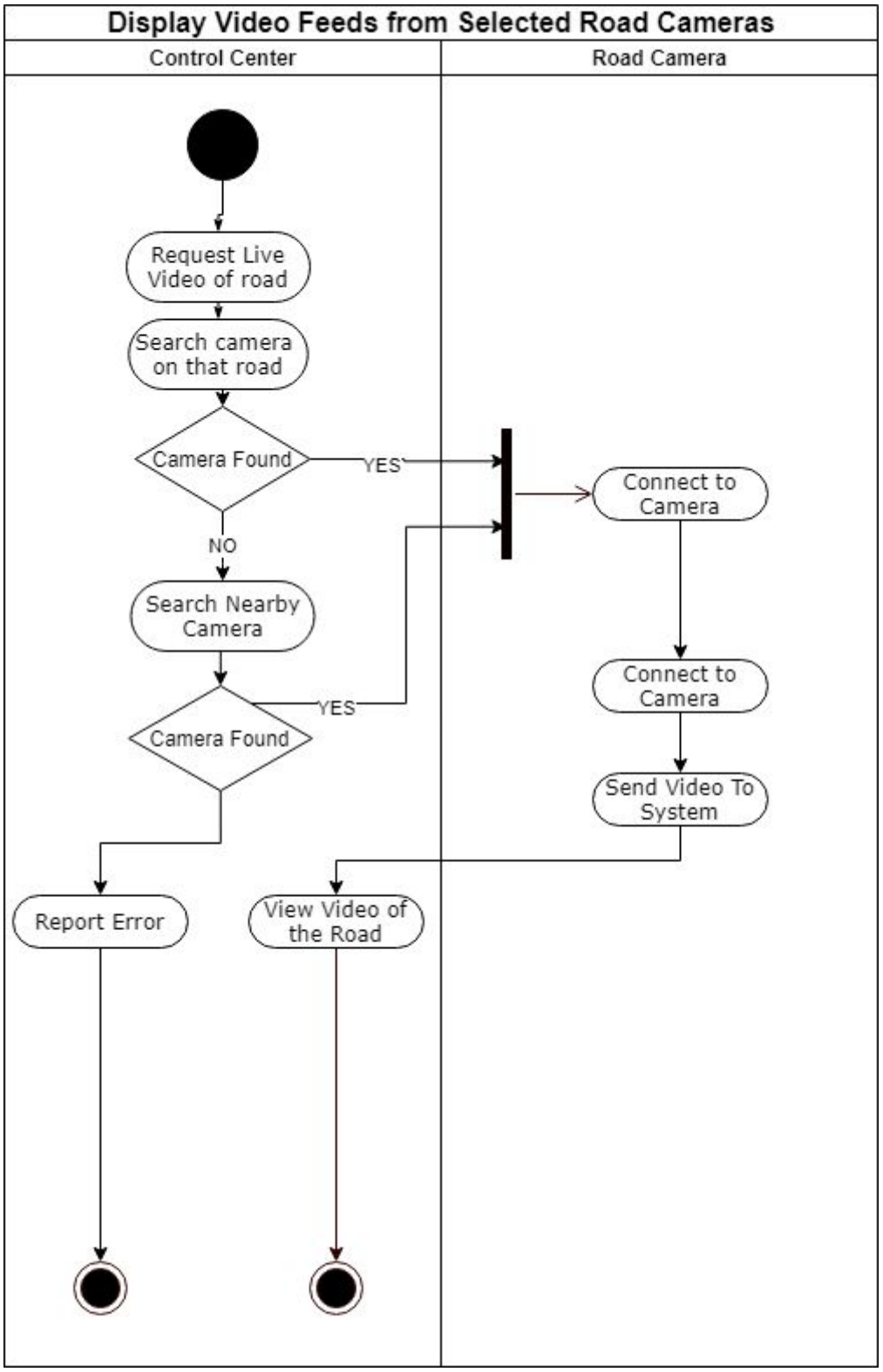
7.8 Update Car Count - Tina Moghaddam 44348292



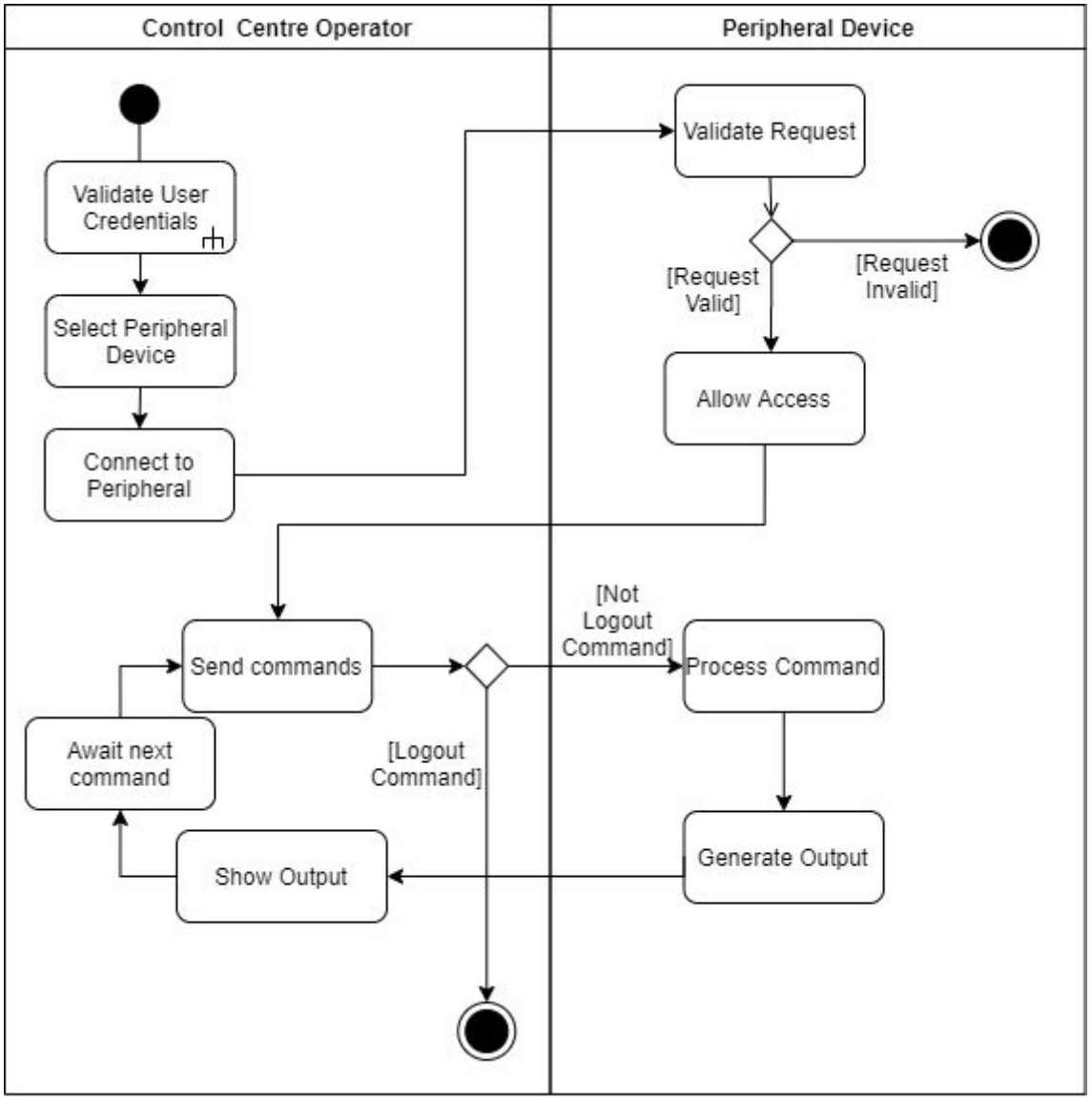
7.9 Register Sensor- Tina Moghaddam 44348292



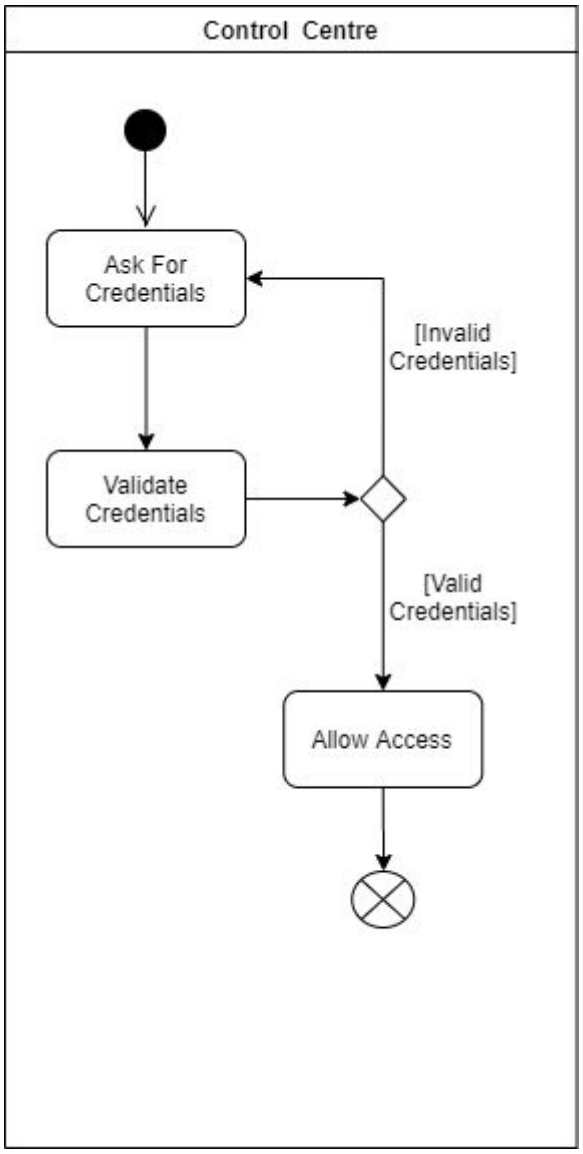
7.10 Display Video Feeds from Selected Road Cameras - Hyun Jeon 42865320



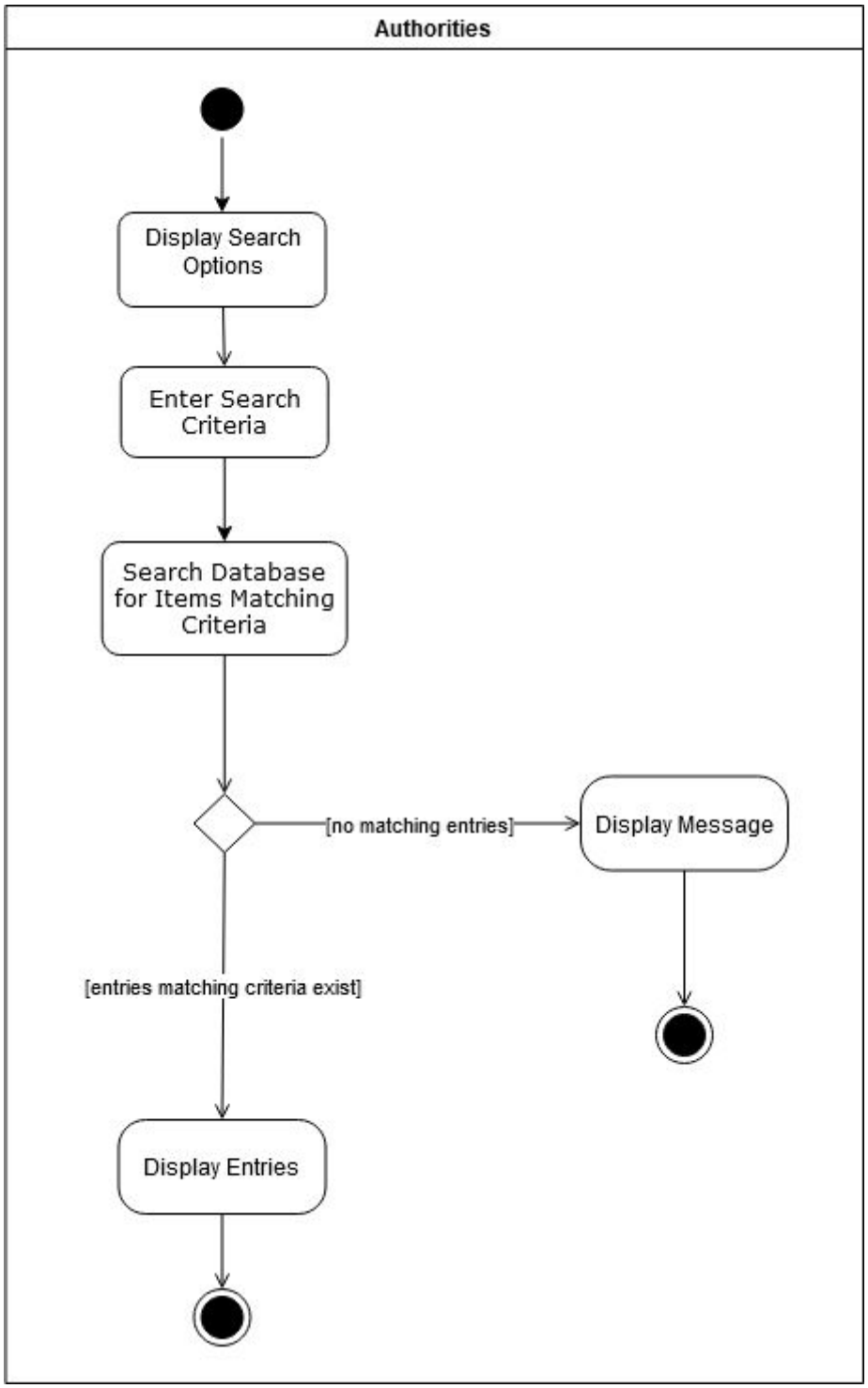
7.11 Peripheral Device Access - Andrew Mylonas 43168907



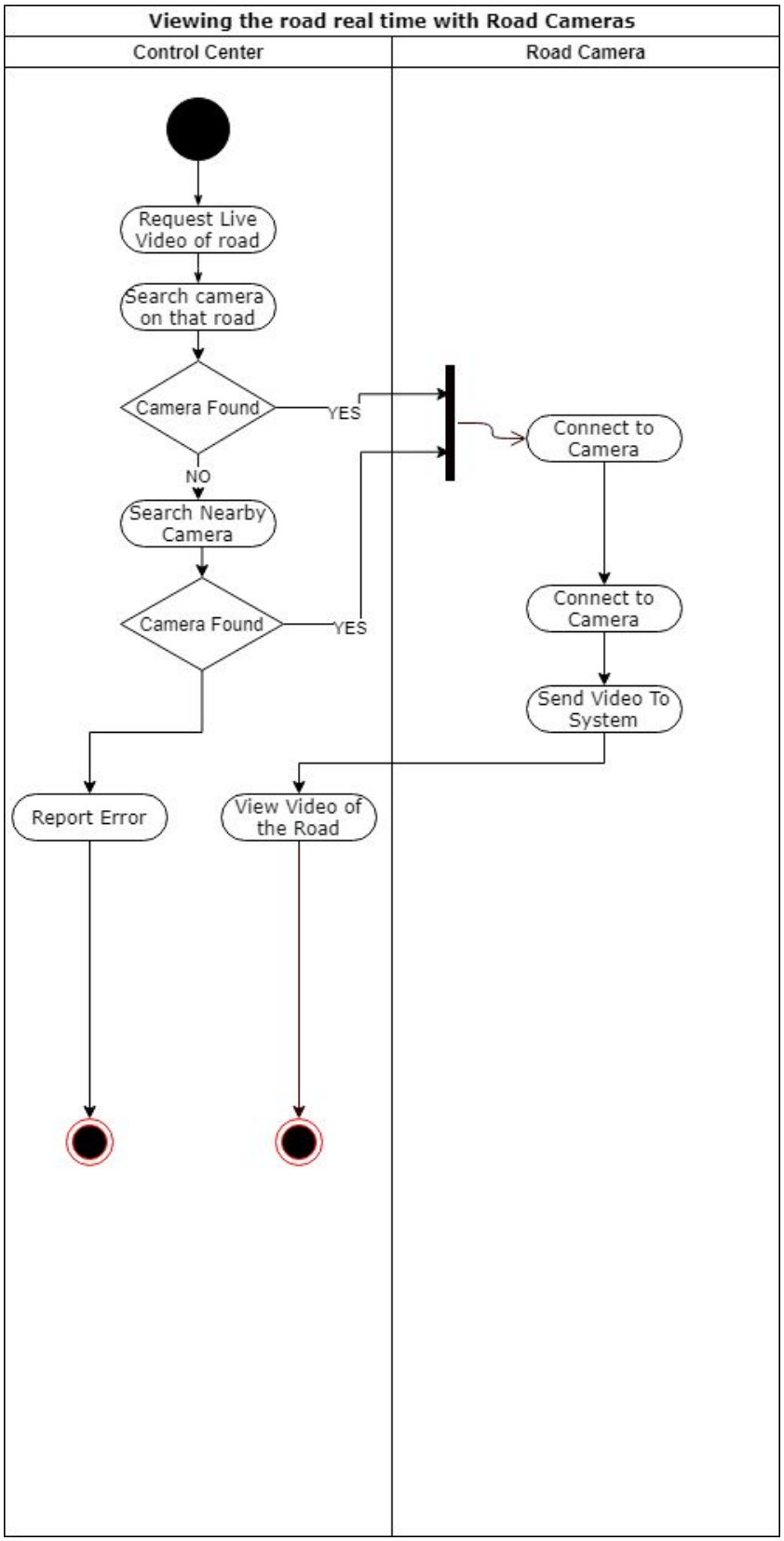
7.12 Check User Credentials - Andrew Mylonas 43168907



7.13 Poll Database - Tina Moghaddam 44348292



7.14 Viewing the road real time with road cameras- Hyun Jeon 42865320



8.0 Non-Functional Requirements

Ref. #	Description
NFR01	The system must be responsive, with average response under 10 seconds, and should not go over 30 seconds
NFR02	The system must be up, operating 24/7 with 99% uptime
NFR03	The system must be secure and should only allow access after validating the security information
NFR04	The system should be portable to meet the needs of certain types of actors who will be moving
NFR05	The system should be flexible to be used for different types of roads in different cities
NFR06	The system should recover gracefully from faults - it should recover within 1 minute
NFR07	The system must have data integrity providing accurate data at all times
NFR08	They system should be easily maintainable any updates on the system should be done easily
NFR09	The system should be interoperable with any required existing system.

9.0 Risk Management

9.1 Risk Table

Probabilities: Almost Certain (AC), Likely (L), Possible (P), Unlikely (U), Rare (R)

Impact: Very High (VH), High (H), Moderate (M), Low (L), Very Low (VL)

Ref. #	Risk	Probability	Impact
Risk01	System doesn't integrate well with the existing system.	P	VH
Risk02	System requirements don't capture all customer use cases.	P	M
Risk03	System malfunction results in a car crash.	R	VH
Risk04	Big data features are not useful or possible.	P	H
Risk05	Loss of access to required APIs.	U	H
Risk06	False or malicious data supplied to the system by external API.	U	M
Risk07	Digital speed signs are accessed by a non-authorised user and tampered with.	U	H
Risk08	System is subject to cyber terrorism, and made to malfunction.	VL	VH
Risk09	System becomes obsolete due to a rapid transition to autonomous vehicles.	L	H
Risk10	Government indecision and mismanagement lead to sudden changes in requirements	M	H

9.2 Mitigation Plan

Ref. #	Mitigation Plan
Risk01	Mitigated by thorough consultation with the relevant government department and by testing the interoperability before integrating.
Risk02	Mitigate by considering all possible customer use-cases beforehand
Risk03	Mitigated via redundancy. Two independent controllers removes the risk of relying on a single controller.
Risk04	Mitigated by starting AI work early and employing experts when the project is stalled.
Risk05	Mitigated by only receiving data from authorised third party API providers
Risk06	Mitigated by vetting third-party information providers to ensure that their own systems are secure.
Risk07	Mitigated by ensuring secure communication protocols are used and implementing peripheral sensors to only accept authorised data.
Risk08	Mitigated by consulting with security experts to ensure that level of security implemented is appropriate.
Risk09	Mitigated by investigating new external developments that could affect the project.
Risk10	Mitigated by consulting with stakeholders at every level and by keeping abreast of intra-stakeholder communications if possible.

10.0 Release Plan

10.1 Release One - 03/07/2020 (33 story points)

The first release contains core functions for the TMS to operate, this is the essential functionalities of the Road Control and Internal Data package, as well as security features. The included use cases are:

- Change Traffic Lights (1 story points)
- Display Inputted Images/Messages (1 story point)
- Crossing Button (3 story points)
- Generate Alerts (8 story points)
- Record vehicle details if speed over threshold (5 story points)
- Register Sensors (1 story point)
- Update Car Count (1 story point)
- Poll Database (2 story points)
- Peripheral Device Access (5 story points)
- Validate User Credentials (3 story points)
- Report Presence/Absence of Cars (1 story point)
- Display Video Feeds from Selected Road Cameras (2 story points)

10.2 Release Two - 31/07/2020 (27 story points)

The second release will focus on the functionality that relates to third parties either providing information to the system or using system information.

- Notify emergency services when anomaly detected (1 story point)
- Find fastest path to destination (5 story points)
- Receive notice of traffic violations (3 story points)
- Issue Traffic Alert (2 story point)
- Receive weather information from Weather API (5 story points)
- Database API for Navigation providers (5 story points)
- Notify speed camera location (1 story point)
- Generate User Credentials (5 story points)

10.3 Release Three - 04/09/2020 (42 story points)

The third release includes functionality that is automated by the system or requires more system computation.

- Check Registration. (8 story points)
- Be notified about potential accidents. (13 story points)
- Set to automatic control. (21 story points)

10.4 Release Four - 02/10/2020 (34 story points)

The fourth release builds upon existing functionality to allow the system to control routes and traffic for emergency services.

- Open up the fastest routes. (34 story points)

10.5 Release Five - 30/10/2020 (34 story points)

The fifth release focuses on implementing functionality that tracks the number of people in a selected area.

- Track number of people to be accounted for (34 story points)

10.6 Velocity estimation

Sample use case: Peripheral Access 5 story points

Task	**Time (hours)**
Create GUI	20
Test user interface	10
Create functionality to automatically add registered sensors onto UI	8
Create functionality to be able to select a registered sensor	15
Create functionality to display sensor status when selected	8
Create functionality to send commands to selected sensor	20
Create functionality to be able to multi-select for an area and display options	8
Display errors	6
Test use case	25
Total	**120**

120/5 = 24 hours per story point

For 5 team members working 40 hours per week, with a release approximately every month, we can allocate 34 story points per release.

Velocity: V = *#team-members * hours per person per week * (length of release (weeks) / hours per point)*

= 5 * 40 * (4/25)
= **34**

Release 1 = 34
Release 2 = 28
Release 3 = 42
Release 4 = 34
Release 5 = 34

11.0 Summary

Traffic congestion is a handbrake to the economy. It has been estimated that congestion will cost the Australian economy $50 billion in lost productivity by 2031 (Australia's $50 billion time bomb, 2020). Our TMS, as specified in this document, is a cost-effective attempt to mitigate a portion of this lost productivity. This is achieved by replacing existing infrastructure such as cameras, sensors, traffic lights with internet-capable versions, and by allowing these devices to communicate and act as a cohesive whole. Innovative AI features coupled with the use of live data makes our product a modern and sophisticated traffic management solution.

12.0 Glossary

Term	Definition
TMS	Traffic Management System
Digital Road Sign	A sign on the road with a digital display that can be accessed remotely.
Control Centre	Person employed to deal with the day-to-day manual operations that may be required by the system.
Sensors	Vehicle counter, camera, pressure pads, speed detector
Signals	Traffic lights, Road Signs
Weather API	Application Processing Interface that can request and receive weather information
Road Camera	Cameras that are installed on the roads for multiple purposes, such as speed camera, surveillance camera

13.0 References

NewsComAu. 2020. *Australia'S $50 Billion Time Bomb*. [online] Available at: <https://www.news.com.au/finance/economy/australian-economy/traffic-congestion-may-cost-50bn-by-2031/news-story/83d3885c82175b3eadbeb1b66e9b2600> [Accessed 3 June 2020].