A Web Based Automation of Cadastral Survey Workflow and File Tracking System

Anne M. Mwangi[1,*], David Kuria[2], Arthur Sichangi[1]

[1]Institute of Geomatics, Geospatial Information System and Remote Sensing, Dedan Kimathi University of Technology,
P.O Box 657-10100 Nyeri, Kenya
[2]National Land Commission, P. O. Box 44417 – 00100, Nairobi, KENYA
*Corresponding author: annewamwangi15@gmail.com

Abstract Currently, the checking of cadastral survey files at the Survey of Kenya land survey division is analogue. This has led to challenges in handling the ever increasing cadastral survey jobs submitted by the surveyors for quality checking and processing. Modern survey techniques for carrying out the field survey pose another challenge as the section is not adequately equipped to handle the ever evolving technological advancement of the post-colonial times. The main goal of this study is to develop a web based cadastral survey workflow and file tracking system at Survey of Kenya and if implemented, will support all cadastral survey workflows hence address the delays experienced in the land survey division and reduce the interaction between the clients and the officers. It will make use of information technology by use of internet and mobile technologies in disseminating the information to the end users. A Land Information Management System (LIMS) is an information system that enables the capture, management, and analysis of geographically referenced land-related data in order to produce land information for decision-making in land administration and management.

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1. Introduction

The Department of Surveys under the Ministry of Lands and Physical Planning is the official Government Agency for land surveying and mapping [3]. The role of the department is to survey land, collect data for research and production of topographical and thematic maps, plans, charts and aerial photographs [6]. These functions are carried out within the provisions of the Survey Act (Cap 299) of the Laws of Kenya, under which the department drives its legal mandate and the title Survey of Kenya [3]. Cadastral survey division is one of the branches at Survey of Kenya which is the government mapping agency in the country. It is headed by a Director who is charged with responsibility of providing safe custody of maintaining, updating, retrieving, dissemination and managing cadastral information in Kenya. The Cadastral system in Kenya was established in 1903 to support land alienation for the white settlers who had come into the country in the early part of the 20th Century [1,7]. The aim of this project is to develop a web based system that can assist the surveyors spread all over the Kenyan territory to track their submitted cadastral field survey files at Survey of Kenya. With a unique identifier code (surveyor's reference number) for each fixed cadastral survey work

submitted by licensed/ government surveyors at Survey of Kenya, surveyors will access the web portal any time anywhere in their android devices or on a desktop at the comfort of their offices. The system will aid in tracking stage the survey file stage and at what status, approved or not approved. When approved, one can download an authentication slip and pay the checking fee online using a pay bill number and when not approved the interface should provide a link for enquiring the possible cause of disapproval. A surveyor will therefore not need to physically visit the Survey of Kenya premises moving from one office to the other tracking the cadastral survey file manually as it is today. A local area computer network at Survey of Kenya with regular updates through the office interfaces will help in updating the database server which will be managed by a database administrator [6]. Meanwhile the ministry is training officers on file tracking system that aims at solving the problem of missing files and improve efficiency in service delivery. However, the lodging of cadastral surveys for approval by the Director of Surveys is still required to be done in analogue form despite the use of digital land surveying equipment when capturing data in the field. To be suitable for modern technology-based land administration, the cadastre together with the land register have to be automated, taking into account common standards and data models. [2]

2. Methodology

This system is expected to make cadastral survey services accessible from the comfort of the users' homes and offices without having to visit the public agencies through the online and mobile platforms.

2.1. Problem Identification

Two questionnaire samples were prepared, one for the officers who interacts with the manual system daily and another for the users. The users considered were the private and government surveyors who are in the field and submits their cadastral survey files at Survey of Kenya for quality checks and title processing.

2.1.1. Data Sets

The study involved various activities including data acquisition, data processing and data analysis and interpretation. Two categories of datasets are generally stored in geo database. First is the cadastral data which is directly connected with land ownership and the second category is the supporting data such as geodetic reference points, administrative boundaries and topography, which assures basic cadastral data (legal cadastral objects) of accurate referencing in relation to physical objects and to the earth, as well as allowing integration with other types of spatial data. Data from the submitted cadastral survey files details will be acquired from cadastral division at Survey of Kenya. The primary data to be collected for this study will provide the possibility to examine the opinion relating to the information sharing in the cadastral survey division. Two methods will be used to obtain the information questionnaires, and observations. An explanation of how the two will be put to use is given hereunder.

2.1.2. Questionnaire

The Questionnaires were hand delivered to potential respondents. The two sets of questionnaires were meant to address inter-related issues with a bearing on the development of an effective web based cadastral survey system. In particular, the government/ private Surveyors questionnaire dealt with the following: data storage; updating records; access of information; security of cadastral survey file information; and linkage between the departments. The questionnaires were both closed and open type where possible answers were given. Closed ended have been seen to inhibit the free thinking of the respondent but the open type gave a room to give their views that is by use of commenting more on the question. Observation method is largely employed in areas where the methodology of interviews and questionnaires is unlikely to yield results. A number of factors favor the use of questionnaires. First, it is particularly appropriate due to its anonymous nature. Second, it curbed the cost and time constraints that would hinder the prospect of reaching respondents scattered all over the country. Finally, it allowed respondents adequate time to respond which enabled the procurement of in-depth information. Even then, questionnaires pose some challenges, the problem of low response rate. This was resolved by allowing adequate time and constant reminders to the respondents.

2.1.3. Secondary Sources

Apart from primary data mentioned above, secondary data was gathered in the course of this study. These were the collected and analyzed historical data from both published and unpublished materials. Secondary sources included the field survey, books, journals, newspapers, magazines and previous theses. The field data was captured through the various interfaces in every office avoiding redundancy in the database. Data captured was the cadastral survey file submission date, name of the licensed surveyor who signed the file, registry entry number, records officer, folio register number, computation number and the current officer carrying out the task.

2.2. Research Approach

2.2.1. GIS Database Design

The database is designed using the post GIS and postgre SQL software. PhpAdmin which is a postgre SQL graphical interface was used to connect the database so as it can handle the SQL queries. The database in this project is surveyplan application.

2.2.2. Application Development

This involves the use of mapserver and Php scripts. Apache Web Server was used to serve both static content and dynamic web pages on the local host. Mapserver for windows (ms4W) was installed on a local host server together with Apache. PHP script was used to create web pages, tools and functionalities. Mapserver then was used to link the data stored in post GIS database and thus web mapping application was developed.

2.2.3. Website Development

To create the website, Dreamweaver software was used. It offers login section so as to control the accessibility of the system.

2.2.4. System Integration

Once the database, application and website were developed, all were integrated to form the web based cadastral survey workflow and file tracking system. HTML was used to embed the application on the website.

2.2.5. System Implementation

This involved testing of the system on a local host. The test was successful as it was running and one would track a cadastral survey file online.

3. Results and Discussion

The outcome of the questionnaires administered to different government and private surveyors at the Ministry of Land and Physical Planning is as shown in Figure 1 and Figure 2 below;

The overall results indicated that at present state, the cadastral division at Survey of Kenya has not kept pace with new technology. The research inquired on the problems that, in the opinion of the officers, hindered their timely delivery of services. 45% pointed out lack of soft

wares and hardware, 15% blamed it on low level of computer literate staff, 15% blamed it on lack of ICT skills among the staff, another 10% on faster changing emergency of technology, and 5% was not a priority to them. In the opinion of the system users, 40% pointed out that there exists the problem of modern file tracking services. 20% blamed the system on long cadastral survey processes that

a file must go through, 20% blamed it on lack of automated services at Survey of Kenya for tracking a cadastral survey file. 10% said they also face difficulties in accessing the records since some go missing and others are torn out.

To access the application, a web link gene.webfactional.com/survey/ will be used to log in as shown in the interface below (Figure 3).
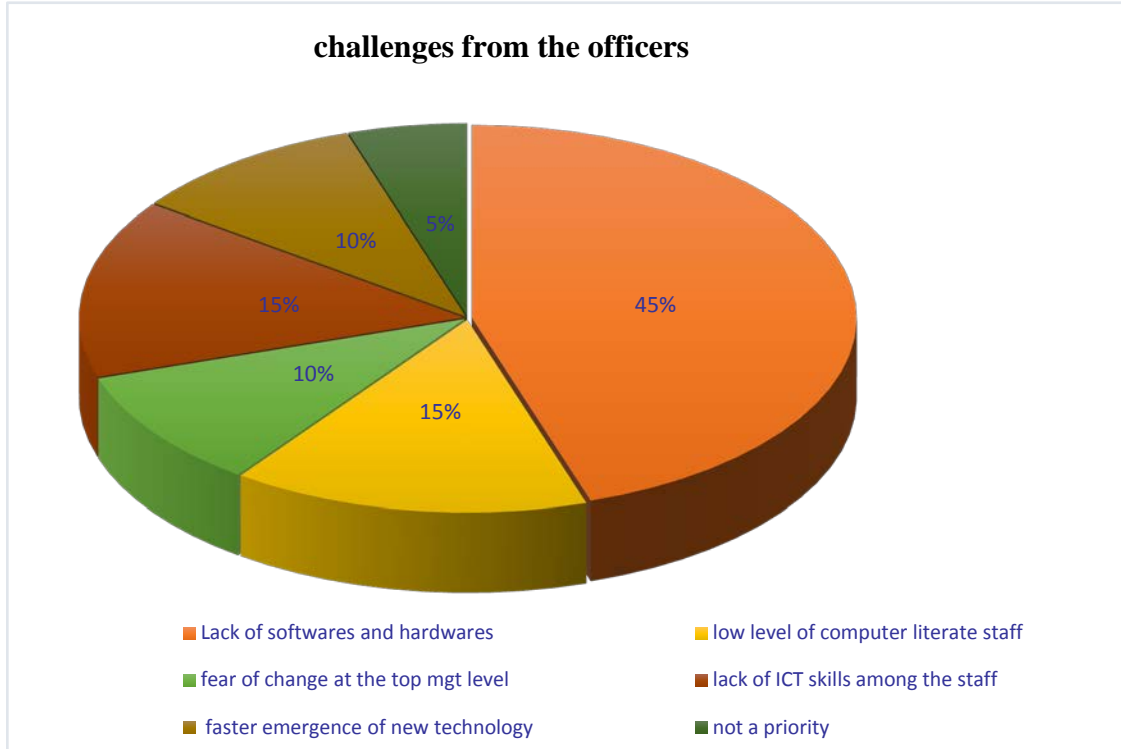

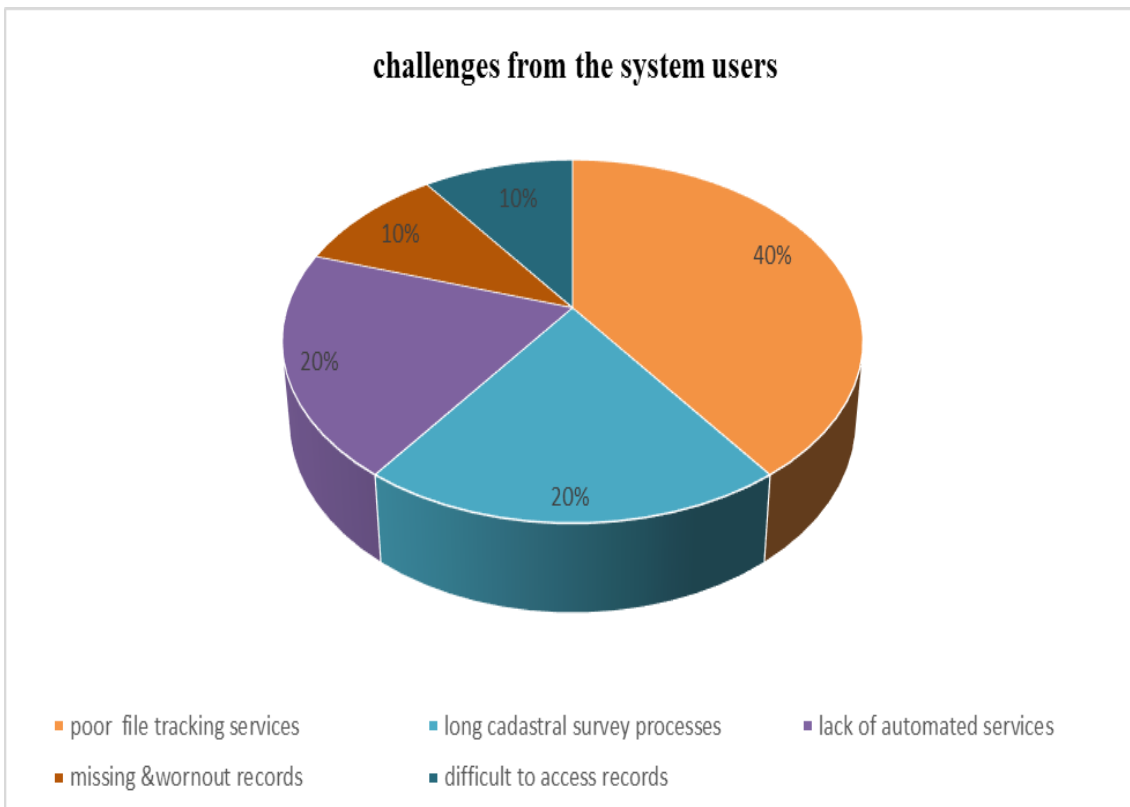**Figure 1.** Survey of Kenya officers' challenges

Figure 2. System users' challenges

This will be used by the officers interacting with the system on daily basis. For the users to access the information, they would need to register for access rights and this will enable them to access only the required information while the information for the users will be hidden. To track for the cadastral survey file, the user types the link gene.webfactional.com/survey/search/search.php, with the unique identifier for tracking a cadastral survey file been the surveyor's ref no. The resulting interface is as below;

Figure 3. Survey of Kenya officers sign up window

Figure 4. File tracking interface

The results are displayed as in the figure below;

Figure 5. Search results window

The results displayed to the online user tracking the cadastral survey file at Survey of Kenya will be; the computation number of the file, folio register number, date that the file was received, the current office where it's being worked on and the file's status (approved, rejected or pending).

3.1. Conclusion

In this study, the existing problems were identified using the questionnaires administered to both the officers interacting with the system on daily basis and other users which includes the government and the licensed surveyors. The main deliverable was the prototype web based cadastral survey workflow and file tracking system which was successfully achieved. This system is a representative of how all the workflows in the Ministry of Land and Physical Planning can be implemented. Its importance is in addressing the automation of the cadastral survey workflow and file tracking at Survey of Kenya.It is important to stress that the current manual cadastral file workflow and file tracking system scenario is time consuming due to the long processes that one has to undergo to track a cadastral survey file at Survey of Kenya, tedious because of moving from one office to another tracking a file, expensive in terms of time and money and insecure due to non-accountability among the members of the staff.

The main deliverable was the prototype web based cadastral survey workflow and file tracking system which was successfully achieved. This system is a representative of how all the workflows in the Ministry of Lands and Physical Planning can be implemented. Its importance is in addressing the automation of the cadastral survey workflow and file tracking at Survey of Kenya. The prototype system designed provides a quicker means of tracking a cadastral survey file at Survey of Kenya. This system is expected to make cadastral survey services accessible to all surveyors in the Republic of Kenya from the comfort of their homes and offices without having to visit the public agencies through the online and mobile platforms. One of the achievement of this system once implemented is that it will be easier to view and track tasks. The database administrator will be able to tell who is responsible for what and whether tasks were accomplished on time as required or not.

This system can be modulated to serve other private and public sectors with workflow and file tracking services. Survey of Kenya should embrace going digital in all sections and automating services to the public and also be improved to support data sharing in land registration section. Therefore, the Ministry of Lands and Physical Planning should adopt the new technology of a web based system of file tracking and cadastral survey workflow in the cadastral division. The Survey Act Cap 299 should be amended to allow the submission of cadastral survey files in soft copy online. This system can be extended to the 48 county governments in Kenya to provide services to the land stakeholders at the county levels who might be in need of tracking their cadastral survey files at Survey of Kenya.

Acknowledgements

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