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# Modelling and Simulating Mobile Service-Oriented Systems

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**Abstract:** When an accident occurs; it causes threat and disturbance to approaching vehicles; to void this threat and any inconvenience caused by an accident we propose that there should be mobile web services deployed on police vehicles that broadcast an accident information in the vicinity of an accident place; and if and accident has blocked the road then nearby junctions should be notified about the blockage of a road and an accident information so that they can divert traffic to other routes.

**Keywords:** Mobility, Mobile UML, Mobile Web services.

## 1. INTRODUCTION

We are taking a real world application for modelling and simulating mobile service-oriented systems. We take accident assistance service as our case study to model and simulate mobile service oriented systems. We propose that there should be mobile web services (Geiger, and Zndorf 2006 Berger, 2003 Srirama, *et al.*, 2006) hosted on police vehicles that alert approaching vehicles to void any threat or inconvenience. If an accident has blocked a road then nearby junctions should be notified about the blockage of the road due to an accident as traffic could be diverted to other routes. We propose following options to handle the situation.

1. Accident alert message should be broadcasted by a vehicle with which an accident has occurred; and then that message should be propagated to other vehicles by approaching vehicles.
2. Accident alert message should be sent to nearby junctions. On receiving an accident alert message these junctions should display the message on their display screen; and propagate this message to other surrounding junctions.
3. Accident alert message sent to nearby junctions should be displayed at junctions' display screen; further it should be broadcasted in the cell in which accident is occurred for information of vehicles which are approaching an accident place. And this message may be broadcasted in surrounding cells too for remote vehicles.

## 2. RELATED WORK

### AGILE (Mobile UML)

AGILE has given architectural approach which is based on uniform mathematical framework and graph-oriented techniques that has addressed the mobility complexity in distributed environment. We are interested in the first view of AGILE project which describes notation and abstraction for mobile systems; where abstraction is given by UML extension (Mobile UML). Mobile UML (Grassi, *et al.*, 2004 Latella, *et al.*, 2005 Knapp, *et al.*, 2004) is defined to model systems with mobility. Mobile UML extends class, activity and sequence diagrams, and state machine. UML state machine is extended for describing mobility and network management such as creation of network nodes and object migration.

### Mobile Web Services

At present mobile web services (Srirama, *et al.*, 2006 Srirama, *et al.*, 1999) are in its infancy and they need realization; mobile web services are facing problems such as resource-limited mobile hosts and network coverage/bandwidth. Traditionally there are many frameworks that support only mobile system as a client not a host; e.g. Nokia Web Service Framework; J2ME and .Net My Services SDK. Personal Java, a prototype, is given by Sun Microsystems for developing mobile web services for mobile hosts.

## 3. A CASE STUDY IS MODELLED IN FUJABA.

We have modelled our case study in Fujaba (Nickel, *et al.*, 2000 Burmester, *et al.*, 2005), a graph transformation tool. In **(Fig. 1)** activity diagram (story board) of the case study is given.

1. In the first story an accident has occured with a vehicle v1 and it took place at place p1.
2. In the second story vehicle v1 notifies accident assistance service (AAS) about the accident where it is registered
3. In the third story AAS finds the police station in the area of the accident and reports the police station about the accident.

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4. In fourth story police station directs available police vehicles near to the accident place to recover the victims of the accident and clear the accident place.
5. The fifth story depicts mobility of police vehicles from current location/place p2 to the accident place p1.
6. 6th story depicts that police vehicle alerts vehicles (approaching to the accident place) by broadcasting an accident information in the vicinity of the accident. Police vehicle also alerts adjacent junctions set j1 to display accident information on their display screen.
7. 7th story shows that if the accident has blocked the road then adjacent junctions of the road should be alerted for diverting traffic to other routes.

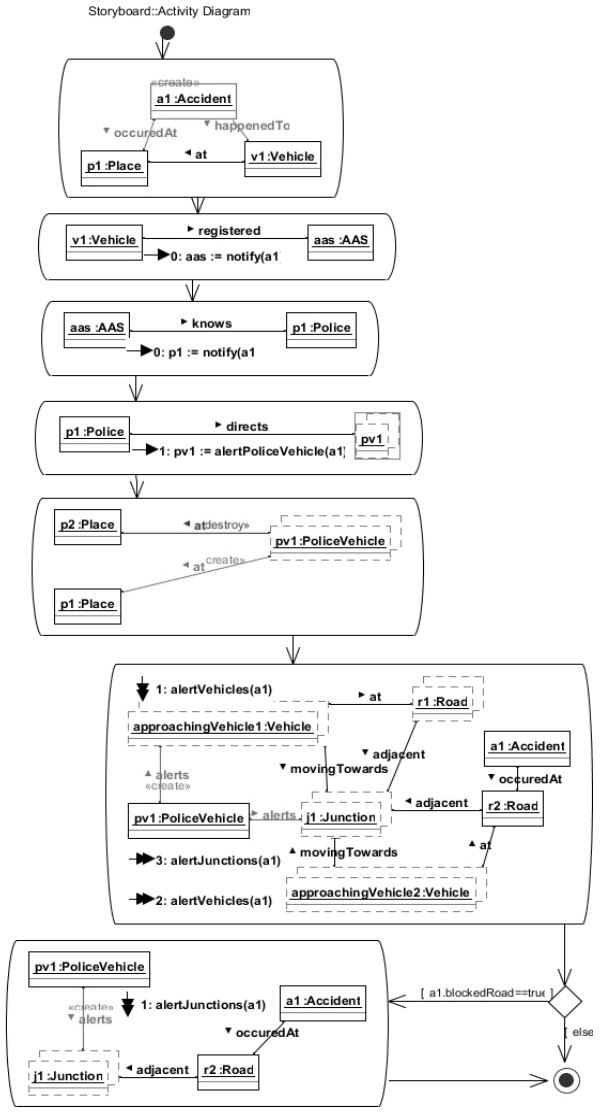



**Fig. 1. The activity diagram of case study.**

In **(Fig. 2)**. class diagram is given which depicts conceptual and structural view of the case study and give implementation details of it. Vehicle is associated with accident assistance service (AAS) (Dominik and Koch, 2007) through registration. Vehicle is on some place that can be either a road or a junction. A road and a junction are specialization of a place. Accident may occur with a vehicle at certain location. We have used a Coordinate class here for representing GPS location of a vehicle. On receiving accident information from a vehicle AAS finds police station of that area where an accident has occurred and reports police station to recover the accident. We assume that AAS has database of all traffic police stations in the country. Police stations have pool of traffic police vehicles which are used to recover the accident and clear the accident place for smooth flow of traffic.

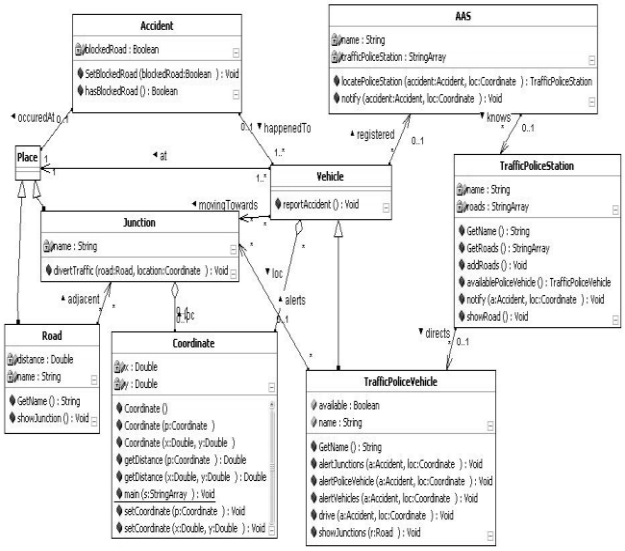



**Fig. 2. Class diagram depicting structural view of case study.**

## 4. Fujaba Model is Tested in eDOBS.

Graph grammar of our case study is given in Fujaba; now we test our case study model through eDOBS (Geiger, and Zndorf 2006) (eclipse Dynamic Object Browser System) which is a graphical debugging tool for eclipse. In which we can browse, editobjects and visualize the transformation of our case study.

- In **(Fig. 3)** object diagram is given which shows location of a vehicle on a road map before an occurrence of an accident.
- **(Fig. 4)** depicts the occurrence of an accident. When an accident happens to a vehicle, a vehicle invokes its reportAccident method with accident information and a current location to the accident assistance service (AAS). On receiving information from a vehicle an

AAS notifies the traffic police station to cover the accident and to rescue the victims. The police station then finds available vehicles in the vicinity of the accident area and directs them to reach the accident spot and rescue the victims and clear the road.

- **(Fig. 5)** depicts the location of vehicle and a road map after an occurrence of an accident.
- **(Fig. 6)** shows the mobility of police vehicle from its current location to the accident spot.
- **(Fig.7)** shows the object diagram when police arrives at the accident spot. When a police vehicle/s arrives at an accident spot; it broadcasts an accident alert message to approaching vehicles about the accident. If the accident has blocked the road then a police vehicle sends a message to nearby junctions to divert traffic to other routes.
- In **(Fig. 8)** adjacent junctions of the road are sent an alert message by a police vehicle to divert traffic to other routes.
- **(Fig. 9)** shows last scenario of the case study; in which the police vehicle directs nearby junctions to divert traffic to other routes.

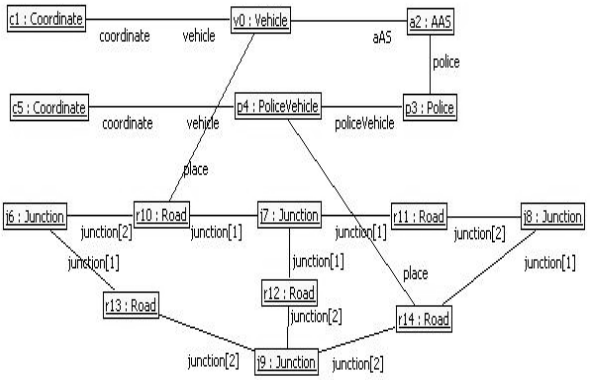



**Fig. 3. Object diagram of case study before occurrence of an accident.**

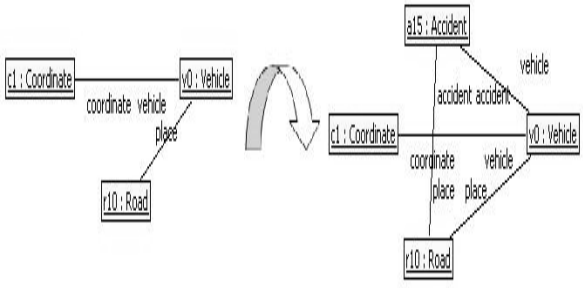



**Fig. 4. In this rule an object diagram depicts an occurrence of an accident**

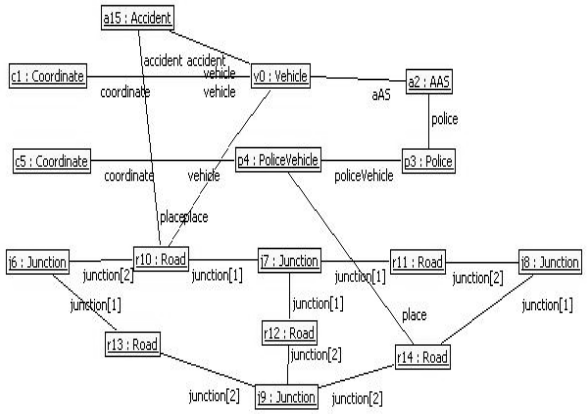



**Fig. 5. An object diagram of case study after an occurrence of an accident.**

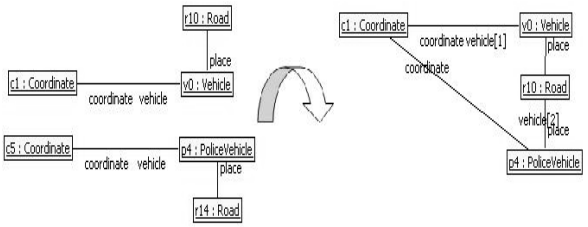



**Fig. 6. In this rule object diagram shows mobility of a police vehicle from a current location to an accident spot.**

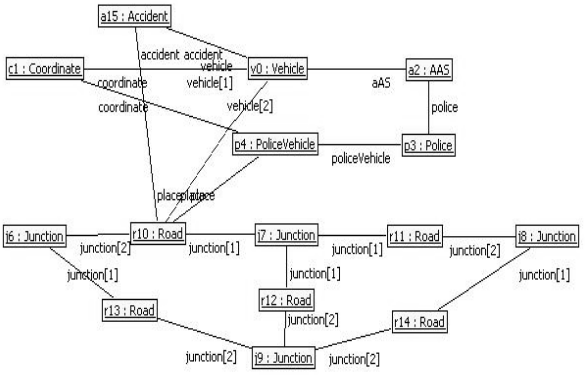



**Fig. 7. In this diagram of a case study police arrives at an accident spot.**

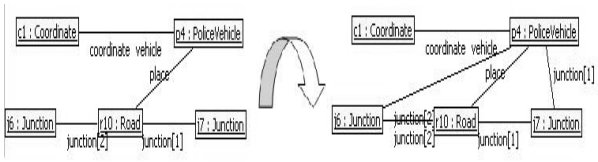



**Fig. 8. In this rule police sends a message to nearby junctions to divert traffic.**

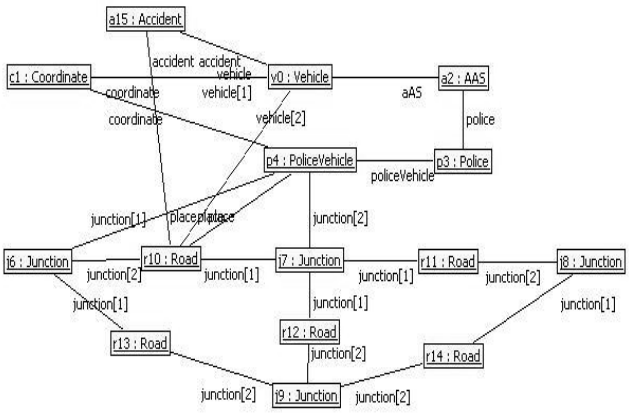



**Fig. 9. This graph shows the last scenario of our case study; in which police vehicle arrives at the accident place and alerts adjacent junctions to divert traffic.**

## 5. CONCLUSION

In the case study we have given a real world application; where mobile web services are deployed on police vehicles; which alert approaching vehicles about an accident and if an accident has blocked a road; then police vehicle notifies nearby junctions to divert traffic to other routes. Police vehicles having deployed mobile services collaborate and cooperate with each other as peers.

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