Design and Development of Biometric Traffic Offence System (BTOS)

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Abstract

The study was about the design and development of Biometric Traffic Offence System (BTOS) that would ease storage and retrieval of traffic offence cases in the Federal Road Safety Commission (FRSC) and the Traffic department of Nigeria Police force. The method used to manage traffic cases is manual; information collected daily is written on paper and stored in files for reference, thus making the captured cases susceptible to loss, easy access by unauthorized people and destruction. Data collection techniques such as interviews and observation were applied to get the necessary information from the Traffic officers in the FRSC Asaba, Delta State. The system developed captures the defaulters' bio data, traffic offence committed and the charge for the traffic offence. The TCRMS makes the use of the camera that captures the photo of the defaulter and the biometric gadget that captures the defaulter's thumb print for reference. All these are centrally stored in the database but are sharable with FRSC and Nigeria Police Traffic department which government departments work closely with police in regard to such offences. Different programming languages were used during the development of the system including Visual Basic for the front end and SQL Server2005 for the back end. The system is thus user friendly in the way it inserts, retrieves and updates user information. Recommendations for implementation and future development were made.

Introduction

Rules and regulations are paramount in all aspects of life that range from way one wishes to live to how others should accommodate one's life style. All human being need to enjoy their rights to access and use public infrastructure. The law enforcement agents world over are charged with such a responsibility and work towards sustaining it at the expense of keeping law and order. One such related public infrastructure is roads that accommodate automobiles. Much as each person is free to use the road he/she should not infringe on the other's right too. But at time drivers and pedestrians fall short on this calling for law enforcers' intervention. (Mubaraka, Jirgi and Nanyanzi, 2013).

Traffic offence is a violation of traffic regulations, such as breaking the speed limit and stop sign infractions. Stopping for a stop sign (or traffic light) means the vehicle must come to a complete stop.

There is no such thing as a rolling stop and "slowing down" is not stopping. Drivers approaching a stop sign must bring their vehicle to a complete stop in one of three places (depending on the intersection; at the marked stop line, before a marked crosswalk or before entering the intersection).

According to Osuagwu (2007), Biometrics refers to a brand new technology to reliably indicate whether people are actually who they say they are using traits unique to them. These traits include fingerprint patterns, the arrangement of tissue in the eye's iris, and the timbre of a person's voice. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals (Jain, 2000). Biometric identifiers are often categorized as physiological versus behavioral characteristics (Jain et al, 2008).

Motivation

In Nigeria, the law enforcement agencies responsible for the inspection of Traffic Highways are the Federal Road Safety Commission (FRSC), Vehicle

Inspection Officers (VIO) and the Nigerian Police Force. These agencies are bound to the use of brick and mortar inspection techniques which make use of paper based manual recording system for storing the records of traffic offenders. The limitations of these manual systems; Lack of Real-Time Verification or records for traffic offenders; Lack of Offender's Database Bank; Lack of Monitoring/Tracking of offenders; Inconsistent Grading System; and Inadequate Identification make it difficult for the enforcement agencies to track and monitor traffic offenders. It is on this backdrop of this that this project aims to conduct research on the design and development of Biometric Traffic Offence System (BTOS).

Challenges of Road Safety

Despite technological advancement and improved environment including good conditions, the rate of road traffic accidentss continues to increase. According to David (1999), the second African Road Safety congress in Addis-Ababa, Ethiopia in 1989 revealed that the road safety situation in a developing Economic (especially Africa) still poses a great concern as shown in the following coparative statistics: At the global level: 500,000 persons die and 10, 12 to 15million persons are injured every year in road accidents throughout the world and approximately 30% of these fatalities and injuries are experimented in developing countries. A recent analysis of Global Burden of Disease, in assesing changes in ranking order of disease burden for 15 leading causes in the world, shows that road traffic accidents ranked No. 9 in 1990 and will probably be No. 3 in the year 2020, if not properly checked and controlled. At the regional level: Research shows that road accidents are the second highest cause of death for the 5 to 44 years age group in Africa. The major challenge facing the Federal Road Safety Commission and other coordinating bodies is act of competent support staff and experts to assess the relevance of existing road safety. Programme implementation and continuity, funding and follow-up of the actions undertaken, are additional challenges. There is need for increased funding, the initiation of the in-depth studies and actions plan to improve Road Safety situation at the national, sub-regional and regional levels. The essence is exchange of experiences and results in order to gradually increase available relevant knowledge.

Aims and Objectives of the Study
- To provide better services to the public and users making the highway safe for motorists and other road users.
- To keep records that are complete, integrated and up to date, also recommending works and devices designed to eliminate or minimize

accidents on the highways and advising the Federal and State Government including the Federal Capital Territory Administration and relevant governmental agencies on the localities where such works and devices are required.

• To produce a system where information and output report will be produced or made available much faster, more accurately and more detailed to the commission and the public by educating motorist and members of the public on the importance of discipline on the highway.

• Maintaining the validity period for drivers' licences which shall be three years subject to renewal at the expiration of the validity period as well as designing, registering and producing vehicle plate number.

• Conducting researches and also the standardization of highway traffic codes.

Related Literature

Information system is a set of hardware, software, data, procedural and human components that work together to generate, collect, store, retrieve, process, analyze or distribute information (O'Brien, 2001). While Loudon (2005) says that an information system is a combination of human and computerized resources that result in the collection, storage, retrieval, communication and use of data for the purpose of efficient management of operations and for business planning. According to Inmon (2003), system of record (SOR) is an information storage system commonly implemented on a computer system, which is the authoritative data source for a given data element or piece of information. The need to identify systems of record can become acute in organizations where management information systems have been built by taking output data from multiple source systems, re-processing this data, and then re-presenting the result for a new business use.

According to Loudon (2005) all traffic management departments in any country around the world have systems that they employ to manage the records of the traffic itself, staff, penalties and cases. The rise of the new system of case management introduced building of jail rooms, use of knowledgeable people for example policemen, fines after every case coverage and compensations.

Also Inmon (2003) notes that in United States of America, the Model State Traffic Records System (MTRS) was developed to integrate information now stored in different forms and systems through the state, to integrate operations of various agencies and to reduce duplication of effort by different entities. MTRS also aids in comprehensive planning and evaluation. Highway safety problems are isolated by applying accident and UTC data supported by roadway environment, driver, and vehicle background information to: i) location analysis techniques to identify hazardous locations; ii) standard statistical analysis techniques to identify patterns that indicate possible problem areas and details of the MTRS data base are summarized. The Traffic Records System Inventory is provided as a service to the public and in particular those within the highway safety community. It represents the best available information about each of the traffic safety data systems within each state and territory. The information contained in the Traffic Records Systems Inventory drawn from a database containing basic information about the traffic records systems within each state and contact information for each state system. States are encouraged to update their pages at least annually.

Significance of Computerized Systems

With the growth in information technology, the study offers numerous values to the Federal Road Safety Commission and any organization that deals with offence documentation data/information. Huge files kept through

the manual method in offices will no longer be there again because information will be stored on the computer with the help of the Biometric Traffic Offence System (BTOS). It will help to keep a comprehensive record of traffic offence documented.

The Biometric Traffic Offence System is provided as a service to the public and in particular those within the highway safety community (Sam, 1997). It represents the best available information about each of the traffic safety data systems within each state and territory. The information contained in the Biometric Traffic Offence System drawn from a database containing basic information about the traffic records systems within each state and contact information for each state system. States are encouraged to update their pages at least annually. The automated records' tracking system eliminates the exchange of papers containing records or tracking data between parties within the traffic department and between nationals. This is achieved by bringing all data together in one database and giving relevant parties access to this data.

However, according to Inmon (2003), automated records' tracking systems used in traffic offices or departments have different strengths which are laid as follows: i) the system requires a username and password so that only authorized people can update records; ii) the system can be configured so that a staff member can access and manage only the section of the system they are responsible for; iii)the system is very quick and fast to change the content in the system without any programming skills whatsoever. The literature reviewed above stipulates that where there is bulky work that may involve daily manipulation for analysis and interpretation (case processing) for the good of customers, an integrated system suffices. This will reduce redundancy and bring effectiveness and efficiency to the traffic management system, hence better service and transparency in the traffic police force.

Research Methodology

The study employed Structured Systems Analysis and Design Methodology (SSADM) which employed both qualitative and quantitative approaches. It was qualitative in that opinions of the traffic officers and some road users were sought and the researcher contextualized them according to his understanding. The existing system was studied to establish its weak and strong points. The information that was acquired from this study gave the basis for the design of the system. A number of steps, procedures and tools were employed as shown below:

Upon interviewing the traffic officers, there seemed to be problems associated with the existing system, they included the following; i) It was evident that there was a lot of duplication in recording of the case records and requirements; ii) Information retrieval from these sources was not easy; and iii) There was a problem when it came to serving the offended in time, among others.

The programming language selected to accomplish actualize the project is Visual Basic Programming Language popularly known as VB. This choice was informed by the following features of the programming language which is an event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model. Thumb Print Image Processing Algorithm and the Microsoft Access Database Management System will be used to store information about the system

System Design
This gives a high level view of the new system with its main components, the services provided and how they communicate to the system. At this stage of the system development, the focus is on the definition of the central architecture of the system.
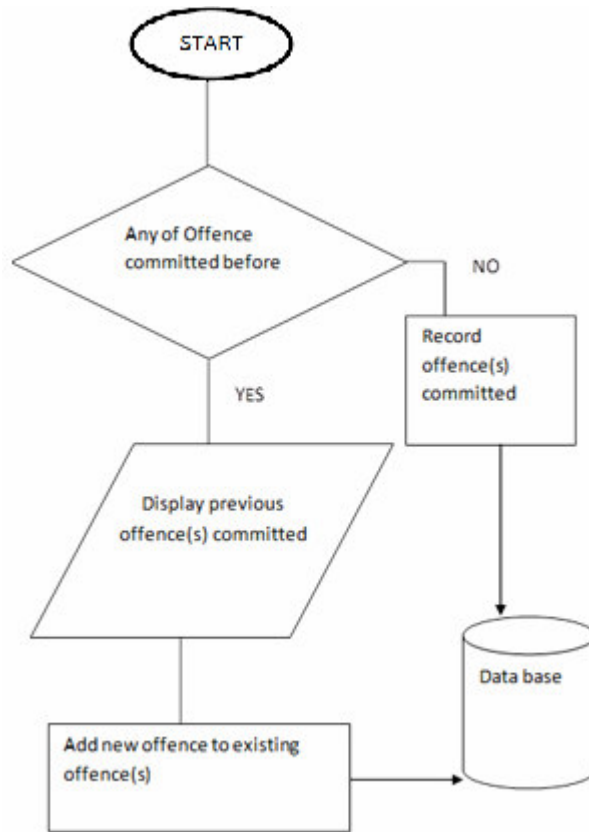

Figure 1: Architecture of Proposed System

Use Case Diagrams
These are behaviour diagrams used to describe a set of actions (use cases) that some system or systems (subject) should
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or can perform in collaboration with one or more external users of the system (actors)
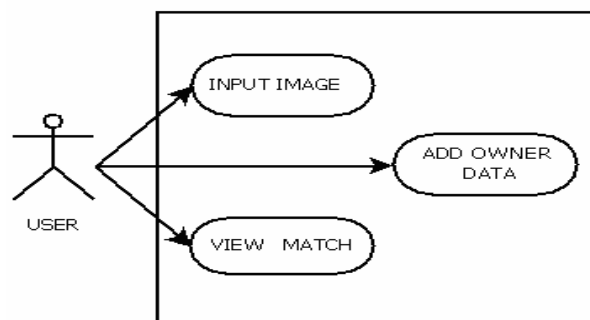
Figure 2: USECASE Diagram

System Flowchart
Below is the diagram showing the flowchart of the proposed system.
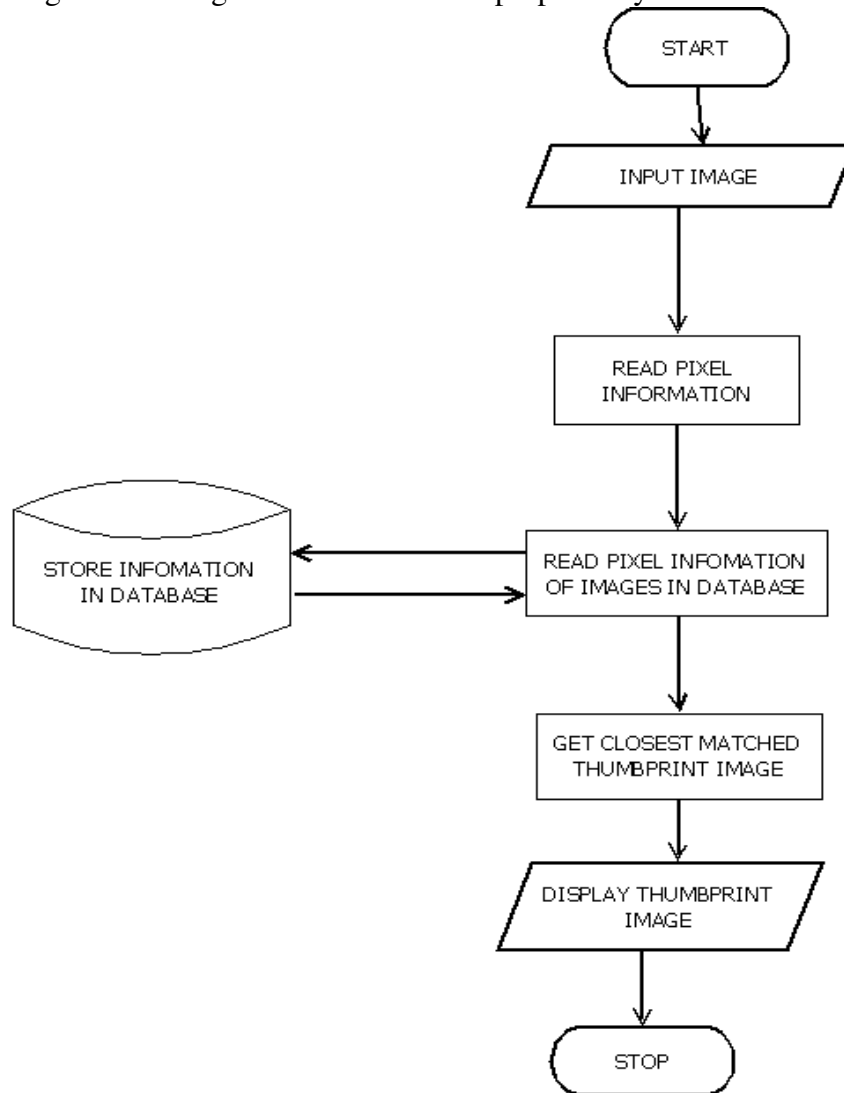
Figure 3: System Flow Chart

System Implementation

The implementation of the system involved different features of validation and verification of different functionalities. The interface input forms were designed with a visual basic code running behind them. The proposed system was developed with an aim of effectively and efficiently handling cases. The proposed system also allows only authorized users with a verified user name and password to use the system. A detailed description of this functionality is shown below: The performance of the proposed system is over seen by two users (administrator and the investigating officer) with a verified account to access and use the system at any time of the day; Users with an account of the system can logout in case they are through with using the system. The interfaces below show different functionalities of the system.

System Login Form

This form lets the security agents submit login details to gain access into the system

Figure 4: System Login Form

Offender Registration Form:
This form is used to enter information about the offender into the system's database.

Figure 5: Registration Form

Thumbprint Identification Form: This form is used to match the image to be identified against the ones in the system's database.
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Offender Search Form: This form is used to search the database if arrested person have been caught before the present arrest
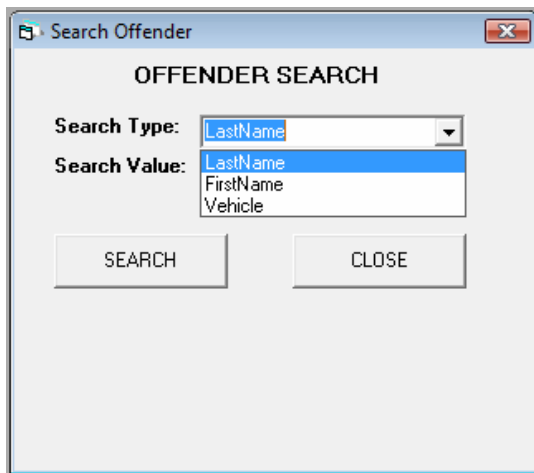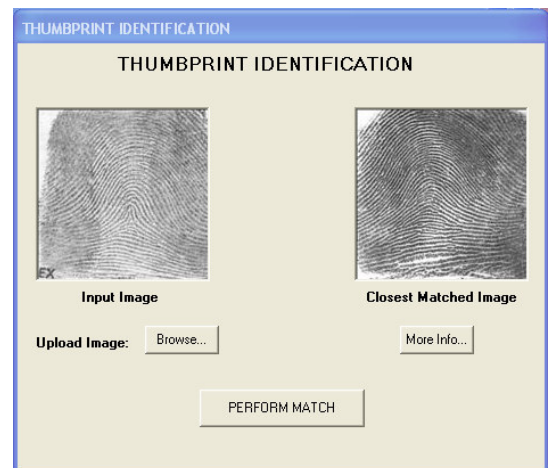
Figure 6: Thumbprint Identification Form

Figure 7: Offender Search

Offender Information Form: This form displays information about the offender with the closest match.

Figure 7: Offender Information Form

Discussion

The designed system can capture, process and retrieve traffic case reports easily. The traffic department has increased the number of particulars captured against each case. This was formerly neglected for fear of bulky processing. Now that the system can capture such details at once then only updates would be required. It has also been noted that traffic cases have reduced to some extent unlike in the past where offenders relaxed. This was partly due to bribery and conspiracy in the police force to lose some files and hence the case. This observation is in support with Inmon (2003) and Sam (1997) who assert that

records management is paramount in bringing efficiency in any system.

Significance of the system

The importance of the proposed system cannot be over emphasized as it will provide the following benefits to the Security agencies: i)The use of biometric details such as the finger print will allow the registration and identification of the owner of the traffic offenders; ii) The information will be stored in an online database which will enable the highway traffic law enforcement agents gain access to the system from the field; iii) Traffic offenders can have their biometric data run through the database on the field to check

if they have had any prior history of offences without having to visit the regional office

Conclusion

The system developed can now provide means for the traffic law enforcer to handle various traffic cases. The system has removed delays which were experienced through the old system because cross checking through the traffic records has been time consuming. The traffic law enforcers has benefited from the new system because there are no longer delays in storing and retrieving traffic offences at the station in case pattern government departments (i.e FRSC, VIO, NPF) need information. The researchers thus recommend that to beef up service delivery in the traffic department, the designed system should be integrated with mobile applications that can run on cell phones so that the offended parties can notify and retrieve pertinent data about the offender which will ultimately reduce traffic and other crimes committed.

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