

Modeling of Traffic Accident Reporting System through UML Using GIS

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Abstract— Nowadays vehicles are increasing day by day in town and cities roads. It is a well-known problem to manage traffics on the roads in towns and cities. A lot of accident occurs on the road due to careless driving and Technical faults in vehicles. The main problem of traffic authorities is to manage the traffic on the road for the smooth functioning of vehicles that can reduce the accident and violation on the road. There is a tremendous demand from traffic authorities to develop a system that can help to avoid the accident and keep the accident report data and also maintain the accident report data. The main objective of this paper is to model a Traffic Accident Reporting System (TARS) through UML using GIS to solve the above problem. Authors are also proposed the sequence and activity diagram for the above proposed model.

Keywords- UML; GIS; TARS; Sequence diagram; Activity Diagram.

I. INTRODUCTION

Models are playing very important role to understand real time problems. A model gives an overall idea about the actual problem in a very simple and clear way [1]. The Object Management Group introduced the Unified Modeling Language (UML) for the software designers to develop useful, efficient, effective designs and quality model system for the industry peoples [2, 3]. The Unified Modeling Language (UML) is a modeling language that covers a large range of different application domains and which is used to design a scientific and research problems [4]. UML model is an accepting a view of actual real world problem and explain in the form of pictures and notations [5]. UML have nine standard diagrams for graphic representation of a system which is represent the different points of view of the system and that are classes, interaction- sequence, objects, interaction-communication, state, use , activities, components and display[6]. Some of the important domain oriented UML models are designed and shown in [7,8,9]. Geography always plays the important role in human's life. A geographic information system (GIS) is a kind of system which is used to

capture, designed, store, manipulate, analyze and manage all types of geographically referenced data [10,11]. The geographic knowledge is applied to human routine tasks such as unfamiliar with the city or searching the exact street or station etc. [12]. Recently there are some important research papers about explaining the GIS system in a very effective and efficient way is given in [13, 14]. These are the some paper that explaining and prevention about the accident in a very simple way [15, 16].

II. UML CLASS MODEL FOR TRAFFIC ACCIDENT REPORTING SYSTEM

A Traffic Accident Reporting System (TARS) has been designed with the use of UML concepts and which is shown in Fig1. UML class diagram demonstrate the structure of the system by depicting classes, attributes and relationship. The complete Traffic Accident Reporting System TARS have been designed with attributes and functions. The different properties have been used like association, aggregation, inheritances etc in the form of sub classes and shown in the UML class model. In a UML class diagram Viewers class multiple associations with TARS and TARS has a single association with Viewers class. Similarly TARS class also has a single association with GIS class and multiple associations with Insurance_Com and Traffic_Officer classes. GIS class has a single association with TARS class and multiple associations with Vehicle_detail class also GIS class has a multiple association with Street class and Street class also has a single association with GIS class. Vehicle_datail class multiple associations with GIS class and also multiple associations with Report class. Report class has a multiple associations with Vehicle_Detail, Traffic_Officer and Insurance_Com class also the Traffic_Officer class and Insurance_Com class multiple associations with Report class. TARS also have a multiple association with Traffice_Officer class and Traffic_Officer class also has the multiple associations with TARS class.

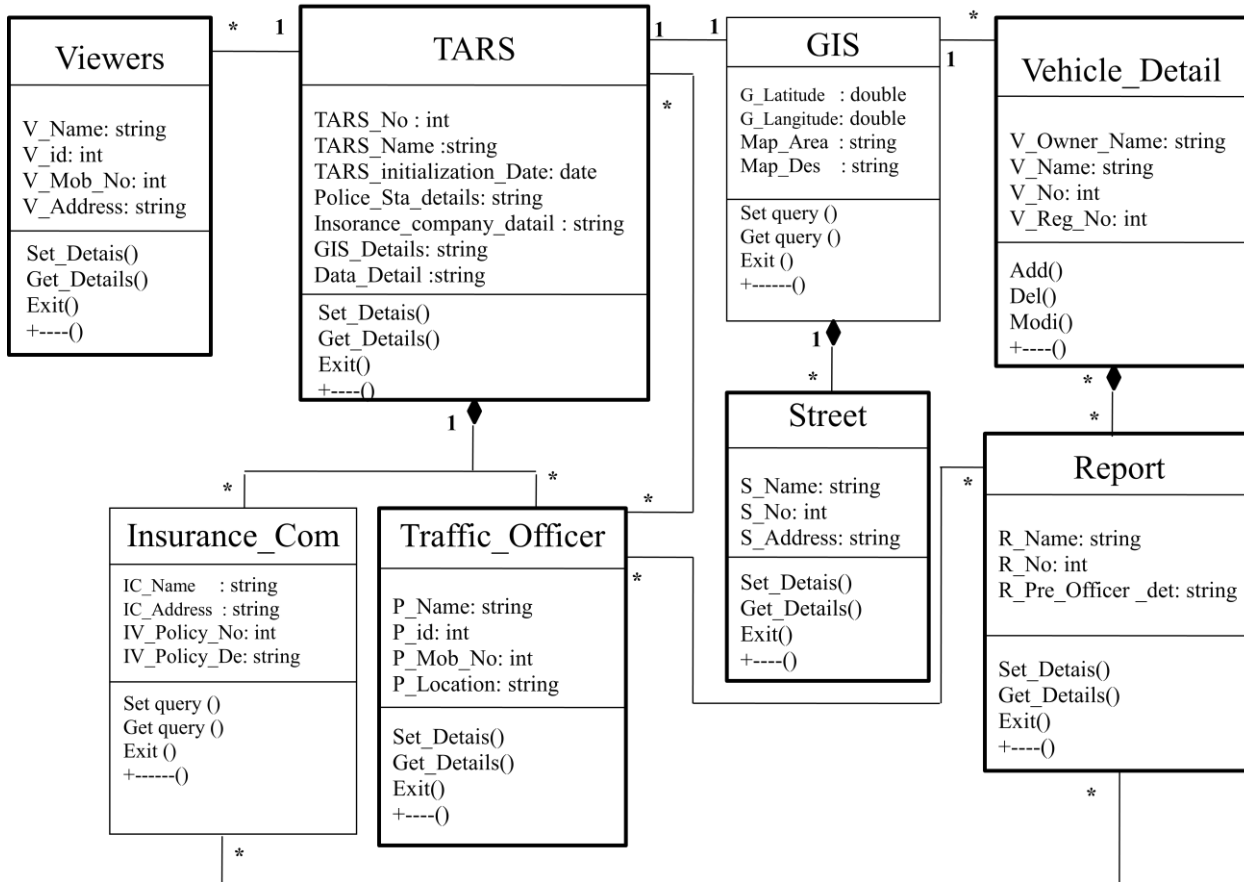


Figure 1. UML Class Diagram Traffic Accident Reporting System

III. UML ACTIVITY DIAGRAM FOR TRAFFIC ACCIDENT REPORTING SYSTEM

An activity diagram is a kind of flowchart that shows the flow of control step-by-step [17]. The activity diagram shows the various activities one by one with the moving for both controlled and uncontrolled activities. The UML activity diagram of the above model is shown in Fig.2. The activity diagram represents the complete process of Traffic Accident Reporting System. According to the activity diagram viewers see the accident and inform to the TARS with mail or through the phone even viewers can go directly traffic police and inform about the accident. When the TARS get the information about accident the system will connect GIS system through internet and find the exact location of the accident. After finding the exact location of the accident the TARS search the nearest police station and inform the responsible person also the same time TARS send the information to the insurance company. When the police officer gets the information about the accident he reaches the proper location prepares the report about the accident and send to the TARS. After that clear the traffic and go back to the other task. Similarly insurance officer reaches the accident place and prepares report and sends to the insurance company and go for other task.

IV. UML SEQUENCE DIAGRAM FOR TRAFFIC ACCIDENT REPORTING SYSTEM

The sequence diagram is representing the interactions between objects. The sequence diagram passes the message from top to bottom. The sequence diagram of above TARS UML model is given in Fig.3 This sequence diagram of TARS have five important object which are shown on the top of the diagram in the form of rectangles boxes with their class names. The five main objects are Accident Effected party, TARS, GIS, Officer and Insurance Company. The communication between two objects is shows by an arrow and the message of that arrow. According to the sequence diagram is given in Fig. 3. The Accident Effected party inform to the Traffic Accident Reporting System (TARS) through the mail or phone. The TARS connect to GIS system and find exact location of the accident. After finding the exact location, system searches the nearest traffic police station and informs and assigns the task to the traffic police officer. Similarly at the same time also inform to insurance company. The traffic police officer and insurance company officer reach the accident place and prepare the report. The insurance company officer sends the report to the company. The traffic police officer prepare the report and send to TARS also the officer clear the traffic after that go to the other task.

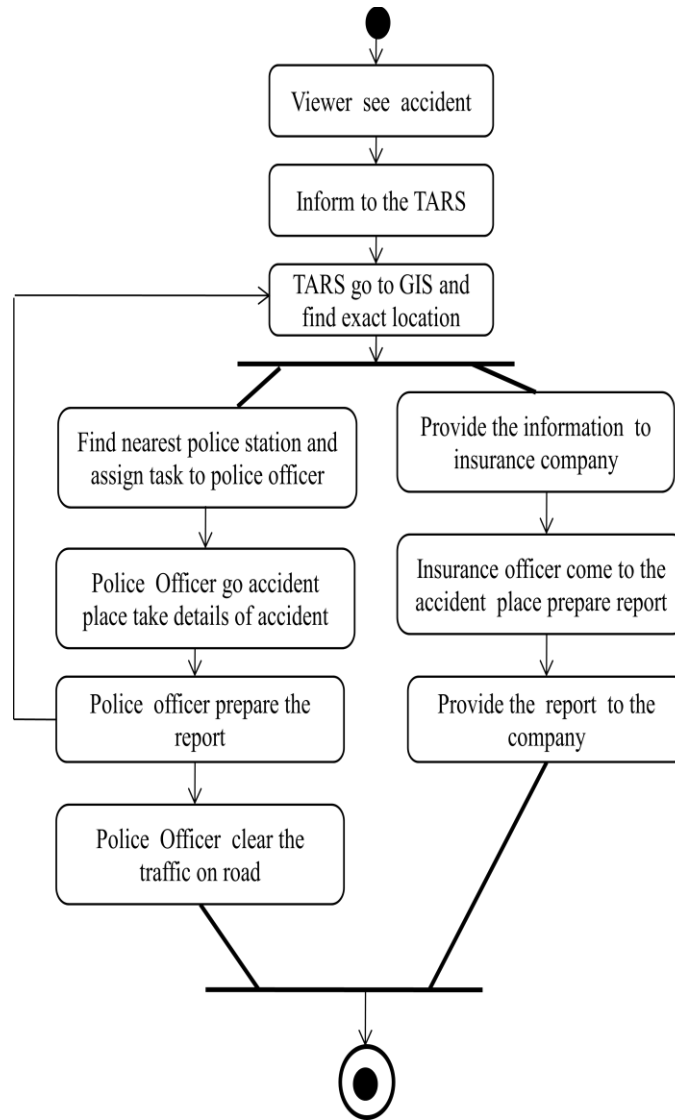


Figure 2. UML Activity Diagram for Traffic Accident Reporting System

V. A CASE AND EXPERIMENTAL STUDY

Saudi Arabia has the highest Road Accident Death Toll in the world and averages of 17 Saudi Arabian residents are died on the country's road each day. A report by the Kingdom's General Directorate of Traffic has revealed [18, 19]. Let us consider the accidental data of Saudi Arabia for evaluating the TARS model.

The following table shows statistics from the General Directorate of Traffic accident and traffic violation recorded in the Kingdom of Saudi Arabia during the years 2000-2008 [20]. The bar chart is giving for the TARS that shown in Fig. 4. The blue color bars showing year and the brown color is shows the number of injuries happened in a year.

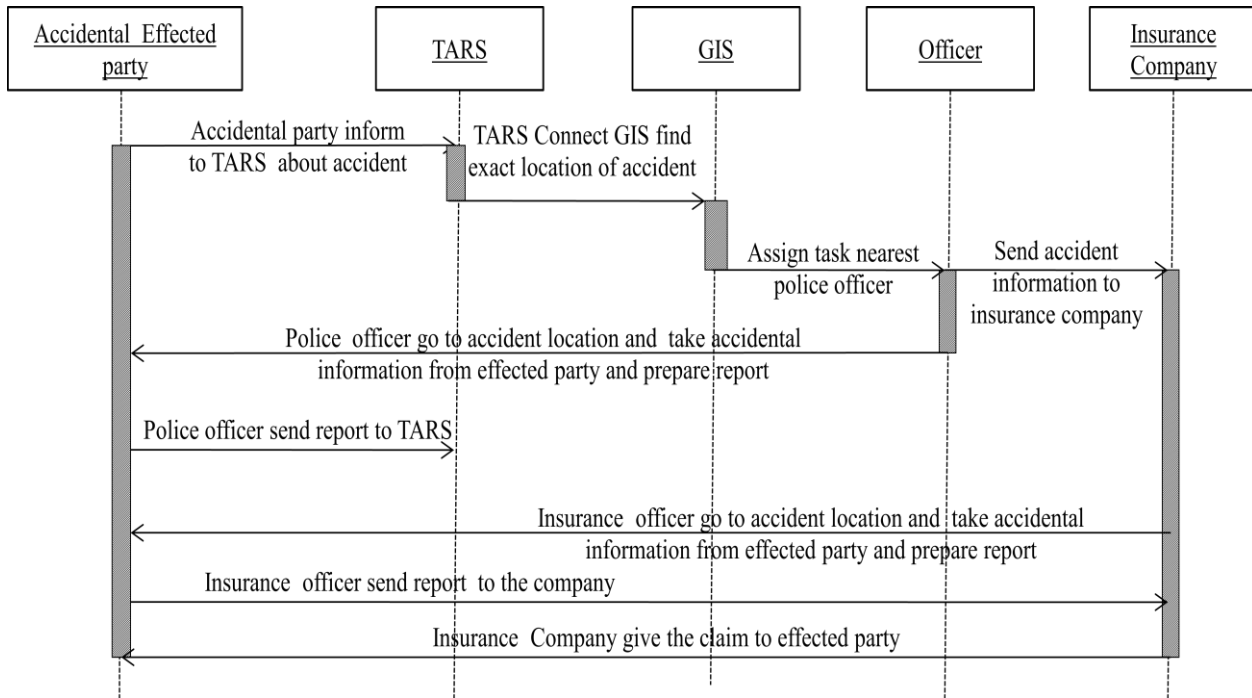


Figure 3. UML Sequence Diagram for Traffic Accident Reporting System

TABLE I. TRAFFIC ACCIDENTS AND TRAFFIC VIOLATIONS IN SAUDI ARABIA

Year	No. of Injuries	No. of Deaths	No. of Accidents
2000	28,998	4,419	280,401
2001	28,379	3,913	305,649
2002	28,372	4,161	223,816
2003	30,439	4,293	261,872
2004	34,811	5,168	293,281
2005	34,441	5,982	296,051
2006	35,884	5,883	283,648
2007	36,025	6,358	435,264
2008	36,489	6,458	485,931
Total	293,838	46,635	2,865,913

Source: General Directorate of Traffic Accident and Traffic Violation KSA [20].

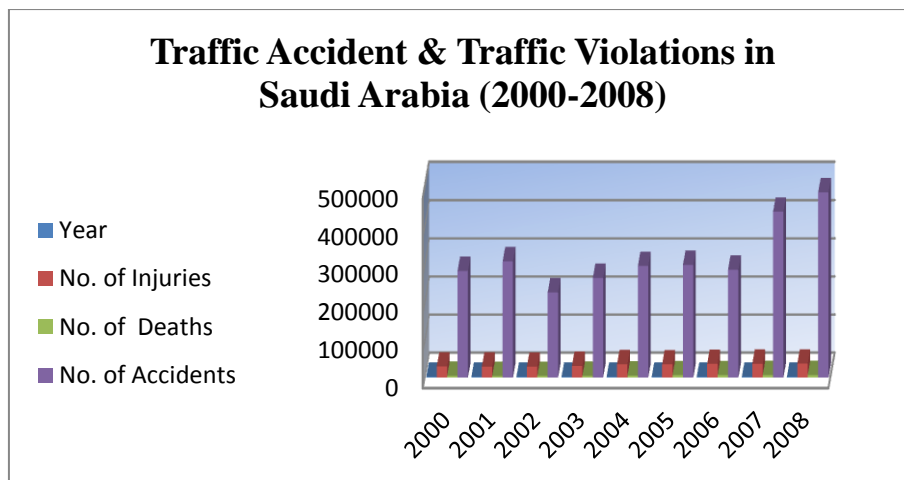


Figure 4. Bar chart for Traffic Accident Reporting System

The green bar is showing the no of death happen in each year and last Byzantium bar is showing the no of accident happened in each year from 2000 to 2008.

VI. CONCLUSION AND FUTURE WORK

From the above study of work it is accomplished that the UML is a powerful modeling language to solve scientific and research problems. In this paper a complete modeling of Traffic Accident Reporting System has been done through the UML and its results are shown in the form of bar chart graph. This model is a simple and has a reusability property also model can easily enhance, modify and updated according to the need of data. This basic work can be expended in the field of data mining using UML and expert system.

REFERENCES

- [1] G. Booch, J. Rumbaugh, and I. Jacobson "The Unified Modelling Language User guide", Addison-Wesley, Reading, MA, 1999.
- [2] OMG Unified Modeling Language Specification, Available online via <http://www.omg.org>, 2001.
- [3] Kovacevic, S. UML and User Interface Design, inUML'98. Mulhouse – France, year, 1998.
- [4] Roff, T., UML: A Beginner's Guide, Tata McGraw-Hill Edition, Fifth Reprint, 2006.
- [5] Craig Larman: "Applying UML and Pattern", Prentice Hall, 1998.
- [6] Booch, G., Rumbaugh, J. & Jacobson, I. The UML reference manual (2nd ed.). Boston: Addison- Wesley, 2004.
- [7] V. Saxena and Ansari, G.A., Ajay Pratap "Enhancing Security through UML", "International Journal of Computer Sciences, Software Engineering and Electrical Communication Engineering" Vol. 2(1), pp 31-36 June 2011.
- [8] Ansari, G.A., "A Domain Oriented Modeling of Indian Education System through UML" the Icfai Journal of Systems Management (IJSM) (ICFAI Press India), Vol. VIII; No.3; August, 2010.
- [9] V. Saxena and Ansari, G.A., "UML Modeling & Protection of Domain Based System" International Journal of Computer Science and Network Security (IJCSNS), South Korea, Vol. 8, No. 7, pp. 338-344, July 2008.
- [10] Geographic Information Systems as an Integrating Technology: Context, Concepts, and Definitions" ESRI, 9 June 2011.
- [11] Amdahl, G. Disaster Response: GIS for Public Safety, ESRI Press: Redlands, California, 2001.
- [12] De Smith, M.G., Goodchild, M.F. & Longley, P.A., Geospatial Analysis: A Comprehensive Guide to Principles, Techniques, and Software Tools. Winchelsea Press: Leicester, 2007.

- [13] Fonseca, Frederico, Sheth, Amit "The Geospatial Semantic Web" UCGIS, White Paper, 2002.
- [14] Longley, P.A, Goodchild, M.F, Maguire, D.J and Rhind, D.W "Geographic Information Systems and Sciences, Chichester: Wiley, 2nd edition, 2005.
- [15] A.S. Al-Ghamdi, Z. Nemeth and R.Rogness. "Forecasting Traffic Accidents in Saudi Arabia by Using a Time Series Model" Presented at the 72nd Annual Meeting of TRB Conference, Washington, D.C, 1993.
- [16] S.E. Asogwa, The Use of the Police for Limited Road Accident Data Collected in Developing Countries. Accident Analysis and Prevention, Vol. 14, No.3, pp. 203-208 1982.
- [17] Ericsson. Maria. "Activity Diagrams: What They Are and How to Use Them" <http://www.ibm.com/developerworks/rational/library/2802.html> Accessed on dated 1-1-2012.
- [18] Public Health (2000) 114, 37-39. <http://www.publichealthjrn.com/article/S0033-3506%2800%2900306-1/abstract> 2000
- [19] The General Directorate of Traffic, Ministry of Interior, Riyadh. The Publications of Road Accident Statistics, for the years 1974-1994.
- [20] Yassar Hauas "Workshop for Setting Regional and National Road Traffic Casualty Reduction Targets in the ESCWA Abu Dhabi, UAE 16-17 June 2009.

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Dr. Gufran Ahamd Ansari received his Bachelor degree (B.Sc. Computer Science) from Shia P.G. College, Lucknow, India in 1997, MCA from DR. B.R. Ambedkar University Agra in 2002 and Ph.D (Computer Science) from Babasaheb Bhimrao Ambedkar (A Central) University, Lucknow, U.P. India in 2009. He is currently working as an Assistant Professor in Department of Information Technology, College of Computer Qassim University Saudi Arabia. He has produced several outstanding publications in National & International Journal on



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