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Data Model for Road Traffic Accident in Nigeria

A.P. Idowu
Department of Computer Science & Engineering
Obafemi Awolowo University
Ile-Ife, Osun State, Nigeria
paidowu@yahoo.com

B.L. Abimbola & O.B. Alaba
Department of Computer Science
Tai Solarin University of Education
Ijagun, Ogun State, Nigeria.
abimbolabl@tasued.edu.ng, alabaob@tasued.edu.ng

ABSTRACT

The collection, management and public exposure of road traffic accident (RTA) incident related events has posed a dangerous problem to Nigerian road safety officers and stakeholders alike. This is particularly true because of the absence of a central repository from which all accidents related information can be stored and handled. Where available, this information is available in paper based form and this presents a bottleneck in updating the available data. In this study, a Web based Road Traffic Accident Monitoring System (RTAMS) was developed for Nigerians. The Road Traffic Accident Monitoring System (RTAMS) was developed using Adobe Dreamweaver and Notepad++ as the Integrated Development Environments, HTML, CSS and JavaScript were used for the front end, PHP was used as the scripting language, and MySQL served as the database server. Most of the languages and tools used were open source which ensured that the application would be robust, reusable, cheap and highly scalable. The result of the developed system shows that road safety officers, users, policy makers and all other stakeholders are able to register, login, submit reports and run queries on information that has been previously entered into the system such as the accidents that occurred on a particular route or the accident in which an identified victim was involved. This could be done with the mobile phones that are internet enabled. Policy makers can run these queries in order to consider appropriate steps in minimizing road traffic accident occurrences. Many instances of missed or missing individuals could actually be a victim of road accidents. In conclusion, this system will help create a paperless alternative to the present method of RTA information and thus make information dissemination quicker and also improve first aid response to accident occurrences.

Keywords: Road Traffic Accident, Data Model, Sub Saharan Africa

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1. INTRODUCTION

The World Health Organization [1] estimated that 1.17million deaths and 50 million injuries occur each year worldwide due to road traffic accidents. When this is further broken down, about 70 percent of the deaths occur in developing countries. The increased rate of fatal and non-fatal road traffic accident worldwide has been attributed to population explosion and increased motorization. Increased motorization may be characterized briefly as the "automotive revolution", that is the motorizing of urban population, especially in the developing countries[2].

Statistics indicate that over 90 percent of traffic accident situations in Nigeria can be attributed to driver errors[3]. Road accidents appear to occur regularly at some flash points such as where there are sharp bends, potholes and at bad sections of the highways. At such points over speeding drivers usually find it difficult to control their vehicles, which then result of fatal traffic accidents, especially at night[4] .

Cases of fatal road traffic accidents are reported almost daily on the major highways in Nigeria. Various categories of vehicular traffic are also involved in these fatal road traffic accidents in the state. Research in this area has focussed on cases of road traffic accidents, collation of road traffic accident statistics and impact assessment of road safety campaign [5]. At the local level research in this area are concentrated on the effects of land use and human factors on road traffic accidents[2], [6]. Motor vehicle crashes are the leading cause of death in adolescents and young adults[7][2] and of the estimated 856,000 road deaths occurring annually worldwide, 74% are in developing countries [2], [8]. Dramatic increases in the proportion and absolute number of traffic facilities have been witnessed in a number of developing countries, while they decreased by more than 20% in industrialized nations [9]. In Nigeria[10], [11] , a fivefold increase in traffic related fatalities was observed over the last 30 years.

African and Asian countries, with relatively low vehicle densities, are experiencing substantially higher fatality rates per 10,000 vehicles than the industrialised European and North American States[12], [13].Traffic crashes also impact on the economy of developing countries at an estimated cost of 1-2% of a country's GNP per annum, as a result of morbidity, mortality and property – related costs[3], [12], [14]. Causes of motor vehicle crashes are multi-factorial and involve the interaction of a number of pre-crash factors that include people, vehicles and the road environment [13], [15]. Human error is estimated to account for between 64 and 95% of all causes of traffic crashes in developing countries [4]. A high prevalence of old vehicles that often carry many more people than they are designed to carry, lack of safety belt and helmet use, poor road design and maintenance and the traffic mix on the roads are other factors that contribute to the high rate of crashes in less developed countries.

International comparison indicates that the chance of a vehicle, killing someone in Nigeria is 47 times higher than in Britain. The proportion of fatalities to injuries reported is also very high. For example, while Czech Republic has only one death in 175 accidents, France, one death in 175, South Africa, one death in 47 accidents, Nigeria has one death in 2.65 accidents [16].The study revealed that private cars, buses and taxis were more prone to accidents in Lagos State and more than 90% of road traffic accidents in Lagos State could be attributed to recklessness on the part of drivers, ignorance of high way codes, over speeding etc.

Various road safety strategies and countermeasures have been used at different stages of network development. This method of seeking to prevent road accident mainly involves conscious planning, design and operations of roads. One of the most important factors in this method is the systematic identification and treatment of hazardous locations. Monitoring is viewed as the monitoring of the behaviour, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting. Monitoring is therefore an ambiguous practice, sometimes creating positive effects, at other times negative. it is sometimes used synonymously with the word tracking. It is sometimes done in a surreptitious manner. It most usually refers to observation of individuals or groups by government organizations, but road surveillance, for example, is monitoring the condition of a road within a specified location. Monitoring is very useful to governments and law enforcement to maintain social control, recognize, and monitor threats, and prevent/investigate criminal activity[13], [17] .

2. ROAD TRAFFIC ACCIDENTS

An accident is defined as an unexpected, undersigned and unplanned event or circumstance, often with happening by chance or with lack of intention or necessity[18]. It usually implies a generally negative outcome which may have been avoided or prevented had circumstances leading up to the accident been recognized, and acted upon, prior to its occurrence.

Experts in the field of injury prevention, avoid use of the term 'accident' to describe events that cause injury in an attempt to highlight the predictable and preventable nature of most injuries. Such incidents are viewed from the perspective of epidemiology as predictable and preventable. In preferred words are more descriptive of the event itself, rather than of its unintended nature (e.g., collision, drowning, fall, etc.). Accidents of particularly common types (crashing of automobiles, events causing fire, etc.) are investigated to identify how to avoid them in the future. This is sometimes called root cause analysis, but does not generally apply to accidents that cannot be deterministically predicted. A root cause of an uncommon and purely random accident may never be identified, and thus future similar accidents remain "accidental." [18].

Road traffic accident is a form of accident occurring on roads; this type of accident involves one or more vehicles, pedestrians, pedal cyclists, motorcycle riders, occupants of three-wheeled motor vehicle, the occupants of pick-up truck or van, occupants of heavy transport vehicles, bus occupants and individuals injured in another land traffic accident (animal riders, occupants of a railway train etc.). According to the World Medical Association (2006), serious injuries and mortality in road collisions are a public health problem with consequences similar to those of major diseases such as cancer and cardiovascular disease.

World Health Organization reports [19] estimated that in 2002:

i. Worldwide, about 1.2 million persons were killed on the roads and an additional 20–50 million were injured.
ii. Road traffic injuries were the 11th leading cause of death worldwide and accounted for 2.1% of all deaths globally.
iii. Road traffic deaths accounted for 23% of all injury deaths worldwide.
iv. An overwhelming majority (90%) of the road traffic deaths occurred in low income and middle-income countries, where 81% of the world's population live and own about 20% of the world's vehicles.
v. The overall global increase in road traffic accident mortality is predicted to be 67% by 2020 if appropriate action is not taken.

2.1 Road Traffic Accidents in Nigeria

Statistics indicate that over 90 percent of traffic accident situations in Nigeria can be attributed to driver errors [3]. Road accidents appear to occur regularly at some flash points such as where there are sharp bends, potholes and at bad sections of the highways. At such points over speeding drivers usually find it difficult to control their vehicles, which then result of fatal traffic accidents, especially at night[4]. Cases of fatal road traffic accidents are reported almost daily on the major highways in Lagos State. Various categories of vehicular traffic are also involved in these fatal road traffic accidents in the state.

At the local level research in this area are concentrated on the effects of land use and human factors on road traffic accidents [6]. Motor vehicle crashes are the leading cause of death in adolescents and young adults [2], [7] and of the estimated 856,000 road deaths occurring annually worldwide, 74% are in developing countries[16]. Dramatic increases in the proportion and absolute number of traffic facilities have been witnessed in a number of developing countries, while they decreased by more than 20% in industrialised nations [9]. In Nigeria [4], [10], a fivefold increase in traffic related fatalities was observed over the last 30 years.

African and Asian countries, with relatively low vehicle densities, are experiencing substantially higher fatality rates per 10,000 vehicles than the industrialised European and North American States[2], [14] . In Nigeria, road traffic accident situation over the last three decades has been particularly disturbing. In 1976, there were 53,897 road traffic accidents resulting in 7,717 deaths. Although in 1981, the magnitude reduced to 5,114 accidents, but the fatality increased to 10,236 which mean that there was an average of 96 accidents and 28 deaths for every day of that year [20]. The situation in subsequent years has not been any better. The number of people killed in road accidents between 1990 and 2005 rose from 28,253, and the fatality rate remains consistently high [4].

International comparison indicates that the chance of a vehicle, killing someone in Nigeria is 47 times higher than in Britain[4]. The proportion of fatalities to injuries reported is also very high. For example, while Czech Republic has only one death in 175 accidents, France, one death in 175, South Africa, one death in 47 accidents, Nigeria has one death in 2.65 accidents[20]. Various road safety strategies and countermeasures have been used at different stages of network development. This method of seeking to prevent road accident mainly involves conscious planning, design and operations of roads. One of the most important factors in this method is the systematic identification and treatment of hazardous locations. International comparison indicates that the chance of a vehicle, killing someone in Nigeria is 47 times higher than in Britain. The proportion of fatalities to injuries reported is also very high. For example, while Czech Republic has only one death in 197 accidents, France one death in 175, South Africa, one death in 47 accidents, Nigeria has one death in 2.65 accidents [16].

Road traffic accident statistics in Nigeria reveal a serious and growing problem with absolute fatality rates and casualty figure rising rapidly. In the majority of developing countries, accident occurrence and related deaths are relative to either population or number of vehicles. Ironically, in Nigeria, studies have indicated that better facilities in terms of good quality and standardized roads have been accompanied by an increasing number of accidents[21] . This is totally contrary to the trends in countries where even the level of sophisticated road network and volume of vehicular traffic are much higher [16].

3. METHOD

Unified Modelling language (UML) is used to develop the data model. UML is the formal language of the object-oriented technique for data modelling and will be used to specify, represent and visualize the processes used in the development of the system. The main elements of UML object oriented approach is encapsulation, modularity, abstraction, and hierarchy . The class notation will be used in connection with semantics, relations, operations, and attributes to realise the UML elements. In the model, all the objects will have attributes, instances and methods. Relations between objects will be defined through associations.

3.1 Road Traffic Accident Data Modelling

Data modelling is an important aspect of database design. It is not only the first step in database design, it is also used for many other purposes. This ranges from high level conceptual models to physical models. It allows the database designers to be able to visualize how each data item is related and how the designers will be able to represent, visualize and present data. It is the analysis of data objects that are used to identify the relationships within objects. The process of data modelling is "an attempt to capture the essence of things both concrete and practical in the problem domain"[22].

The road traffic accident data model is fully complete. This is so because it has the ability to capture all the required data that is needed to develop a road traffic accident monitoring system, particularly in the area under consideration, Osun State of Nigeria. The model supports all the necessary data required to develop a robust system. Based on the attributes captured, queries can be made to get more information about the location, such as nearest town, the user's distance from the nearest town, the road type, the road surface condition, weather condition and light condition. The system also captures other variables that relate to road traffic accident monitoring such as vehicle information like the number plate of the vehicles involved in the accident, vehicle type(s), vehicle condition, victim names, total number of victims as well as the number of dead, injured and uninjured victims.

The model is also correct because no attribute was misrepresented in the model. As regards flexibility, the model is very flexible as it can cope with possible changes to the data in the system and it can accommodate new data. If new data need to be inserted into the system, it can be easily done without adversely affecting the road traffic accident monitoring system as a whole. In addition to the above, the data model is simple and easy to understand. The use of the Unified Modelling Language (UML) tools makes it easy for developers who want to develop a similar system to develop the model easily. The Use case diagrams used, for instance, have made it easy for developers to understand the actors in the system and the roles they play.

The stages of data modelling employed in developing a data model for this system are the contextual data modelling and the conceptual data modelling phase. These data modelling stages were used in order to develop the road traffic accident monitoring system for routes in Nigeria using state roads in Osun State as a case study.

3.1.2 Contextual Data Model for Road Traffic Accidents

The contextual data model is the first step in the data model design process. In the RTA contextual model, the major entities are first identified, after this other entities, classes and subclasses are also shown and the relationships between them.

The contextual data model generally serves as input to the conceptual data model. Therefore, for the conceptual data model to capture all the necessary entities, it is important to have a well-designed and well-structured contextual data model. In the contextual data model that was developed, relevant subject areas were included and these subject areas had super classes and subclasses. Subject areas are very useful in dividing a model into interrelated classes. This allows easy understanding of what the model does. The three major subject areas used are: road activities, parties and locations as shown in Figure 1.

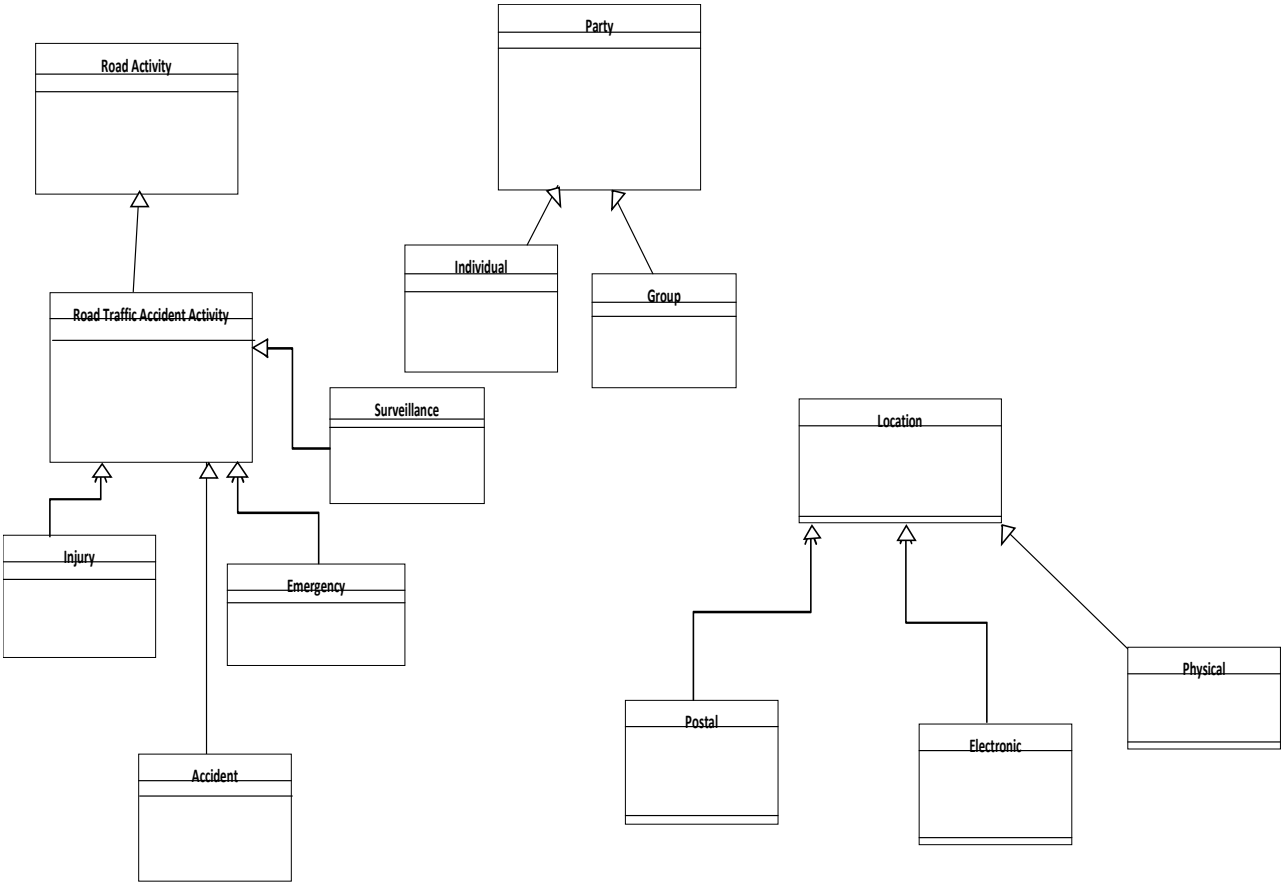

Figure 1: Contextual Data Model for Road Traffic

3.1.3 Conceptual Data Model for Road Traffic Accidents

The conceptual data model is the first stage in the development of the required data model. In the modelling of the developed system, relationship association was used to depict the relationship between two entities. The relationship association was also used to show the type of relationship that exists between the super type and the sub type classes. Relationships were featured with cardinality such as zero to one, zero to many, one to many, and many to many. Each of the road activities is associated with zero or more activity relationships. For example, an accident occurrence at a particular location can be linked to environmental factors such as potholes or vehicular factors such as brake failure.

Party relationship is the relationship that exists between two or more parties in the road activity. One example is the relationship that exists between road safety officers and the victims of road accidents; another relationship could be that between a driver and a pedestrian. There could also be a relationship between two locations with a similar number of road traffic accidents. Participation association is used to show the relationship that exists between the subject areas. Each of the classes in the model has a many-to-many relationship to all the other major classes in the model. For example, roles played by road safety officers to make sure the number of accident occurrences on a particular route is reduced, roles played by government to supply emergency response services and also the roles played by road safety officers to report accident occurrences.

In the developed data model, participation association is depicted using a participation class. Three participation classes were used, namely party location participation, actor participation, and target participation. Party location participation shows the relationship between a party and a location. For example, the relationship between road traffic accident victims and their location of residence. Actor relationship depicts the active roles played by a party in the health activity. For example, roles played by road safety officers in reporting an incident and offering first aid treatment. The target participation shows the passive roles played by parties in the road activity. The core components of the developed model are discussed as follows.

Road Activity
The road activity subject area contains information about different road activities and actions which are required in road traffic accident monitoring in Osun State. In the developed road traffic accident data model, road accident, treatment, road surveillance and road education which are the major classes in the road activity subject area. With the developed data model, road safety officers will be able to capture the data that have to do with roads. Examples of such data include route, accident severity, collision type, first aid an emergency treatment administered.

Parties
The parties' subject area holds information concerning the people that are involved either directly or indirectly in road activities. It contains information about individual persons and group of persons. The person class stores information about the demographic data of individuals. Group of persons are people that have things in common. The group of persons class has two sub-classes, namely: Formal and informal sub-classes. The formal sub-class stores information about road safety officers and emergency hospital staff. The informal sub-class contains information about victims of accidents, pedestrians etc.

Location
The location subject area contains information about the locations where the parties involved in road activities reside. It also contains information about where road activities take place; and that of the location where road accidents occur most often. The location subject area holds information on three different types of location; these are the physical location (such as house number), the electronic location (such as phone number and e-mail address) and spatial location. The object oriented technique of data modelling was used in this study as opposed to the entity relationship approach. This approach involves the use of the Unified Modelling Language (UML). UML is the formal language of object oriented techniques for data modelling and is used to specify, represent and visualize the processes involved in the system development. The main elements of the UML object oriented approach are encapsulation, modularity, abstraction and hierarchy .

In this model, all objects had attributes, instances and methods. Relations between objects were defined through associations; as a result of this the road traffic accident data model was developed. In order to develop the prototype, road traffic accident (RTA) database was developed using MySQL. In the process of developing the RTA monitoring system database, different tables, files, records and fields were created. This made it possible for various road traffic accident details to be collected; these conditions include the route, date, cause, collision type, hospital(s) patients were referred to, nature of injury, and health status. When gathered, these conditions are stored in the database.
WampServer was used by the inbuilt MySQL database platform to create and populate the database. The prototype was implemented using Dreamweaver and PHP was used to query and manipulate entries available in the database. Apache served as the web server to provide functions required for a web based system. PHP was used as the scripting language to program the server side manipulation of the knowledge in the database. Finally, a web based road traffic monitoring system was implemented in the developed system architecture

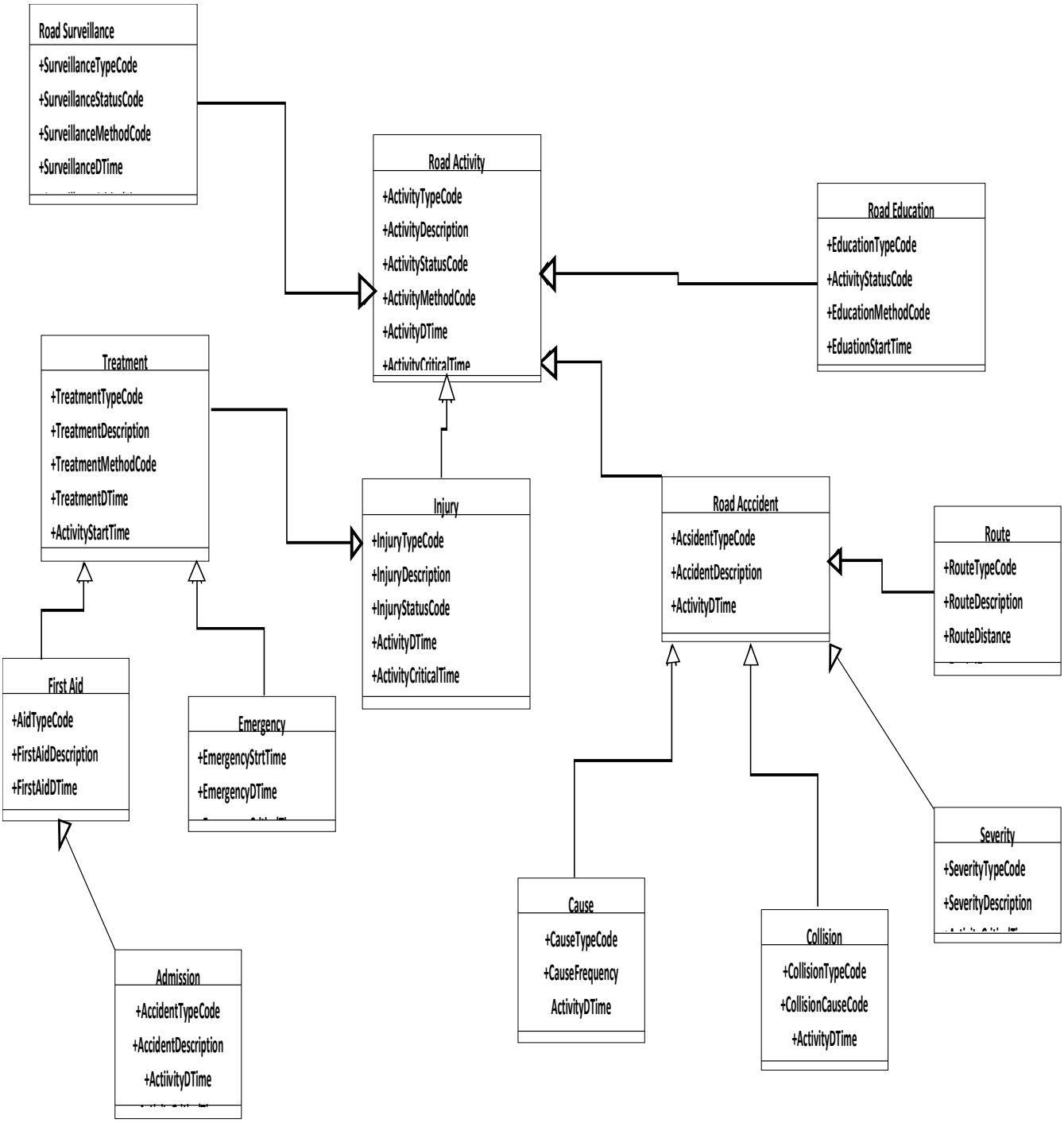

Figure 2: The Road Activity Data Model

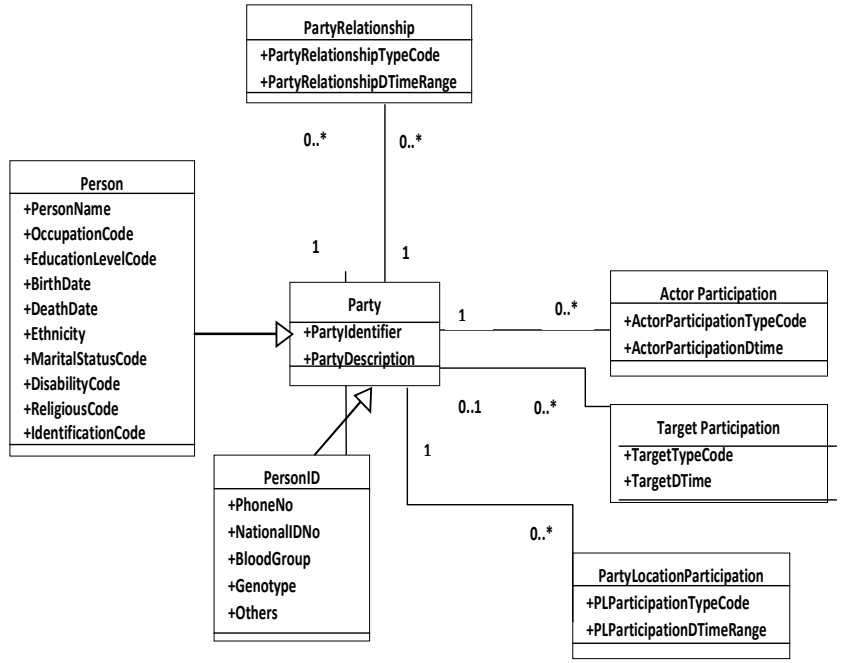

Figure 3: The Party Component of the Data Model

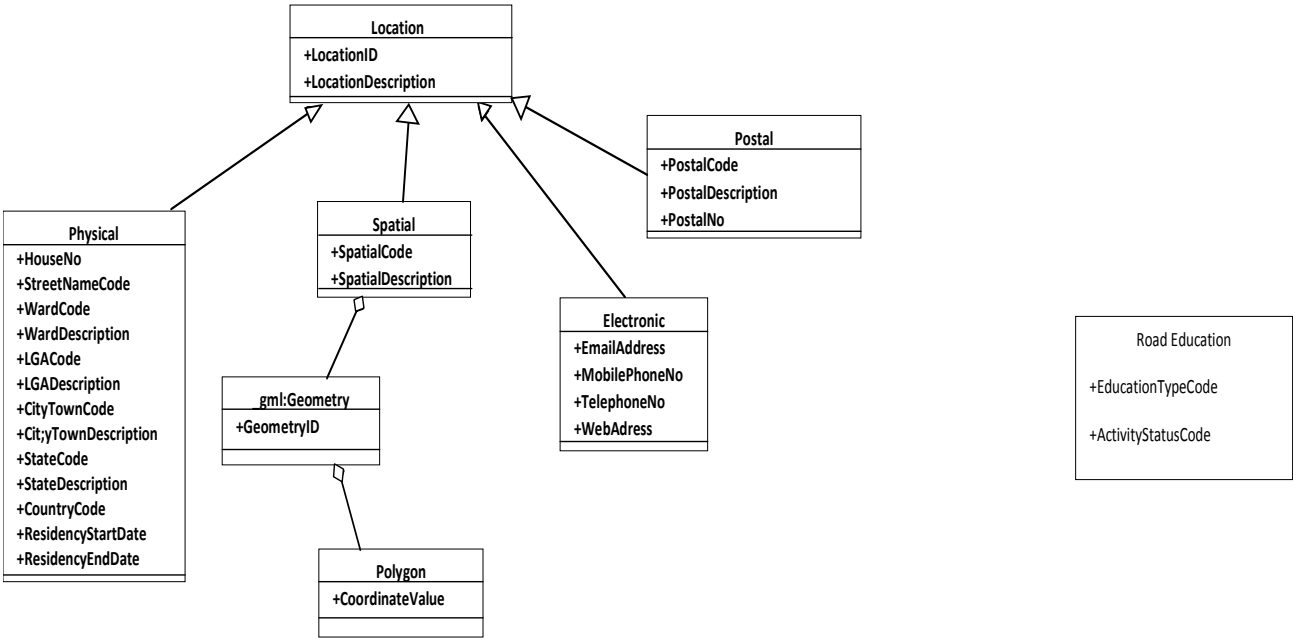

Figure 4: The Location Component of the Data Model

1

4. DATABASE DESIGN

Road Traffic Accident Monitoring System (RTAMS) model is a database model based on the relational data model which focuses on representing entities through the relationships that exist between such entities. This model has its theoretical basis on predicate logic. The data or entities are represented using tables, which is a two-dimensional structure composed of rows and columns. Each table row represents a single entity occurrence within the entity set and each table column represents an attribute; each attribute has a distinct name.

The following are the attributes of the relational table:

- Each Row is Unique
- Column Values are of the Same Kind
- The Sequence of the Columns is Insignificant
- The Sequence of Rows is Insignificant
- Each Column has a Unique Name

Certain fields may be designated as keys, which mean that searches for specific values of that field will use indexing to speed them up. Where fields in two different tables take values from the same set, a join operation can be performed to select related records in the two tables by matching values in those fields. But not always, the fields will have the same name in both tables. This can be extended to joining multiple tables on multiple fields. Because these relationships are only specified at retrieval time, relational database is classed as a dynamic database management system. [23]. The design of the application database was done using the Relational database model approach. The database consists of thirteen (13) relations (tables) which are:

- **ACCIDENT:** This table is used to hold information regarding the total number of victims, the total vehicle count, and the number of uninjured, injured or dead victims.
- **AID:** It is the table that holds information about the nearest town(s) to the accident scene, the nearest hospital(s) and the type of injury sustained by victims. This table generally holds information that would be useful in administering first aid treatment to crash victims.
- **IDENTIFICATION:** This table holds data about names of people identified, their phone numbers, and other information such as national Identity cards that were found at the accident scene.
- **LOCATION:** This table holds information about the location and weather condition of the accident scene. The road condition, the weather condition, the road type, the road surface condition and light condition are the
- **LOCATION_TOWN_MAP:** This table links the Location and Town tables by making the town column the foreign key.
- **OFFICER_RANK:** this table contains possible ranks of officers that can handle information in the RTAMS.
- **REPORT:** this table holds general information about an accident, such as the date of occurrence, route, severity and a short description.
- **REPORT_STAGES:** this table holds data about the current stage an accident report is in. Accident reports could be resolved or unresolved.
- **ROUTE:** this table contains general information about the route where an accident occurs.
- **STATION:** this table holds information about the station where the officer in charge of an accident case is based.
- **TOWN:** this table holds information about the town name and local government area.
- **USER:** this table holds information about the individual's name, username, phone number, e-mail address, and password.
- **VEHICLE:** this table holds information about a vehicle type, its plate number, condition, color etc.

The system uses MySQL database where all the tables are related and interact using a special attribute called the primary key or the foreign key. For instance, the *report-id* is a primary key in the *report* table and also serves as a foreign key in the *aid* table; this is so because every first aid effort has a unique report identification number as well as a first aid identification number in order to prevent redundancy and duplication within the database. The choice to use this database was due to its flexibility and operability with other programming languages. Below are the screenshots from the Accident and Aid table from the database.

	report_id	accident_tab_id	vehicle_count	total_victims	uninjured_victims	injured_victims	dead_victims
Edit Copy Delete	14/01/0001	14/01/0001	3	18	15	2	1
Edit Copy Delete	14/01/0002	14/01/0002	2	10	1	7	2
Edit Copy Delete	14/01/0003	14/01/0003	3	20	5	10	5
Edit Copy Delete	14/01/0004	14/01/0004	1	3	1	2	0
Edit Copy Delete	14/01/0005	14/01/0005	2	17	13	3	1
Edit Copy Delete	14/01/0006	14/01/0006	5	30	9	20	1
Edit Copy Delete	14/01/0007	14/01/0007	2	6	5	1	0
Edit Copy Delete	14/02/0001	14/02/0001	5	15	9	5	1
Edit Copy Delete	14/02/0002	14/02/0002	4	15	13	1	1
Edit Copy Delete	14/02/0003	14/02/0003	3	10	9	1	0

Figure 5: The Accident Table

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	aid_tab_id	int(10)			No	None	
2	report_id	int(10)			No	None	
3	nearest_towns	varchar(255)	latin1_swedish_ci		No	None	
4	nearest_hospitals	varchar(255)	latin1_swedish_ci		No	None	
5	injury_type	varchar(255)	latin1_swedish_ci		No	None	

Figure 6: The Aid Table

5.0 CONLUSION

Road traffic accident in Nigeria has not received the attention warranted considering the magnitude of the problem. Most times, accident victims are presumed lost or missing, due to the fact that there is no means of capturing and storing data of victims. There is need to view road accident as an issue that needs urgent attention aimed at reducing the health, social and economic impacts. Safe road in Nigeria is more of changing our driving behavior than just blaming the government alone and advocating for good road infrastructure.

REFERENCES

[1] World Bank, "Development Practice: Sustainable Transport Priorities for Policy Reform," 2004.

[2] A. O. Atubi and P. C. Onokala, "Contemporary Analysis of Variability in Road Traffic Accidents in Lagos State, Nigeria," *J. African Geogr. Rev.*, vol. 28, pp. 11–41, 2009.

[3] A. Aworemi and E. C. Alawode, "Roads to where?," *Newswatch*, p. 13, 2009.

[4] A. O. Atubi, "Modelling Road Traffic Accidents in Lagos State, South Western Nigeria.," *J. Soc. State*, vol. 1, no. 1$ 2, pp. 57– 74, 2009.

[5] Central Bank of Nigeria, "Annual Report and Statement of Account for the Year Ended 31 December, 1996," 1997.

[6] P. C. Onokala, "The Effect of Landuse on Road Traffic Accident in Benin-City, Nigeria.," *J. Transp. Stud.*, vol. 1, no. 1, pp. 34–44, 1995.

[7] World Health Statistics Quarterly, "Accident Mortality in Children, Adolescence and Young Adults," 1986.

[8] World Bank, "Road Safety Problem in the Third World," *Urban Edge*, vol. 14, 1990.

[9] A. Ross, C. Baguley, V. Hills, M. Mchonald, and D. Silcock, *Towards Safer Roads in Developing Countries: A guide for Planners and Engineers*. 1991.

[10] A. . Oluwasanmi, "Road Accident Trends in Nigeria. Accident Analysis Prevention," *AFRIMEDIC J.*, vol. 25, no. 4, pp. 485–487, 1993.

[11] A. . Ezenwa, ""Prevention and Control of Road Traffic in Nigeria," *J. R. Soc. Health*, vol. 106, no. 1, pp. 25–26, 1986.

[12] G. D. Jacobs and I. . Sayer, "Road Accidents in Developing Countries'. Transport and Road Research laboratory, TRRI Supplementary Report 897 Crowthorne," 1983.

[13] E. O. Akinyemi, *Contributing Road Factors in Accidents on Rural Roads in Nigeria, in Road Traffic Accidents in Developing Countries*, vol. 1. 2009.

[14] World health Organisations, "Analysis of Achievements of Traffic Safety in Industrialised and Developed Countries," 1989.

[15] S. K. . Stansfield, J. S. Smith, and W. P. McGreevey, *In Diseases Priorities in Developing Countries*. 1992.

[16] A. O. Atubi, "Road Transport System Management and Traffic in Lagos, South Western Nigeria," *J. African Res. Rev.*, vol. 4, no. 4, pp. 459–470, 2010.

[17] R. A. Lyons, S. Brophy, R. Pockett, and G. John, "Purpose, development and use of injury indicators.," *Int J Inj Contr Saf Promot*, vol. 12, no. 4, pp. 207–11, 2005.

[18] O. O. Odugbemi, *Road Transportation and Tourism in Nigeria*. 2010.

[19] World health Organisations, "Global Status Report on Road Safety: Time for Action," 2009.

[20] A. O. Atubi, "Determinants of road traffic accidentoccurrences in Lagos State: Some Lessons for Nigeria," *Int. J. Humanit. Soc. Sci.*, vol. 2, no. 5, pp. 225–343, 2012.

[21] K. . T. Gbadamosi, "Traffic Regulation and Road Traffic Accidents in Nigeria: A Spatial Analysis.(An Unpublished Ph.D Thesis submitted to the Department of Geography University of Ibadan).," 2003.

[22] Keufffel, "No Title," *Appl. Occup. Environ. Hyg.*, vol. 16, no. 2, pp. 154–158, 1996.

[23] I. H. and F. E. Witten, *Data Mining: practical machine learning tools and techniques with java implementations*. 2000.