

# Requirements Document for Junction Traffic Control System



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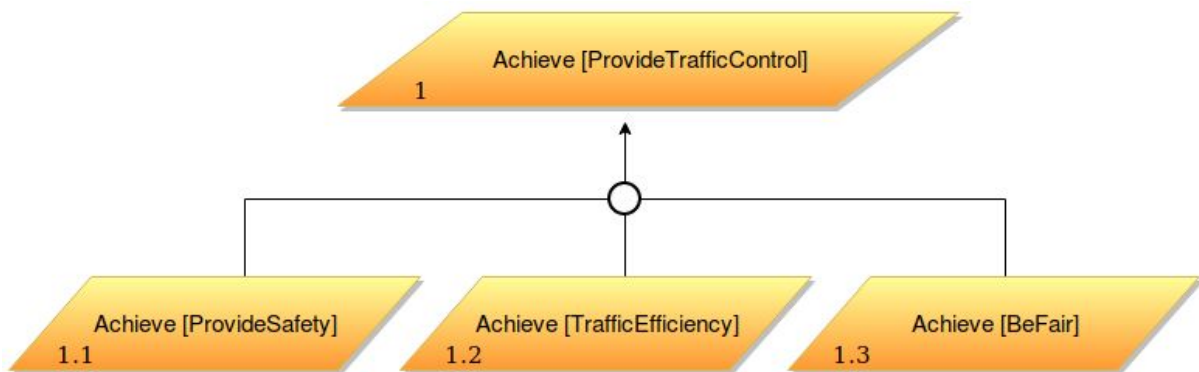
# 1. Introduction

Intersection junctions are by design need to be structured carefully to avoid any issues. The old junctions were not designed to be very efficient because the low number of vehicles on the roads in 1900's. However, with the ever growing number of cars that are being driven on the road today, designing a safe, efficient and fair traffic light system is mandatory. In this paper, the requirements are shown in models of goal, obstruction, agent, object and operation using diagrams and annotations. The main idea is to create a safe passage to both vehicles and pedestrians as well as considering the economical side of things where if a road is on busy traffic, there will be more time allocated to that road's passage while not blocking the other roads indefinitely.

## 2. Sections

### 2.1. Goal Model

A goal model expresses the relationships between a system and its environment. The understanding this gives, of the reasons why a system is needed, in its context, and connects requirements to design.

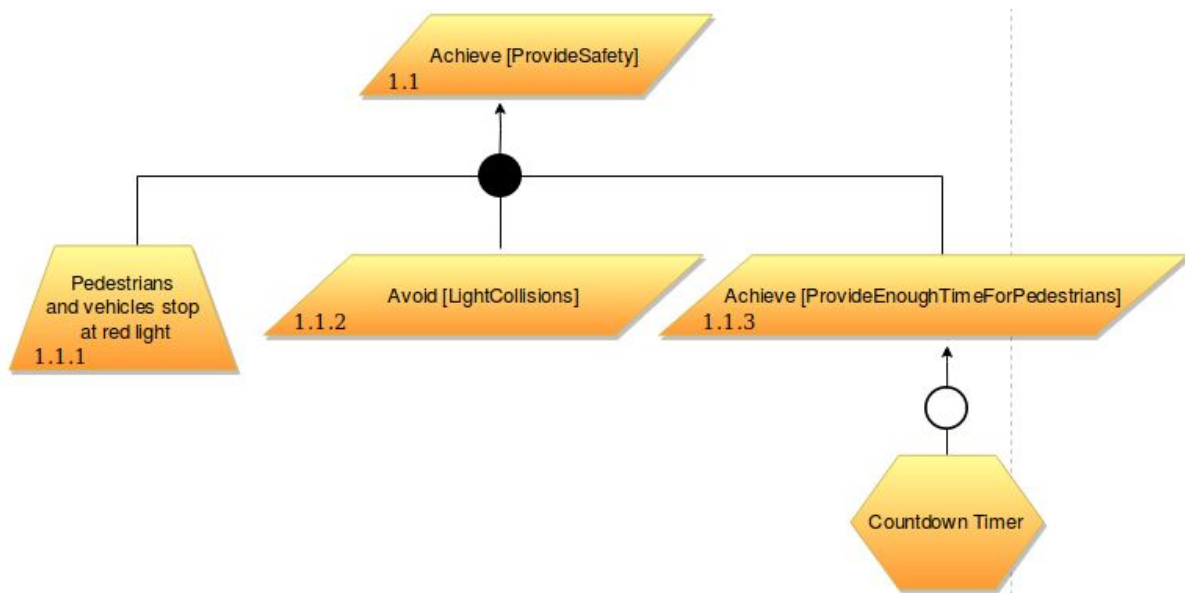


ID	1
Name	ProvideTrafficControl
Description	The system shall provide a traffic controlling mechanism which is safe, efficient and safe
Type	Achieve
Priority	Highest

ID	1.1
Name	ProvideSafety
Description	The system shall safety for both vehicle and pedestrian crossings Type: Achieve
Type	Achieve
Priority	Highest

ID	1.2
Name	TrafficEfficiency
Description	The system shall calculate the amount of vehicles on a road to allocate more time on heavier traffic
Type	Achieve
Priority	High

ID	1.3
Name	BeFair
Description	The system shall be fair towards other crossings. Even if one road is busy, it will give the other roads to chance to cross
Type	Achieve
Priority	High

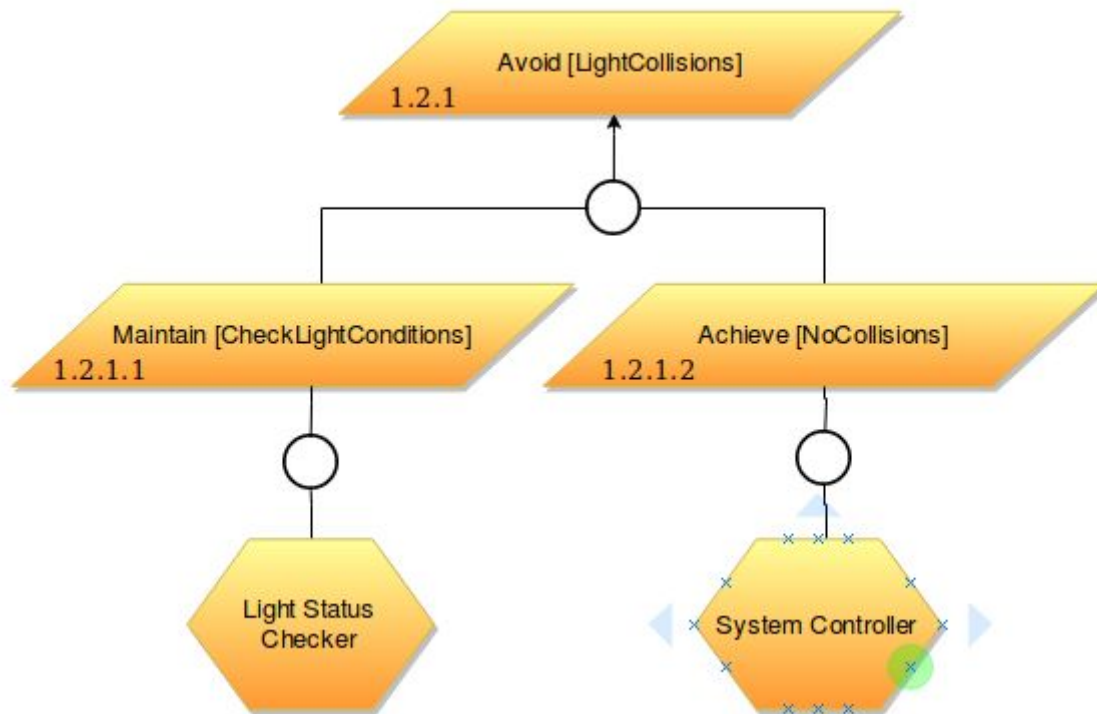


ID	1.1
Name	ProvideSafety
Description	The system shall safety for both vehicle and pedestrian crossings Type: Achieve
Type	Achieve
Priority	Highest

ID	1.1.1
Name	Pedestrians and vehicles stop at red light
Description	Assumption for the system to work. Pedestrians and vehicles will stop at red light condition.
Type	Domain Property

ID	1.1.2
Name	LightsCollisions
Description	The system must avoid green light collisions on adjacent and crossing roads
Type	Avoid
Priority	Highest

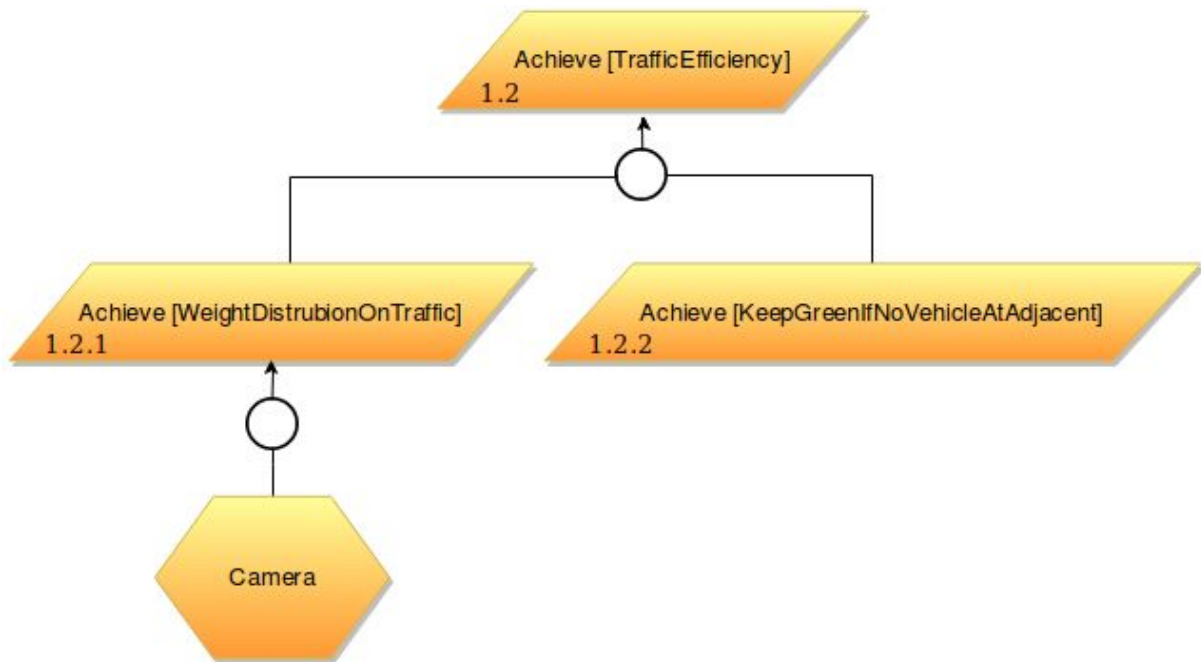
ID	1.1.3
Name	ProvideEnoughTimeForPedestrians
Description	The system shall compute the duration of the pedestrian lights according to a speed of a disabled person and plus a safety margin
Type	Achieve
Priority	Normal



ID	1.2.1
Name	LightsCollisions
Description	The system must avoid green light collisions on adjacent and crossing roads
Type	Avoid
Priority	Highest

ID	1.2.1.1
Name	CheckLightConditions
Description	The System shall keep checking the current condition of the lights Type: Maintain
Type	Maintain
Priority	Highest

ID	1.2.1.2
Name	NoCollisions
Description	The system shall have a notification system to inform the system controller in case of a green light collision
Type	Achieve
Priority	Highest

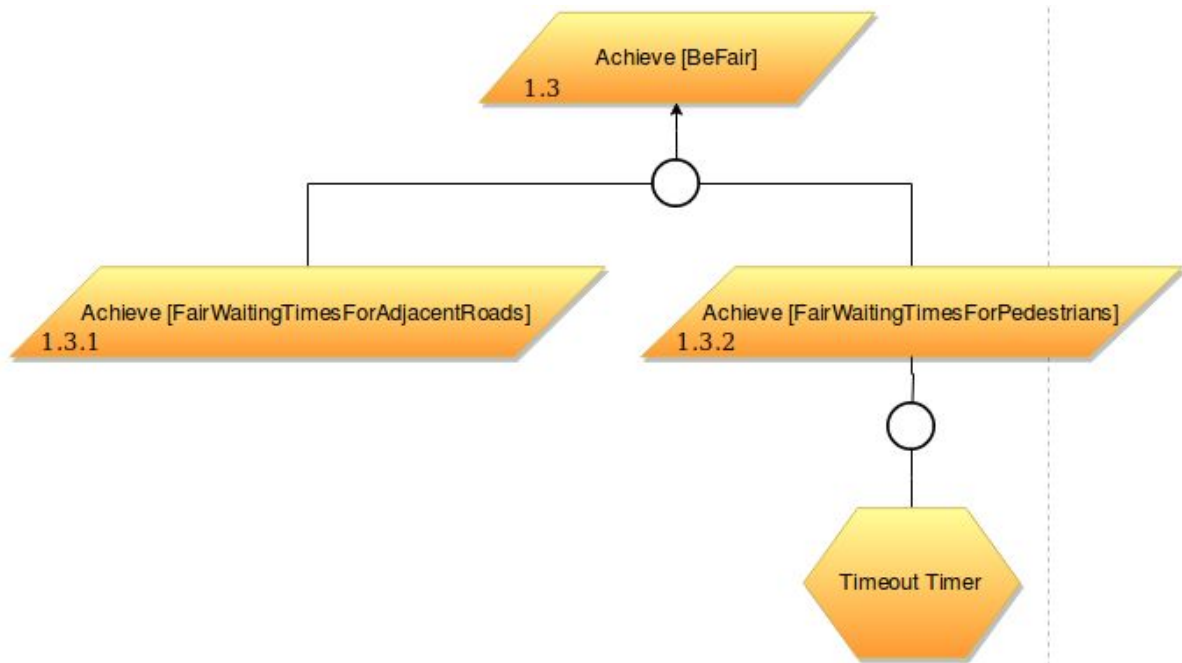


ID	1.2
Name	TrafficEfficiency
Description	The system shall calculate the amount of vehicles on a road to allocate more time on heavier traffic
Type	Achieve
Priority	High



ID	1.2.1
Name	WeightDistribubionOnTraffic
Description	The system shall calculate the number of vehicles are waiting and passing through in real-time to allow heavier traffic more time
Type	Achieve
Priority	Normal

ID	1.2.2
Name	KeepGreenIfNoVehicleAtAdjacent
Description	The system shall keep the green light on if the adjacent road has no traffic to avoid unnecessary holding of the traffic
Type	Achieve
Priority	Normal



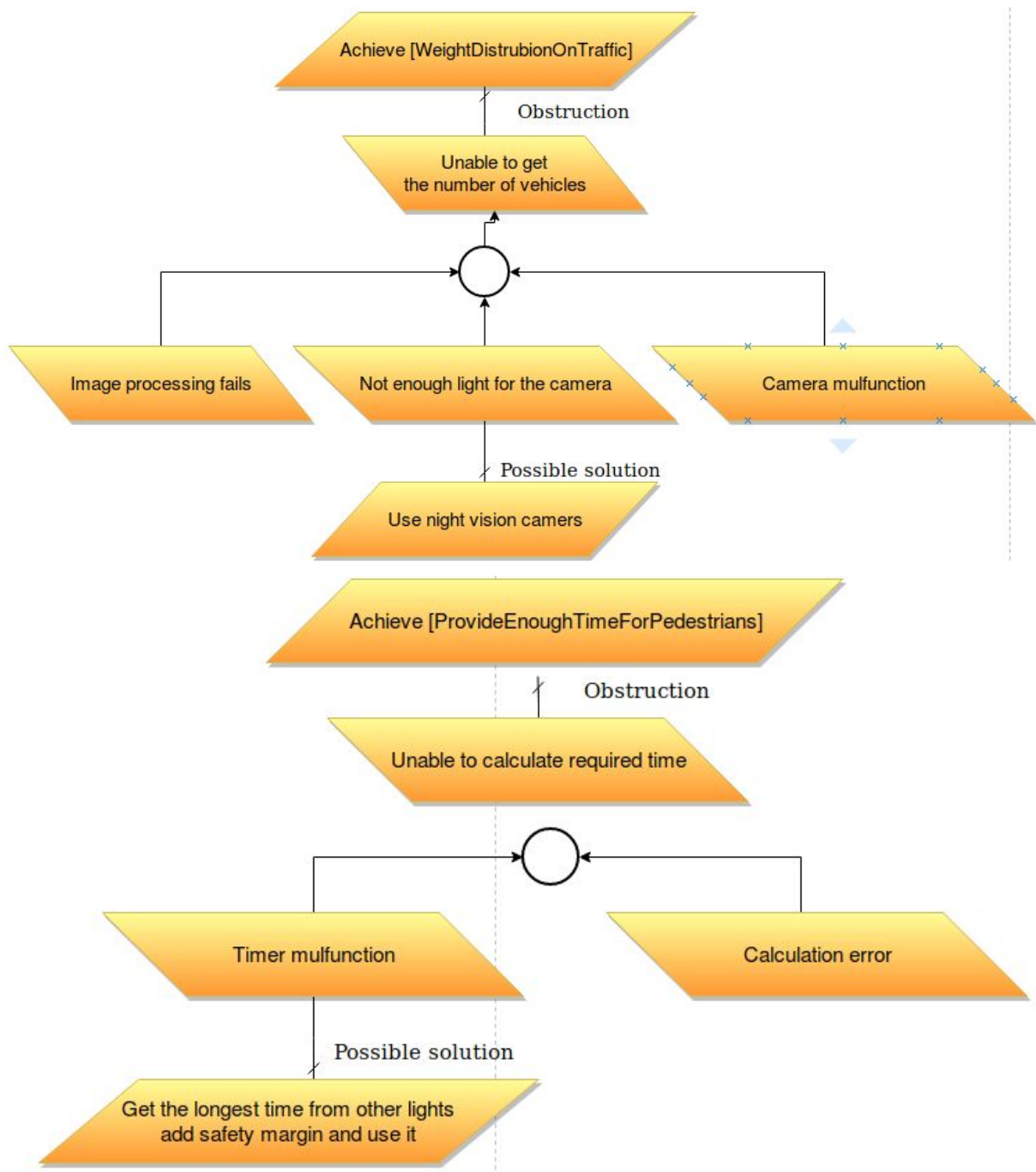
ID	1.3
Name	BeFair
Description	The system shall be fair towards other crossings. Even if one road is busy, it will give the other roads to chance to cross
Type	Achieve
Priority	High

ID	1.3.1
Name	FairWaitingTimesForAdjacentRoads
Description	The system must not cut the passing rights on low traffic roads to provide efficiency for the high traffic roads
Type	Achieve
Priority	Low

ID	1.3.2
Name	FairWaitingTimesForPedestrians
Description	The system must allow pedestrians to cross the road even if the road is on heavy traffic
Type	Achieve
Priority	Low

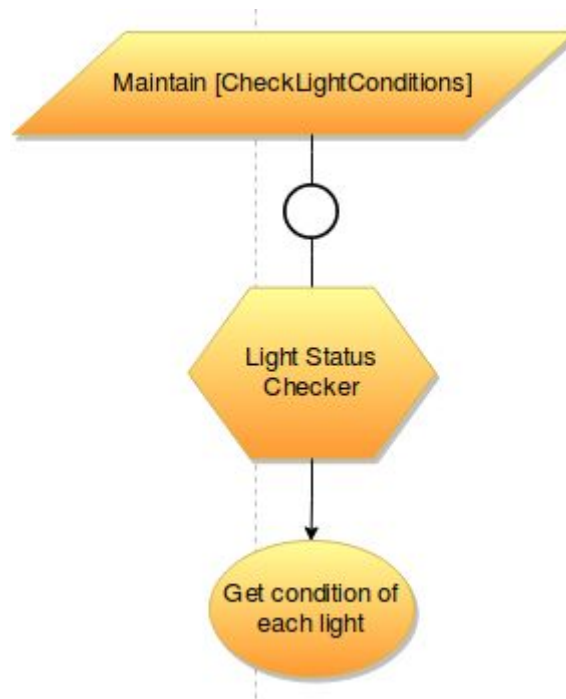
## 2.2. Obstruction Model

Obstacles must be satisfiable through behaviours of one or several agents in the system. Obstacle model is a set of obstacle diagrams associated with goals and hypothesis in a goal model.

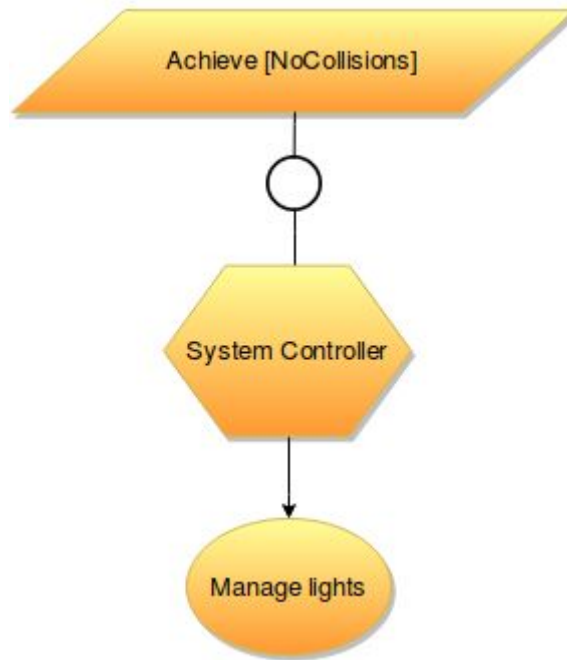


## 2.3. Agent Model

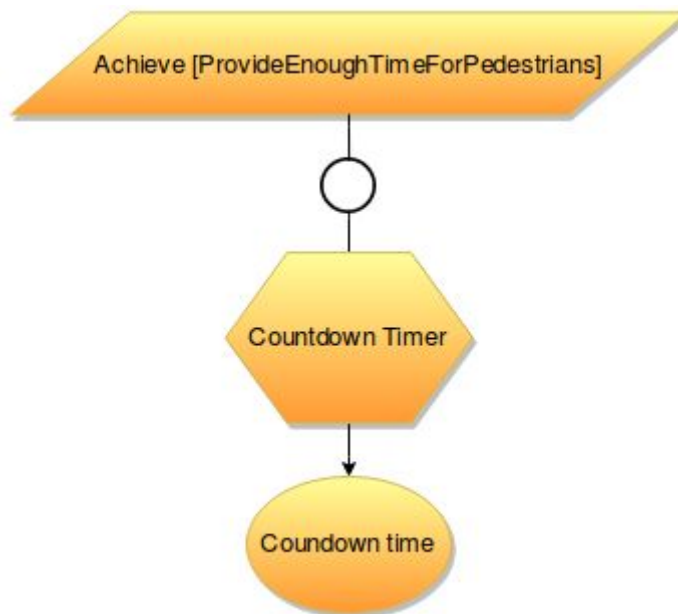
An agent model captures agent capabilities, responsibilities, interfaces and refinements, human agent's wishes, beliefs and dependencies.



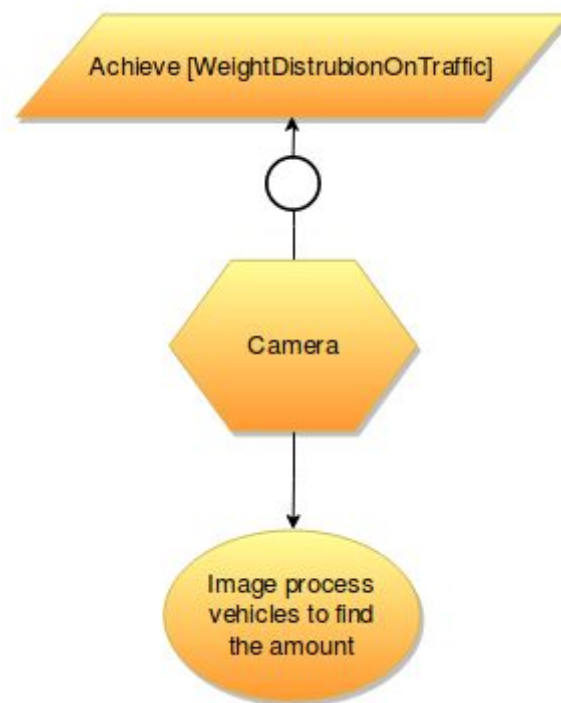
Name	Light Status Checker
Description	A system tool that checks each light status with their appropriate IDs. If the light is green for a particular light, isGreen variable becomes True and vice versa
Category	Software Agent



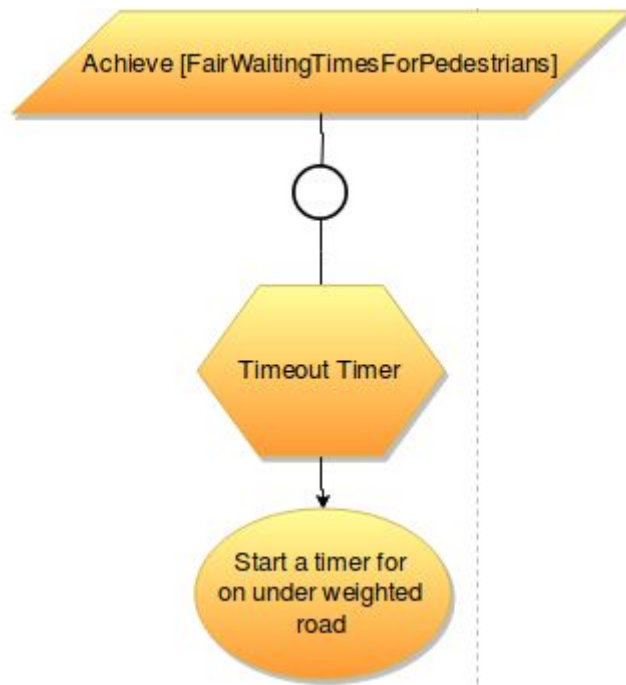
Name	System Controller
Description	Checks if there are any conflicts in and between lights that may cause a possible issue on the traffic
Category	Software Agent



Name	Countdown Timer
Description	Starts a timer which sum of the necessary time required for a disabled pedestrian to cross the road plus a safety margin when green light is lit for the pedestrians
Category	Software Agent



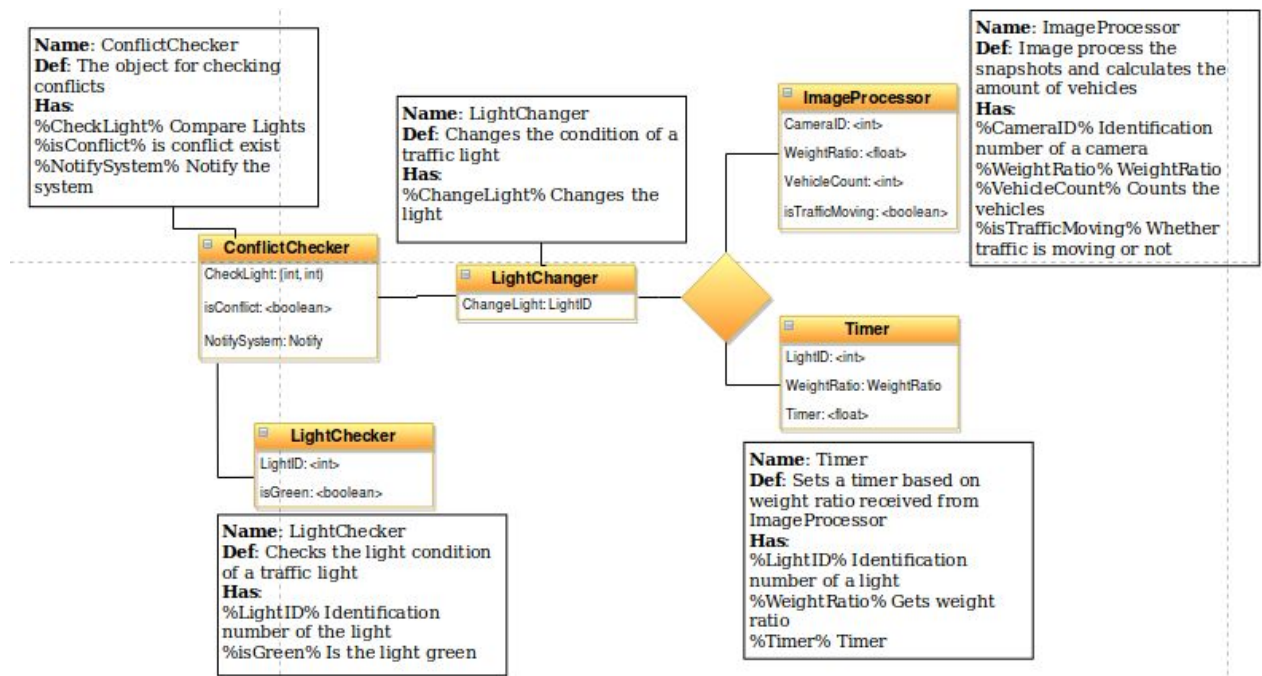
Name	Camera
Description	Counts the number of vehicles either moving or stable state via capturing snapshots and image processing the data
Category	Agent



Name	Timeout Timer
Description	Calculates the timeout value not to keep the low traffic road vehicles no longer than necessary
Category	Software Agent

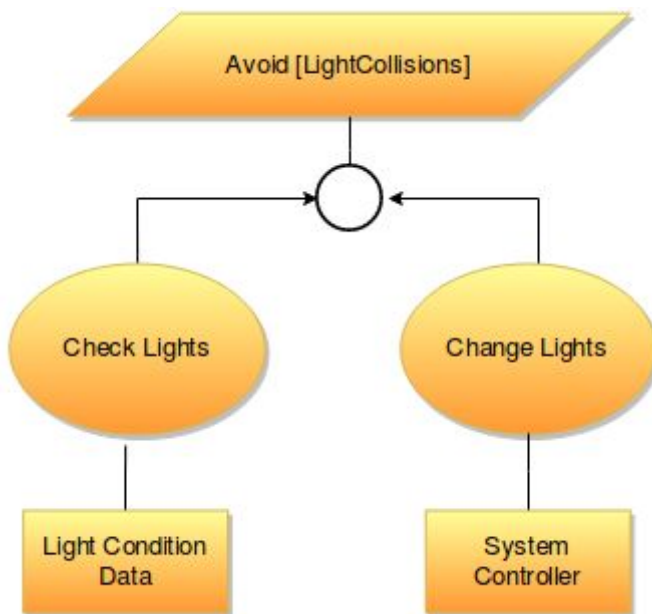
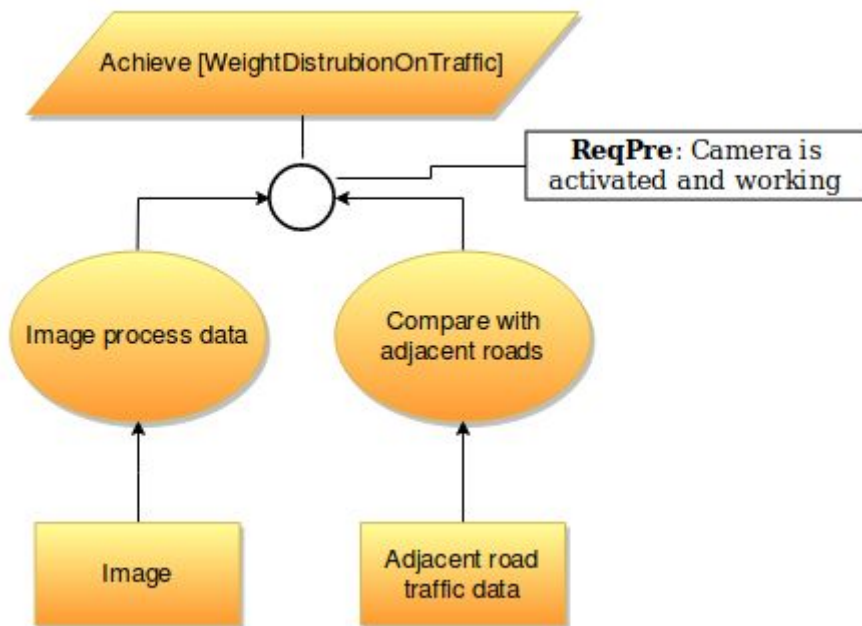
## 2.4. Object Model

The object model encompasses the principles of abstraction, encapsulation, modularity, hierarchy, typing, concurrency, and persistence. What is important about the object model is that these elements are brought together in a synergistic way.





## 2.5. Operational Model



### 3. Conclusion

In this paper a intersection junction system requirements document shown with the idea of intersection being safe, efficient and fair. In order to get the system work as it is intended hardwares such as camera are used. The sub-goals and requirements for achieving these two goals are given in Sections. An example obstruction model is defined. Also, agent model is presented. Thus, all requirements are satisfied for the system, and it is ready to be implemented.

### 4. References

Florida Intersection Design Guide, Florida Department of Transportation, 2007

Multi-Modal Intelligent Traffic Signal System, University of California PATH Program, Savari Networks, Inc., Jul, 2012

Kay Fitzpatrick, Mark D. Wooldridge, and Joseph D. Blaschke, Urban intersection design guide: volume 1–guidelines, Feb, 2005