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On The Development of a System for Land Acquisition and Verification

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ABSTRACT

Information and Communication Technology (ICT) has played a major role in every facet of human endeavor. It is not left out in land acquisition and verification as the application of ICT makes it much easier to prevent land database data from being altered, prevent potential land buyers from being defrauded and can also provide a medium for real-time allocation of lands to new land owners. This informed the reason to design and develop an enhanced land acquisition and verification system (ELAVS). A hybrid methodology (derived from the fusion of Structured System Analysis and Design methodology (SSADM) and Object-Oriented Hypermedia Design Methodology (OOHDM)) was employed in the design and development of ELAVS. The system was implemented using Microsoft Structured Query Language (MSSQL) database engine, Active Server Pages (ASP.NET) and Microsoft C-Sharp (C#) programming language. The result is an enhanced and robust land acquisition and verification system that provides an easy check module for users who intend to sell lands without going to the land office for verification, registration of users using their fingerprint, verifying and updating users using the fingerprint and providing a virtual map where lands acquired can be viewed.

Keywords: land acquisition, land verification ICT, biometrics, virtual map, OOHDM

1. INTRODUCTION

Land acquisition entails obtaining or purchasing land from a land owner. A land owner maybe an individual, a group or the government. There are cases where lands acquired cannot be used as a result of dual ownership, non-existent and so on. This leads to land disputes, in litigations, attack on labourers and even death of the land dealers, owners or the buyers. Therefore, there is need for land acquired to go through a registration process. This registration describes a process where matters relating to ownership and claim to a land can be recorded. This is usually done with a government agency in order to provide evidence of title, facilitate transaction and most importantly to prevent unlawful disposal. People have relied on land to satiate their needs, material, social, cultural and spiritual. Land has helped make provisions for production, wealth creation, spiritual engagement and many others (Briassoulis, 2010). Land is needed by both private and public users.

These needs vary as it can come in the form of residential, transportation, institutional, agricultural and many others. This simply implies that land is required in both urban and rural areas, for who needs it at the right time, in the right quantity and quality. So the issue of who controls a land at any given time is very crucial (Jin, Wan & Yue, 2007). Land registration systems are categorized into two different types namely: Registration of Deeds and Registration of Title (Barnes, 2008). Registration of Deeds involves recording the documents affecting interests in land. With this registration of Deeds at a government office, claims could be established whenever the need arises. Registration of Title (also known as the Torrens system) was introduced in Australia in 1858 by Sir Robert Torrens (Haruna & Nuhu, 2008). This system of registration shows the actual state of ownership rather than providing evidence of ownership. Registration of Title is more than the mere entry in a public register; it involves the authentication of the ownership of, or a legal interest in a parcel of land. The singular act of registration confirms transactions that confer, or terminate that ownership once the registration process is completed. This type of title is often referred to as absolute except in the situations where a title was obtained by fraud.

Proper registration of land is essential for all owners as land has great economic values and when properly acquired and registered, will give the land owner a government guaranteed title which can be used to access loans as the case may be. This registration provides a safe and easy means of recording transaction on land since the bench mark of any transaction on land is security of title, which unregistered conveyance (i.e. not verifying a land after acquisition through registration) does not guarantee. It is therefore imperative to provide an avenue to properly register lands so that potential landlords can easily access valid lands for sale via the Internet.

2. RELATED WORKS

A conceptual framework for land information system for increased revenue collection from land rent section of the Department of Lands, Ministry of Lands and Settlements. Nairobi, Kenya was developed by Obongo (2003). This system was used to automate the work of land registration by creating a central database using Microsoft Access. Land users were able to view the details of their land and its title. It made land registration an easy task but had some shortcomings with regards to the database. The database was secured using a combination of a username and password. This means that a registrar or any person that has access to the username and password of such database will be able to gain entry into the system and access the database. This automatically means that data can be altered by unauthorized registrar or even authorized registrar with or without the consent of a land owner.

Kalam and Khan (2005) gave an account of Computerized Land Management System (CLMS) of Bangladesh. This system was introduced in the Demra area of Dhaka, Bangladesh with the intent of reducing public suffering and stopping land grabbers. CLMS was expected to greatly reduce the number of land disputes as fake documents were hard to come by. CLMS used a database that was just username and password enabled. Information on every land, its sales, transfers, current and former ownerships, categories of use, were compiled and stored in a readily accessible database. This database was under the sole control of the registrar who is charged to make entries, queries and update the database. This system instead of solving the problem of land grabbing and reducing public tension, only worsened as public officers saw an avenue to take bribes and effect changes in a database.

Federal Land Information System (FELIS) presented by Adeoye and Mensah (2008) is a computerized land registration system that saves land documents and its likes. This system is designed in such a way that the land owners can send in scanned copies of their land documents to an online platform provided by FELIS. This online documenting of scanned land documents makes up the database of the system. Searches now are made online-based on the PIN used for registration at the first time of registration. Minh (2010) in his study built a system known as the e-Government based Land Administration System (e-LAS). This system tried to put the citizens first as it made sure the citizens were at the receiving end. The updates and information extracts were managed by the registrar. The system is similar to the system presented here in putting citizens first except in its update and security level.

Many informal transactions were made using the e-LAS since database manipulation was handled by the registrar. Registrar with high clearance had access to the system and thus vulnerable. Enemark et al. (2005) in their study of automation of land records where a parcel of land is registered using a unique Property Identity Number (PIN). The parcel register is assigned a unique PIN which must be shown on all plans and documents entering the system. For automated records, the land registrar records the plan or document based on legal description and the PIN, and verifies both at the time of registration or deposit. The land registrar keeps the automated parcel register current. Documents no longer relevant to the current title are usually deleted from the database. This system assigns unique PINs which can be used to query and manipulate the database. This method of using just PIN to secure a record is not safe. This is because once a PIN is seen or taken, land titles, claims and alterations can be made to a record.

Abbas et al. (2014) in their research developed the Land information System (LIS) in order to provide a better and more efficient system for land management. The study was able to achieve the efficient and effective management of the land of the study area with the ability to identify the layout parcels, map them, then generates data to provide a database that will enhance data collection, storage, manipulation, retrieval and dissemination of information at precise and short time and eventually been able to query the database. The data collected operations/manipulations on the data were done by the government. It puts the power of land ownership and its manipulation in the hands of the government other than in the hand of the land owner. The database queries can be performed and updates made from the ministry with or without the consent of the land owner. Querying or searching a database is a common function of Land Information System (Yang & Marc, 2006). This involves probing the database to see if certain specified relationships or conditions exist among some features or data items.

3. MATERIALS AND METHODS

A hybrid methodology made up of Structured System Analysis and Design methodology (SSADM) and Object-Oriented Hypermedia Design Methodology (OOHDM) was adopted. Information about the current trends in the research areas of land acquisition and verification was obtained using the investigative phase of the SSADM (Onyesolu & Udensi 2018). This information gathered from the trends in the research area, brought about the definition of a Hierarchical Input Process Output (HIPO) diagram for the system (Figure 1).

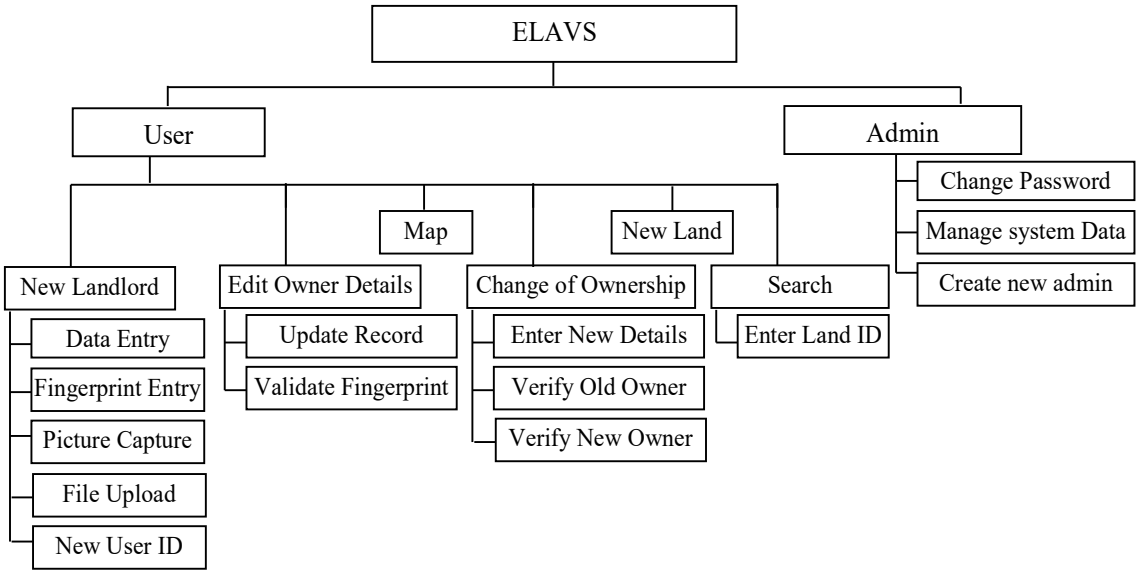

Figure 1: HIPO diagram of ELAVS (Source: Authors)

Using this HIPO diagram, a data flow diagram (DFD) of the new system was designed (Figure 2). An enhanced land acquisition and verification system (ELAVS) was developed and implemented using the Microsoft Visual Studio 2015, ASP.NET, C# programming language; and Microsoft Structured Query Language (MSSQL) database engine.

ELAVS was used in a selected group of landlords in particular at **Ngozika** estate in Awka, Anambra State, Nigeria to assess the impact of this system on these landlords. ELAVS was administered to fifty (50) participants to determine the effect these enhancements adopted would affect land acquisition and verification. ELAVS was evaluated by a land registrar at the Ministry of Lands, Awka, Anambra State, who used the new system to register and verify fifty (50) landlords. The land registrar introduced ELAVS to fifty (50) landlords. Before the registration and verification in a bid to evaluate the system, the land registrar took and recorded the time it took for a landlord to access land record and update this record in the land office. The fifty (50) landlords that were used to evaluate the system were asked to supply the information they needed to update after registration. Upon completion of registration, the landlords were given a space of two weeks so as to leave room for more registrations, after which the landlords were required to make a query in order to ascertain the time it takes to access and update records in seconds. The time taken to make each query in order to access individual record was recorded by the land registrar for the first group made up of twenty-five (25) participants. Again, the time taken to update these individual records was also recorded for the second group made up of the remaining set of twenty-five (25).

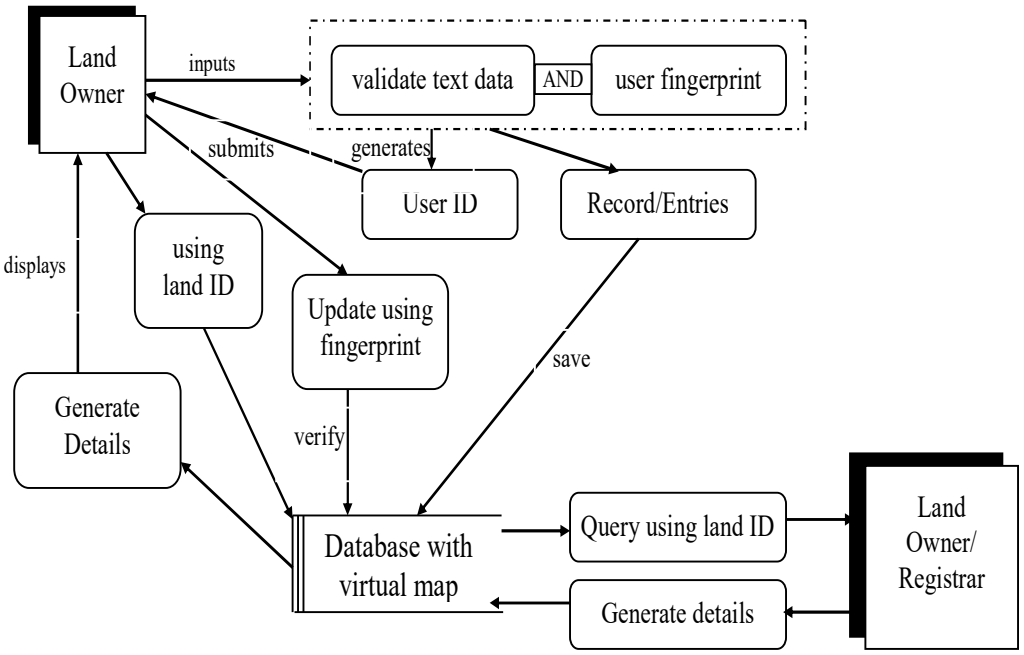

Figure 2: Data flow diagram of ELAVS (Source: Authors)

4. RESULTS AND DISCUSSION

The results of the system are shown in Figure 3a to Figure 3d. Figure 3a to Figure 3d show the screenshots of ELAVS. Figure 3a is ELAVS landowner registration interface. Figure 3b is ELAVS query interface, Figure 3c is the landowners fingerprint verification interface and Figure 3d is ELAVS virtual map with land details. The impact and perception of ELAVS is shown in Figure 4 to Figure 7.

4.1 The Enhanced Land Acquisition and Verification System (ELAVS)

ELAVS is a system that utilizes biometric (fingerprint) identifier for registration and updates. Studies have shown that enhancements that incorporate target users' unique identity are needed to get users involved. This approach is preferred because it is natural and common amongst the target users. In ELAVS, the land registrar assumes the duty of a guide to help the potential landlords or landowners to register their land using their personal details in order to protect their individual record in the database. Now, registering these potential land owners with personal data and including their biometric (fingerprint), makes it a lot interesting and secure for obvious reasons. The intended users are Nigerians because the rate of illegal sale of lands is on the increase. Inaccessibility of personal land details and unaccountable updates to landlords about land records has proven to be issues. Researchers have always stressed the need for interventions to address these issues with regards to land acquisition and verification. The system incorporated the biometric of potential landlords or landowners for registration and for their individual database update.

In ELAVS, a land registrar registers potential landlords by filling out the textboxes with the appropriate information (Figure 3a). There is a section to capture these potential landlords image using the system webcam. The landowners' images can also be picked from the system if it was scanned and saved in it. When these stages of entering data and image capture are done, the land registrar guides the potential landlords as they are provided with a fingerprint scanner, where their fingerprint is captured. Now, there is provision to capture the next of kin to these potential landlords. A new registration is started and a new ID is created for the potential landlord upon completion of registration. During this new registration, the potential landlords have to make an entry whereby their details, images, land documents and their fingerprints are collated and saved in a database. It is with these details that updates and queries can be made to the database.

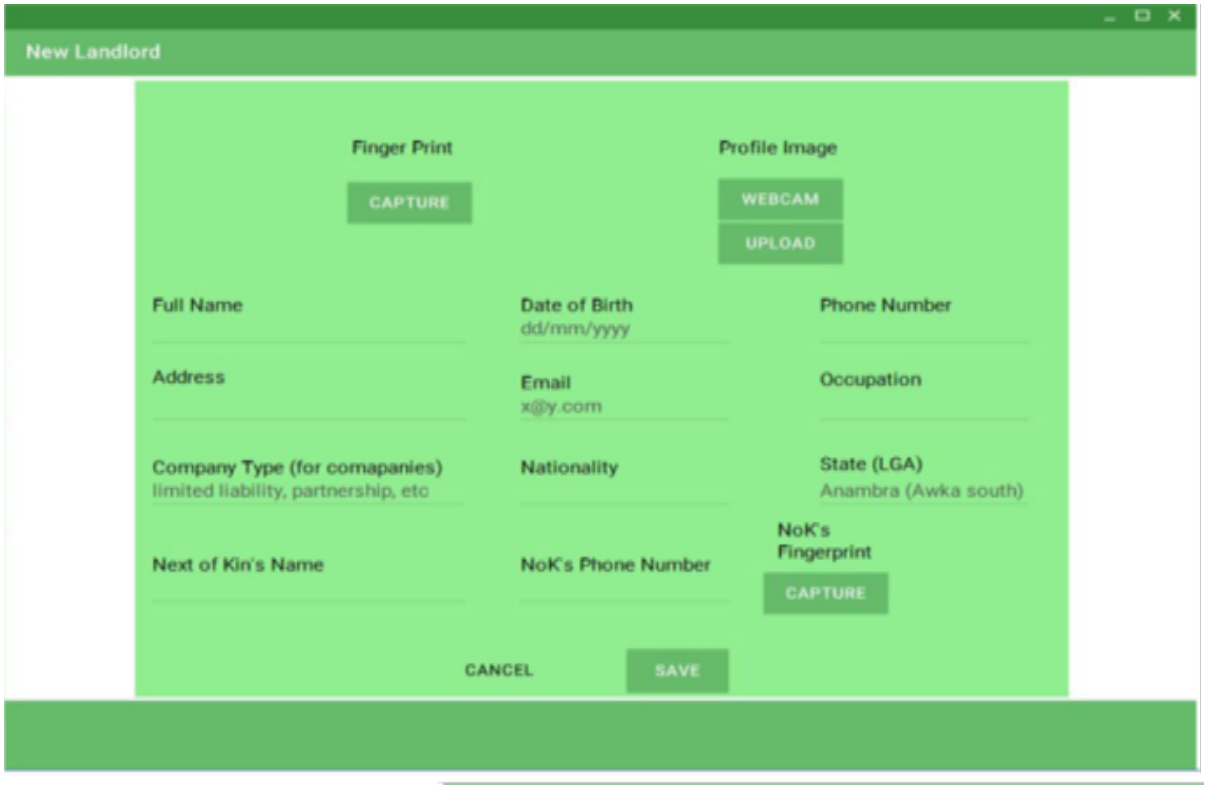

Figure 3a: ELAVS landowner registration interface

Queries can be made using the new ID generated after their first registration using Figure 3b. Updates on the other hand, can only be made after the verification of an already existing landlord's fingerprint (Figure 3c). This entails that a registered landlord has to be present to verify his/her fingerprint in order to have access to the database for updates to occur. Again, when a land is to be acquired by another registered landlord, they are both verified using their individual fingerprints, and thus the necessary documentation is done. Now, in order to confirm that the land has been transferred, a virtual map incorporated in the system has lands mapped out on it (Figure 3d). On hovering on the lands represented in it, the landlords name and some details are displayed. This way, a landlord would be able to know if the land acquired has been transferred to the landlord.

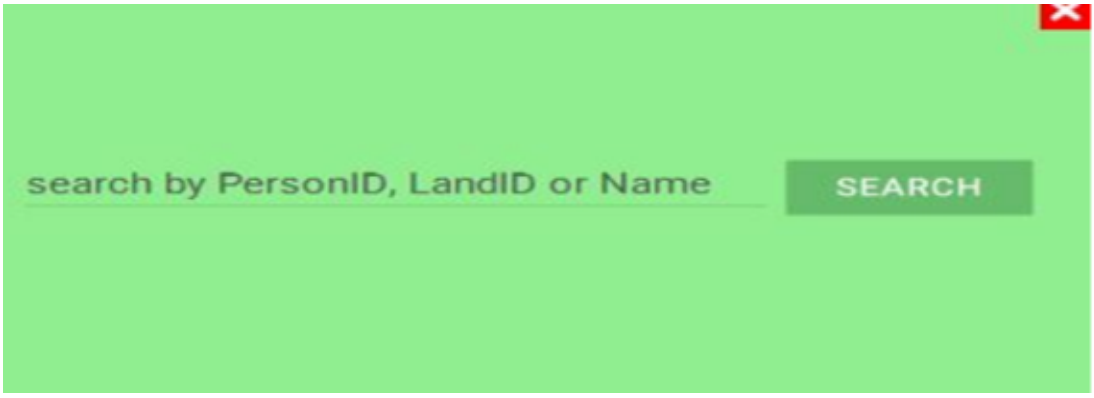

Figure 3b: ELAVS query interface

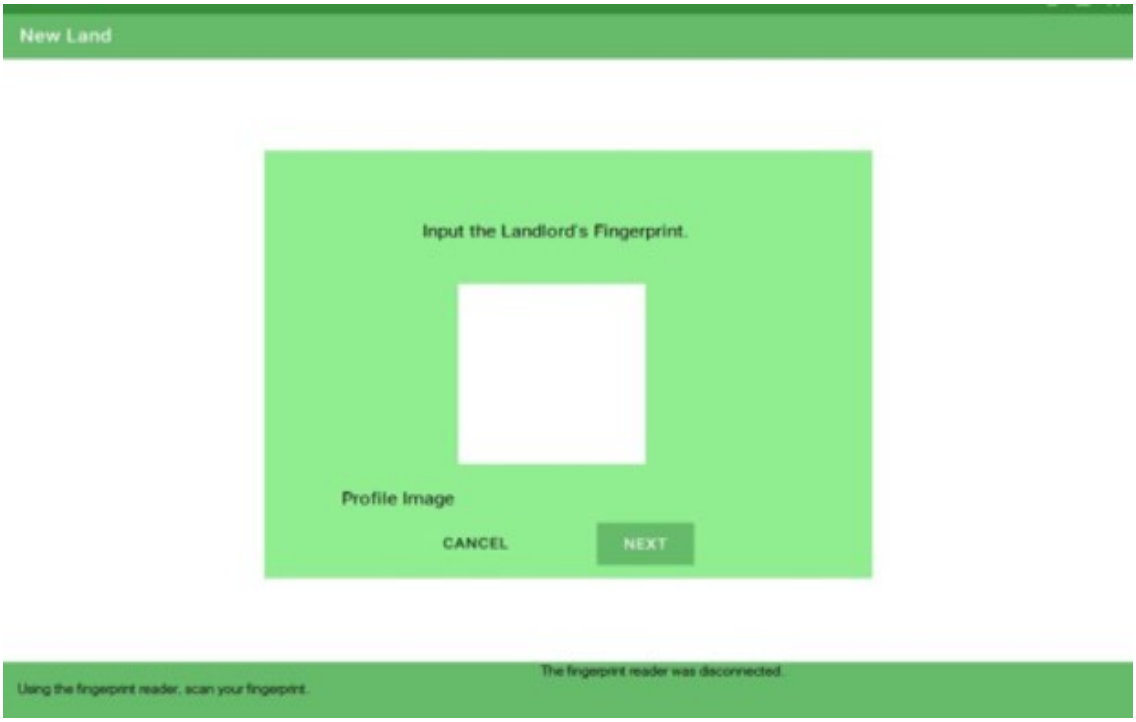

Figure 3c: Landowners fingerprint verification interface

The system changes the "modus operandi" of land acquisition and verification. Having the knowledge that land offices are not usually opened during the weekends, with the land ID, a land can be accessed to verify the ownership over an Internet-enabled device. The introduction of the fingerprint helped to enhance security and thus check the loophole experienced in terms of unauthorized updates to database. ELAVS also puts the security of its potential landlords, first, by enforcing a fingerprint check-first technique. The advantage of using this is that it encourages potential landlords to be relaxed and rest assured that lands cannot be tampered with as they can view their land status on any web-enabled device.

Figure 3d: ELAVS virtual map with land details

4.2 The impact and Perception of ELAVS

The system was used to register fifty (50) volunteer landlords. These landlords were interviewed before the registration and after verification of registration. The impact of the system on the landlords is shown in Figure 4 and Figure 5. Forty eight (48) participants representing 96% of the participants affirmed that land registration and verification using ELAVS made it easier for them to access their land as shown in Figure 4. In Figure 5, forty-six (46) participants representing 92% recorded that using the biometric for update in ELAVS made them have a feel of a secure database, while four (4) respondents representing 8% of the participants concluded that they still did not feel secure. The biometric component is used for update of individual records in the database. The participants also affirmed that the experience they got from the registration, update and verification process of the system (ELAVS), enlightened them on the urgent need for this system (ELAVS) for land acquisition and verification.

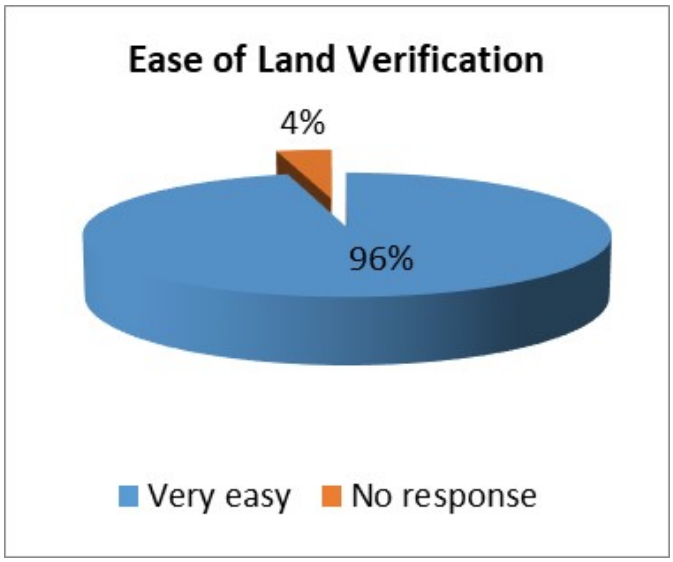

Figure 4: Result for ease of land verification

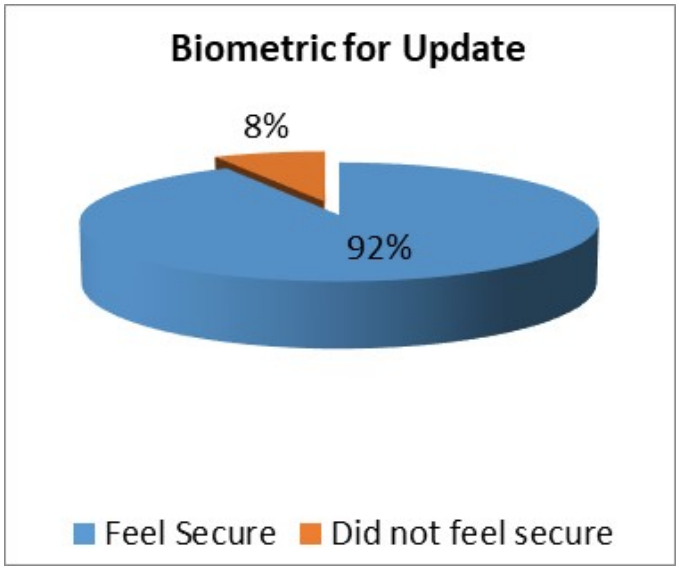

Figure 5: Result for biometric for update

Figure 6 depicts the time taken for participants (landowners) to make queries using the old system against the time taken to make queries after registration using ELAVS. From the figure, the time taken to perform these queries to the database was less for the entire participants. This shows that the acquisition and verification using ELAVS saves a lot of time, as time-saving is an important factor for the participants.

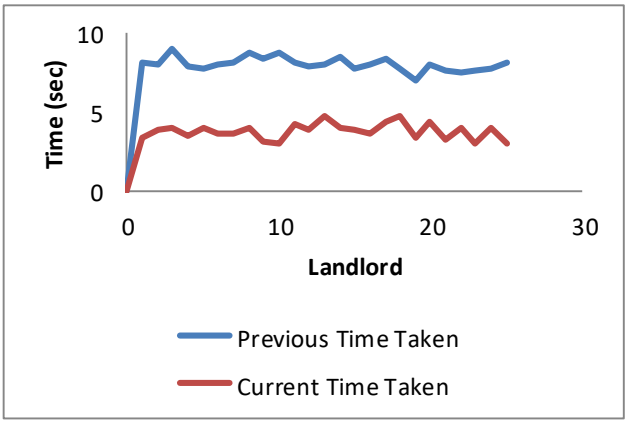

Figure 6: Result for Query

Figure 7 depicts the time it took the participants to make updates. From the figure, it took less time to perform this operation. This shows that the system is time saving and more efficient from the perspective of time. The entire time taken for queries fall within the range of 3 seconds and 4.7 seconds which is ideal, and represents a less time from the previous time taken for similar queries. For the update, the time taken again is less when the same data is used for update on ELAVS.

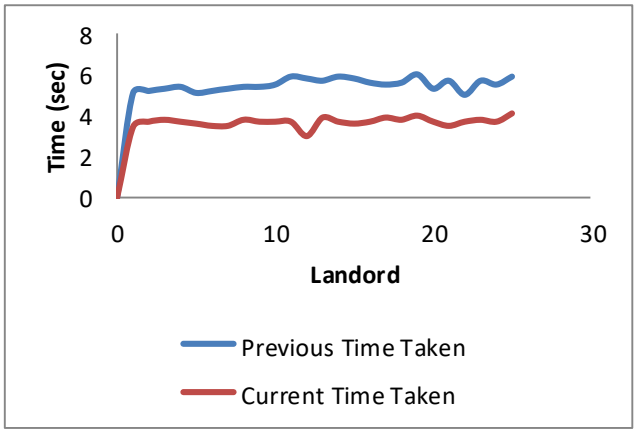

Figure 7: Result for Update

5. CONCLUSION

We developed an enhanced land acquisition and verification system that enables registration and updates that includes the biometrics, a virtual map that displays land details and provides an online module for verification purposes. This enhanced land system known as ELAVS has helped to ease the time taken to perform query for land records, and individual updates to the database. This shows that using the new system helped to optimize time associated with querying database for individual records. For future work, it is recommended that blockchain security be used for lands on the virtual map. Payment of lands to land owners should be integrated in the system so that a verified land can be paid for online either through bank transfer or the use of credit or debit card.

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