RFID Application: Modeling of Online Vehicle Tracking for Public Security System using UML

**Abstract**

The Radio Frequency Identification (RFID) is not a new technology and has covered many decades of use in several fields like military, health care, sports etc. In this paper we use RFID with Unified Modeling Language (UML) and UML gives the coder (Programmer or Developer) to goal the difficulty of a problem field by reflecting the problem not as a group of functions that can be executed but as a set of inters-related, integrated Objects. For better visualization of software system, we use the UML diagrams. The main objective of this research paper is to provide a better visualization about an incident happen at different places into the city. It will help the police to find the correct person which is involved directly/indirectly in the incident. The paper covers all aspects of the vehicle tracking for accident, miss-happenings, vehicle disappear, tracing, challan and toll. It will save the time which involves for finding the vehicle and increase the government revenue also. The paper covers different UML diagrams to show that how system works.

**Keywords:** UML, Case Diagram, Class Diagram, RFID.

1. INTRODUCTION:

UML stands for Unified Modeling Language; is a very dominant modeling graphical language for specifying, constructing & documenting the artifacts of software system [1]. UML is pictorial representation of a common semantic model. Investigations in the software visualization and program comprehension communities have primarily focused on effective layout schemes [2, 3, 4, 5] and key aesthetics criteria [6, 7, 8] with the goal of enhancing the cognitive process One of the purposes of UML was to provide the development community with a stable and common design language that could be used to develop and build computer applications [9]. The UML modeling consists of nine diagrams to model a software system & these diagrams are Use case Diagram, Class Diagram, Object Diagram, State Diagram, Activity Diagram, Sequence Diagram, Collaboration Diagram, Component Diagram & Deployment diagram. UML is used for modeling software systems; such modeling includes analysis and design [10, 11]. A UML model is designed through the UML Class & UML sequence diagrams. A database is generated in the UML Class diagram and the same database is implemented by the use of SQL Server [12]. For identifying object uniquely we use RFID technique; RFID uses radio waves. Now a day’s RFID is using different sectors with different application like defense, medical, shopping malls etc. we can categories the RFID into three main section: 1-RFId Tags; the rfid device/ frid circuit /chip. 2-RFId Reader; which reads the data from RFID tags.3-And Data base ; which store the relevant information of the tags .tag id is use as primary key in the database to obtain any object from database. The RFID tags are mainly divided into two parts; 1-Active tag, 2-Passive tags.

Active tags are those which has its own power and they broadcast its information inform of radio waves. From a large distance the RFID Readers can reads these tags but the life of these tags are very short due to its battery/internal power system. And they are costly in price. [13, 14, 15].

Passive tags are those tags which does not have their own power/batter. It (tag) work when the reader sends electromagnetic waves and after getting these waves tag become active and sends its save information inform of radio waves toward RFID Readers. The life of these tags is very long and...
the cost of these tags is very cheaper than an active tag. Each tag is a combination of three parts: antenna, semiconductor chip, and encapsulation technique. [16][17].

HOW SYSTEM IMPLEMENT
To implement the system, we have to follow the following steps.

1. Each vehicle has its own Vehicle_RFID which is inbuilt into its chechis, because in worst condition of vehicle, all part will change except chechis.
2. We can use any types of RFID tags like passive or active.
3. Install the RFID reader at all crossing / choraha in the city.
4. When any vehicle in city is purchased, the details of vehicle and their owner are stored in RTO and Pollution control board with this Vehicle_RFID.
5. All RFID recognizer are connected with the computer system, when any vehicle in city is moving nearby recognizer after they track the vehicle RFID no. and vehicle RFID no. update the database to their location.

The following figure shows reader implementation at crossing.

FEATURE OF ONLINE VEHICLE TRACK SYSTEM
When the infrastructure of the system setup once, all recognizer and stations are active. Now consider the situation that a vehicle disappears/lost from any location in the city. And the owner of the vehicle is complaining to the public security agency and provide vehicle number / vehicle_RFID, the following steps will require...

1) Vehicle Owner required Vehicle RFID and Vehicle number at the time of complain.
2) Now Agency will check the details of provided vehicle RFID and Vehicle number for verification of owner by verifying the details from R.T.O gateway.
3) Now system sends the vehicle RFID to Vehicle RFID reader server for find the route map of vehicle from given time and date to current.
4) The vehicle RFID reader sends back the route map of given vehicle no/ RFID.
5) Before this system public security agency has to investigate the location from the vehicle disappear and require lot of time as well as the manpower to perform the job.

UML ANALYSIS
UML facilitates the domain of any problem, and a new way to solve the situation in conceptual model that exists. Analysis models do not involve any implementation constraints or how the system is to be built [7]. It will identify the objects and process which are related to the problem to be resolved. Modeling had a major impact on software engineering and it is critical to the success of every enterprise scale solution [7].

A. UML STATIC MODELING FOR VEHICLE TRACK SYSTEMS
This part shows the way that system should look. It analyses the structure and substructure of the modeled system based on objects, attributes, operations, and relationships [18].

B. USE CASE MODELING FOR VEHICLE TRACK SYSTEMS
From the figure 1, use case diagram shows how the system works.
Normal Flow…
1) Vehicle owner provides the vehicle RFID no., Vehicle number, date and time for putting complain into public security agency in case of vehicle disappear.
2) Now the agency, first it will verify the owner’s id so that it will help to find real owner.
3) After that they send the details of vehicle to the Vehicle RFID reader server for find the locations of vehicle into the city.
4) For finding the vehicle route map for specific time and date, vehicle reader server takes help of reader location server.
5) And the Vehicle Track reader server sends the vehicle route map from the location of disappear and for date and time.
6) From the vehicle route map agency are able to find the correct location of vehicle. And they will take the required action/decision.

![Use Case Diagram of Vehicle Track system](image)

**Figure 1: Use Case Diagram of Vehicle Track system.**

**C. CLASS DIAGRAM FOR VEHICLE TRACK SYSTEM**

The requirement of a class diagram is to describe the classes within a model. In an object oriented application, classes have attributes (member variables), process/operations (member functions) and relationships with other classes [11]. The following figure-2 Class Diagram shows how the objects are related to each other, it describe the class working function. From the figure -2, when any vehicle is disappear in the city and Vehicle owner make complain to public security agency. Security agency will use the vehicle Track system and which requires vehicle number / vehicle rfid no for tacking the vehicle. It will use the vehicle RFID reader server to find the different locations where the vehicle moves in the city for given date and time slot. It also provides the route map from location to location the vehicle moves. From this route map agency will take appropriate decision to recover the vehicle which is disappear.

![Class Diagram for Vehicle Track System](image)

**Figure 2: Class Diagram for Vehicle Track System**

**2. DYNAMIC MODELING FOR VEHICLE TRACK SYSTEM FOR PUBLIC SECURITY AGENCY:**

This section shows how the system will work. It design and check performance the system activities, including sequence and collaboration diagrams, activity diagram, and state diagram.
A. STATE DIAGRAM FOR VEHICLE TRACK SYSTEM
A state diagram is a behavior which determines the required sequence of states. And the object visits during its lifetime in response to events, together with its responses to those events [19]. To show the relationship among the states we use arrow, and the arrow shows how they are related to each state. State chart diagram specify dynamic behavior of objects and how they will change during the execution of its life cycle [20]. Figure 3 State diagram shows the different state of truncation occurs during a single vehicle track process.

Figure 3: State diagram for Vehicle Track System.

B. INTERACTION DIAGRAMS
Interaction diagram shows the transactions among the states. How they work and which parameter is require in each state. And what is the output of the transactions. There are two types of interaction diagram in UML, first one the Sequence Diagram and second one the Collaboration Diagram. A collaboration diagram for Modeling of Vehicle track system is shown below. All Objects are drawn as rectangles shapes and the joining lines between them indicate link.[21,22]

The messages along the arrows between the objects are indicated by the number at the head of the message. Each message shows the result of the action performed. Each object perform a specific job then send the result back to last object in form of message. When the vehicle owner provides RFID and Vehicle number then vehicle trace window vehicle owner details from regional transport office (RTO) and track the vehicle into the city with given vehicle number. RFID reader will store the location of vehicle in the city whenever they move nearby any crossing / choraha. RFID reader updates the database runtime when it will scan any vehicle.

Figure 4: State diagram for vehicle track in case of disappear.
UML DESIGN
The purpose of Object-oriented design is to solve the problem into different sub problem which is specify by the different objects; involve in the planning a system.[23] It is one approach to software design.

A. COMPONENT DIAGRAM
A component diagram in the Unified Modeling Language, depicts how components are tied together to form larger components and or software systems.[24]

B. DEPLOYMENT DIAGRAM
A deployment diagram in the Unified Modeling Language serves to model the physical deployment of artifacts on deployment targets. Deployment diagrams show the allocation of Artifacts to Nodes according to the Deployments defined between them. Deployment of an artifact to a node is indicated by placing the artifact inside the node [25].

Figure 5: Sequence diagram for vehicle track system

Figure 6: Component diagram for vehicle track system

Figure 7: Deployment Diagram for vehicle track system
3. EXPERIMENT NEEDS:
To implement the Modeling of Vehicle trace system for public security system; needs object oriented concepts and UML. The system uses an Intel core i3 – 330 M Processor with 2 GB DDR3 RAM. Windows 2003 or higher version of operating system can be used and SQL server 2005 or higher version can be used as a DBMS. RFID tags and RFID reader are need for vehicle. Rational Rose Software is used for the designing of UML diagrams.

FUTURE BENEFITS
After Implementation of this system lot of benefits will comes, some of them I will try to explain here …

1. Reduce the time to track the vehicle in case of accident, chain snatching, vehicle disappears etc.
2. Increase the government revenue in case of pollution certificate expiry, system will generate the list of all vehicle having expiry on a yesterday and generate the challan, which will send all vehicle owner.
3. Reduce the time and size of online toll plaza if vehicle will prepaid the toll tax and it will reflect the changes runtime at all toll plaza.
4. Reduce the manpower of public security system for challan[26] for pollution and over speed at different crossings.

4. CONCLUSIONS:
An attempt has been made to design a complete UML modeling for the Vehicle track system which is very efficient, effective and useful. This model can be utilized by Public security system like police, local agencies authorized by government for better functioning of the governing body, which will also enhance the functioning of the developed software designed on the basis of presented approach. The proposed model will reduce the time, money and manpower for investigating these issues. Above work also concludes that the UML modeling is a powerful language used to design for the software research problems. This paper describes the flow of the system as well as the benefits generated by the system.

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