

CLOUD BASED TRAFFIC SAFETY MANAGEMENT SYSTEM: case study of Ethiopia

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Abstract: Road traffic accidents are increasing due to different factors and causes. One of the main concerns of traffic safety management is data gathering, analyzing and tackling of traffic accident data. This research plans to develop a cloud based safety information and communication system to minimize and avoid traffic accidents. In order to achieve this plan the existing paper based traffic safety management system and practice are studied. Next the contribution of intelligent traffic system is discussed internationally and specifically in Ethiopia. Lastly, cloud based traffic safety management system is proposed.

Index Terms - ITS, ICT Cloud Computing, Traffic safety.

I. INTRODUCTION

Traffic safety management is part of an intelligent transportation system which provides services like autonomy, mobility, decision support and the standard development environment for traffic management strategies and so on. Applying cloud computing for this system is effective due to the increasing benefits of cloud computing. As the ICT (Information Communication Technology) starts to be applied widely in different aspects and services, different beneficiary technologies emerged. Cloud computing is one of the current advantageous technology with high storage capacity on the internet. Currently, internet is the basic aspect which the world is taking as a basement for interaction and communication. In turn the communication and transfer of information the ground for development. [1] Cloud computing is a service delivery like shared resources, platforms, software, and data, as the clients or users requirement intelligent transportation system which improves the transportation area such as road safety, transport productivity, travel reliability, informed travel choices. Intelligent transport systems are set of developed applications desiring to provide creative services of traffic management and transport. The intelligent transport systems help to mitigate traffic congestions and accidents which simultaneously increase with population growth, long travel, air pollution, and fuel consumption.

- **Introduction to Intelligent Transport System (ITS)**

Transportation is a basement for day to day activity and functionality for economy and society of once country. As time passes huge growth in the transport system and significant effect of these developments in society and life is observed. Many different fields are studying and performing researches on intelligent transport systems such as civil and mechanical engineering areas, computer science engineering concepts like AI (artificial intelligence), machine learning, communication, internet and many other emerging engineering information sciences areas become basic of ITS (intelligent transport system).

Because of growth in population, there are different problems such as air pollution, long travel time, fuel consumption, traffic congestion and accidents. ITS (intelligent transport system) is the best solution for all these problems. ITS (Intelligent Transport System) organizations are improving their services in order to solve the above critical issues by building traffic communications and vehicular networking. Currently, the ICT (Information Communication Technology) world has been supported by cloud computing. Applying cloud computing for ITS will modernize and create effective services in ITS. The function is to improve the operations of the transport system which, in turn, support the objectives of transport, the increase of the efficiency, security, productivity, energy savings and the quality of the environment. These objectives are common to all regions of the world, even if their relative priority can vary from one region to the other. Relatively high priority given by countries for efficiency of ITS assisted services is as much as the ability of existing rail and road systems. In many countries, the current traffic congestion would worsen since the construction of new roads has little hope to catch up with the increase in traffic demand due to financial and environmental constraints. [3]

- **Benefits of the Intelligent Transport System**

- ✓ the reduction of congestion and delays at peak hours
- ✓ Increase the security and personal safety
- ✓ Save time and working efficiency
- ✓ Reduction of fuel consumption and emissions
- ✓ Improved customer service and reduced frustration
- ✓ Reduction of accidents and road deaths and
- ✓ Improved economic productivity

- **Intelligent transportation system in Ethiopia**

ITS Ethiopia is a legally constituted, non-profitable; Governmental company that has its own status and governance. ITS of Ethiopia status was approved on February 28, 2013, by charities and societies Agency, which made the company legal and official. The headquarters of its Ethiopia is located in Addis Ababa, Ethiopia. The company plans to contribute to the creation and the development of ITS chapters in various States (regions) of the country, as needed.

ITS vision of Ethiopia is a dream to see our country, Ethiopia to grow, prosper and be stable. This vision includes seeing our country as a modern transportation system, which is safe, reliable, efficient, affordable and environmentally friendly. This will ensure the progress of the country on ITS path of growth and to be able to achieve its development goals.

To modernize the transportation network, we believe that the country needs very good cost effectiveness of implementation and ICT (information and communications technology), better known under the name of ITS (intelligent transport systems), which have proved to be

essential tools to save lives, time and money as well as to increase efficiency, reliability, affordability and sustainability of transport systems in many countries around the world.

The goal of ITS Ethiopia is essential to promote and advance the implementation of its technologies through research and development, as well as the planning and execution of the project. The company will provide a forum to bring together stakeholders in the transport of all sectors of society, including public, private and academic organizations and international institutions, and encourage them to strengthen the partnership and work in a team for the promotion of its programmers and projects in the country. These will be valuable to modernize and maintain the system of transport of Ethiopia, across the country, both in urban and rural areas. ITS Ethiopia will serve an advisory body at the local, regional and national level government agencies to provide advice and expertise to really developing policies and programs and to advance the implementation of its technologies in the country, to save lives, time and money as well as advance economic growth and standard of living of our people.

Who are the stakeholders for ITS Ethiopia?

- ✓ The public and community groups covering transport premises and services
- ✓ International ITS hardware/software vendors and system integrators
- ✓ Local International' civil engineering on the highway and road construction
- ✓ Telecom operators' international donors

ITS Ethiopia is administered by a general meeting of members, which is the supreme leader. Elects the Board of Directors; supervises their activities and determine the policies of the company.

The Board of Directors appoints ITS permanent Committee of Ethiopia, including the Executive Committee, which is responsible for the day-to-day operations of society and of the implementation of the policy guidelines and decisions of the Board of Directors.

[6]

II. RELATED WORKS

The development in cloud computing and internet of things (IOT) have offered a promising chance to resolve the challenges caused by increasing transportation obstacles. As an emerging technology caused by speedy advances in fashionable wireless telecommunication, IOT has received plenty of concerns and is estimated to bring edges to various application areas as well as health care and transportation. This study is designed to give unique standard and multilayered conveyance information cloud platform supported cloud computing to resolve challenges caused by increasing transportation issues. [1] Vehicular cloud computing is aimed to provide services that provide traffic safety and efficiency to vehicles. This technology has the ability of changing vehicular communication strategy. The underutilized resources of vehicles can be shared with other vehicles and traffic authority stations to manage traffic congestion.

Dangers in vehicular applications such as road traffic efficiency and flow control are prime applications for traffic control in urban areas. Developing technologies such as cloud computing lay a basement for the development of new applications and shift the application development strategy.

The vehicular cloud formation broad consists of the following steps.

- Discovery of resources
- Organization
- Resource and information sharing
- Content publishing and storage [4]

As development information communication technology increases better world has been created. One aspect of ICT cloud computing, better gathering, analyzing tackling useful information considering traffic safety has become one of the basic concerns of traffic authorities. The threat to life from road traffic collisions is a scary fact hence, to ensure sound traffic management and for city travelers to get quick access to updated road traffic information are important aspects. ICT should contribute something as the world is moving ahead with ICT, because of theoretical and practical values in the traffic management. Cloud computing has aroused wide concern among researchers. This study tried to design a traffic safety information platform based on cloud computing technology which can act as an excellent channel for communication between traffic authority, staff and the public. [5]

III. PROPOSED SYSTEM

In the past, every organization would have its data and applications on their own servers. Some years ago most organizations have begun switching to outsource their applications and data to large datacenters, hosting providers and cloud providers.

Traffic data is the primary source of awareness on traffic safety management system, human behavior, and vehicle performance. In order to solve traffic safety problems good traffic safety data, meaning data which is timely, accurate, complete, consistent, integrated, and accessible should be collected. There are reasons for gathering inadequate data. The reasons can be dealt with three broad categories:-

- People

There are cases where quality of crash investigation and reporting varies from agency to agency and from officer to officer. There are trainings given to officers but the training given might be different among states and law enforcement agencies. Officers may lack knowledge on accident data element definition or how to measure or give meaning to the information they gather. They also may lack understanding of the importance of the accident data. One way to assist police men and agencies to perform better accident investigation and reporting is to offer them with feedback on the quality of report they submit.

- Process

Wrong information can result from numerous causes relating to the manipulation of accident data. The accuracy of the reported data face cumbersome edit checks with paper accident forms. The timelines of data can be delayed. Generally if the personnel responsible for data processing are provided information and feedback on their processing, they are in a better position to improve their data handling and performance.

- Technologies

Adopting new technologies improve the quality of accident data. Electronic data collections like through laptop computers or online entry of accident data helps improve the timeliness, accuracy and completeness of accident data. This and some other innovations can result positive impact on accident data. Hence if countries establish mechanisms to assess the quality of accident data, it is much better position to detect deficiencies and take steps to correct them.

The basic precondition is improving the traffic records system is to identify its strength, weaknesses, and areas of potential efficiency improvements. Data should be qualified and the characteristics of qualified data are the following:-

- Timeliness :- information should be available within time frame
- Accuracy:- data in the database should be correct and reliable
- Completeness: - data within the database should be complete in terms of all recordable components of the event being reported and available within the database.
- Consistency:-reportable data should be uniform among all reportable jurisdictions using the same information on standard data collection forms.
- Integration :-the information recorded should be linked with information from other databases
- Accessibility:-the registered data within database should be readily available to eligible users of the information.

The above characteristics are essential and traffic data should fulfill them. Hence in order to achieve those characteristics deploying the traffic safety management system on the cloud is the best choice.

Qualified and well organized data has the ability to improve problem identification, the prioritization of different safety problems and the evaluation of effectiveness of the solutions that are taken against the problems. There are countermeasures that are taken against traffic safety problems some are the following:-

- Infrastructures to avoid or minimize the accidents
- Enforcing existing or new laws to ensure driver/vehicle compliance
- Creating awareness on traffic safety issues
- Improving Emergencies Medical services through processes such as training EMS personnel or the deployment of EMS units

The availability of data on road accidents is a prerequisite for each road effective safety management system. Comprehensive and up-to-date accident data is necessary for the recognition of the extent of problems of road safety and public awareness. Reliable and relevant data identify the contributing factors of the accident of person, and to an unveiling of the background of the risk on the road. It offers the best way to explore the prevention of accidents, and the means to implement measures aimed at reducing the severity of the accident. This study entitled with traffic safety management system mainly focuses on the reporting system of traffic accidents in Ethiopia. As indicated above having qualified and well organize database on traffic data is an outstanding support for traffic safety management system. In Ethiopia the road accidents are now registered using a pen and paper. A form is used to record the basic data about the accident on the site of the traffic accident by the police officer. The form is used uniformly in all nation-wide police stations, to record all injuries and accidents. An accident to be registered as a traffic accident by local traffic police officer should include three things: the vehicle, the road, and the person/animal or any object causing death or injury or damage material. In an accident, the officer attends the accident, collects the data and makes a decision on the fault to the scene. Data is saved for personal injury to serve as a witness in court. More photographs and sketches of the accident of location are taken for a better description of the scene of the accident. [2]

Applying the Cloud Computing technology for the traffic database will provide more flexibilities and dynamic resource which resolves the scalability problems. In this study information gathered at regional level and state level act as the foundation for any traffic record system. The system's database reflects the relationship among the information gathered on vehicle, environment, crash, driver and pedestrian. The information is an interlocking set of related information. For traffic safety purposes, crash data is at the center of the information while the other relations are integrated with or linked to the accident data.

This system has a purpose of managing traffic accident information/data. In this system the traffic accident information are registered by the legally registered traffic police men, additionally there is an opportunity for users to appoint the accidents they face and that are happening around them whenever they have the access to our system.

The data also serves as useful information for traffic safety additionally to create awareness in the society, there are news and announcements provided by the system. In this study in order to have accurate analysis general report will be generated. Generally the traffic safety information system has the capability to serve as an information source for traffic safety professionals to differentiate traffic safety problems, identify countermeasures, manage counter measure programs and evaluate the performance of safety programs. A user interface represents the interaction of system management system since it acts as an interface between the user and the content of the clouds.

IV. CONCLUSION

In this research, a cloud-based traffic data collection, management, and reporting system are developed. This kind of traffic accident data collection, analysis and reporting are also useful for other countries to help all stakeholders in traffic safety decision making processes. Therefore, the offices of the traffic police, road engineers, insurance, media, the statistical authorities, the general public etc can easily get and share information regularly using this system. The system was designed and implemented with an Amharic-language and with its translation in English interface to maximize the use of the system.

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