

# Establishment of Mobile Based Street and Property Address System for Nairobi

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**Abstract:** *Mobile Physical Addresses are of essential public good which facilitate the provision of services, increase efficiency for aid and emergency services, helps in navigation, contribute to the enhancement of social and economic development at the broader scale. While some countries already have physical addresses systems which allow them to carry out their postal needs sufficiently, many countries around the world including Kenya still lack a countrywide infrastructure due to technical, political or financial limitations at any stage of the addressing life-cycle. This research introduces geospatial concepts and relates them directly to the field of addressing by summarizing what should be done and describing the steps that a city should take to integrate GIS and other geospatial techniques into their own addressing projects. Various datasets were obtained from different sources to compile a base map. The Cadastral map for Nairobi Central Business District was obtained from survey of Kenya and overlaid on the aerial photographs to check on the accuracy of the cadastral data, every parcel was given a unique identification and the roads connecting the parcels named according to their directions using ArcGIS Desktop. A web application was configured using ArcGIS online and customized to provide the directions and distances, a mobile application was also developed using collector application for ArcGIS and customized with a user interface. The user enters a given parcel ID and the application access the online database to provide directions, shortest routes and the travel distances. The application also provided for updating new parcels where they are subdivided or amalgamated however, a further research should be carried out to inform Secondary level addressing that will take care of multi-level building, rural and Informal settlements to have an address for everyone.*

**Keywords:** Address System, Cadastral Map, Geodatabase, GIS, Mobile Platform

## 1. Introduction

Street and Property Addressing system is a component that is used for way finding. While some countries already have either postcodes and/or addresses which allow them to carry out their postal needs sufficiently, many countries around the world including Kenya still lack a countrywide infrastructure due to technical or financial limitations at any stage of the addressing life-cycle. The Universal Postal Union's 2009 "Addressing the World, an address for everyone" initiative emphasized the importance and helped to establish the foundations for the creation and adoption of addresses around the world. In 2012, the Doha Declaration C 82/2012 was passed which emphasizes the need to adopt new technologies for the development of address infrastructures, thus identifying the measures which should be taken to ensure that the ATW initiative can be fulfilled. (Stephanie R, Patricia V.2014). The absence of street names and property numbers coupled with the mounting rate of urbanization presents a disturbing development trend. Government of Ghana, (2010)

Recently, Nairobi City has experienced extremely rapid infrastructure growth. This has created a scenario where many buildings are not identified in the systems of the National and county Governments. Key services have not been extended to them and so inadequate identification systems have created a worrisome predicament for urban services. Street addressing is a System that makes it possible to identify the location of a plot or property on the ground, that is, to assign an address using a system of maps and signs that give the numbers or names of streets and buildings (Godin, L. 1987).

Nairobi city has been confronted by demographic explosion and therefore urban management has become more challenging amid the current trend towards decentralization of urban services. With little experience in urban management, Nairobi City government has often been unable to develop the resources they need to deal with urban growth. Against this backdrop, systems for identifying streets, buildings, and plots have simply been unable to keep up with the pace of urbanization. Thus, more than 70% of the city streets in Nairobi have no names and therefore no addresses. Statistics by the Courier Industry Association of Kenya (CIAK) show that lack of appropriate addressing system in Kenya has slowed down the growth in e-commerce. In Kenya alone, miss-deliveries owing to lack of clear addresses amount to 17 per cent, delayed deliveries are at 58 per cent and non-deliveries are at 25 per cent. The main objective is to set up a street and property address system database on built and spatial environment which will be the source of urban information and available to improve efficiency in location and service delivery to the public by the relevant agencies, Kenyan government and Nairobi city county government.

## 2. Objectives

The main objective was to set up a street and property address system which will be the source of urban spatial information, others included;

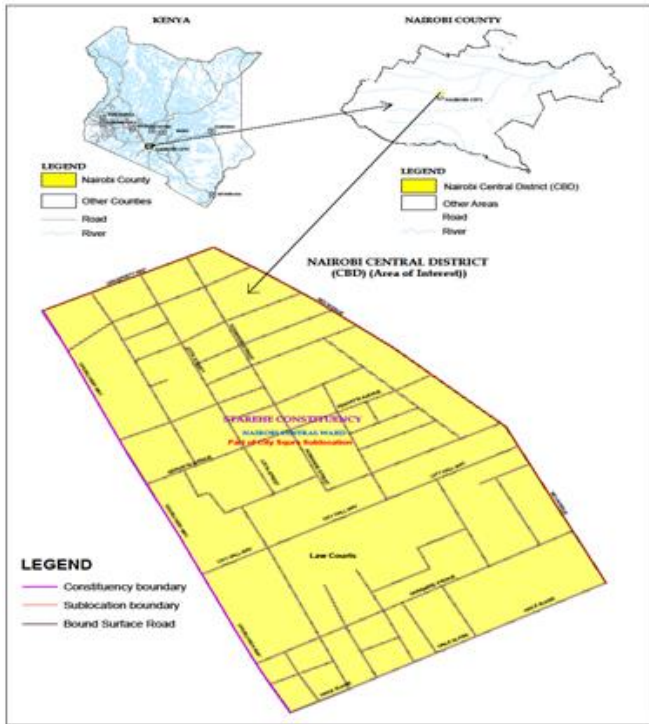
- 1) To develop a Geodatabase of the city CBD that can be used by different Government units for efficient revenue collection and service delivery.
- 2) Design a mobile based data model capable of uploading location based property addresses to the web portal.

3) To enable the portal to be updatable and expandable to accommodate future spatial developments and ease of navigation.

### 3. Methodology

The scope of study covered Nairobi City 's Central Business District (CBD). This is the area enclosed by Uhuru Highway, Haile Selassie Avenue, Moi Avenue and University way. This area is divided into two zones, 1 and 2, where the boundary is Kenyatta Avenue in the CBD.

Nairobi city lies at the Latitude of 1°16.9998' S and a longitude: 36°49.0002' E and covers an area of 695.1 square kilometers. Nairobi County borders Kiambu County to the north, Machakos County to the South and Kajiado County to the west. It has a population of approximately 3.2 Million people making it one of the highly populated counties in the country and in the east African region. Almost all people live in the urban areas since all parts of the County are urban areas.



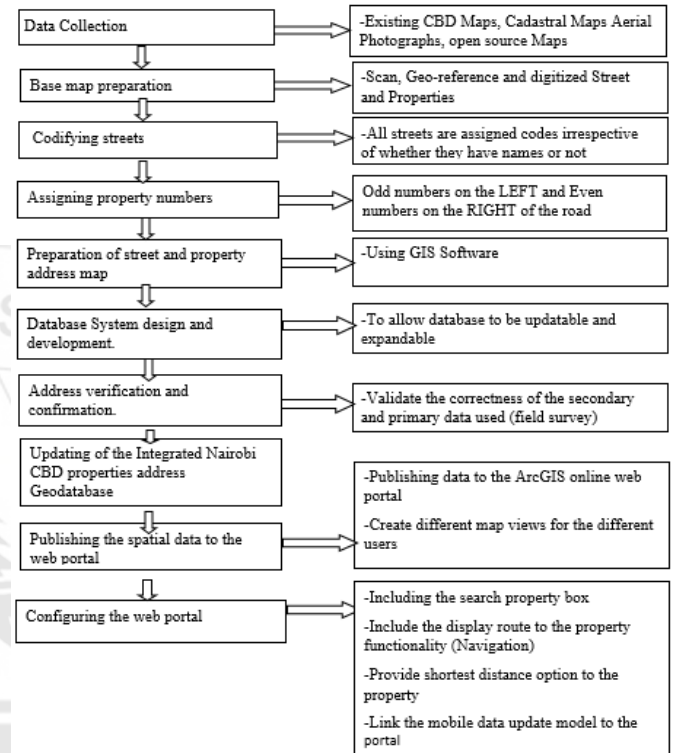
**Figure 1:** Flow Diagram

### 3.1 Datasets and Materials

Various datasets were obtained from different sources to compile a base map. The Cadastral map for Nairobi Central Business District was obtained from survey of Kenya. This was very useful in identifying the property boundaries, the Land reference numbers and the streets which are the basic information required for establishment of a physical address system. Aerial photographs were sourced from the Directorate of Urban and Metropolitan Development. The cadastral maps were overlaid on the aerial photographs to check on the accuracy of the cadastral data. Street center lines data was sourced from the Kenya Urban Roads Authority. Primary data was collected through field survey to identify all the names of the buildings on each property.

### 3.2 Application Development

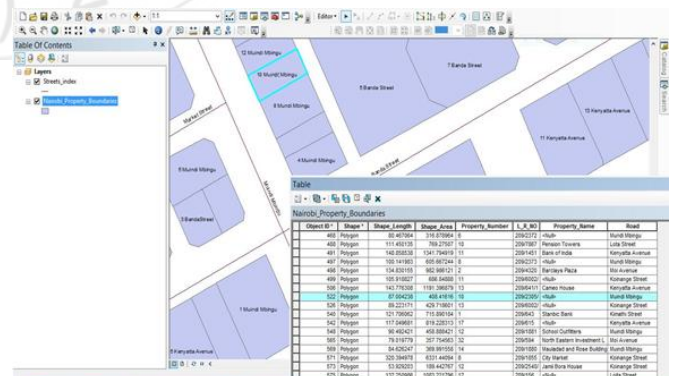
The procedure involved data collection, base map preparation, codifying streets, assigning property numbers, preparation of street and property address map, database system design and development, address verification and confirmation by carrying out ground truthing, Updating of the Integrated Nairobi CBD properties address Geodatabase, Publishing the spatial data to the web portal and Configuring the web portal.



**Figure 2:** Flow Diagram

## 4. Results and Discussions

A GIS Based Physical Address System base map was developed to be up loaded to the web portal.

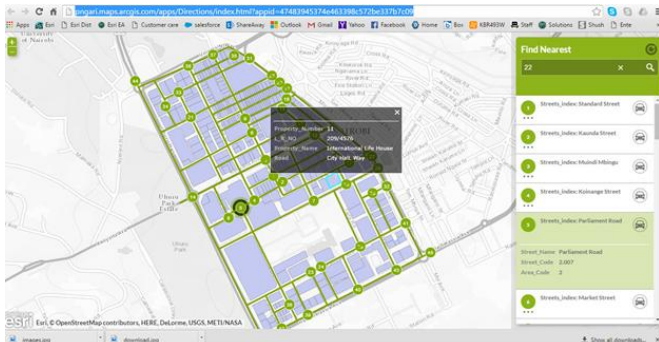


**Figure 3:** A GIS Based Physical Address System Database

### 4.1 Development of the Web Portal

The service was published directly from ArcMap where feature services were published from the geodatabase created. The viewer's functionality was exposed through

sections of prewritten code called widgets. where they enabled clients to switch between base maps in the map display and also allowed clients to find an address on the map. The portal was enabled so that one can add, remove, and customize widgets as needed. Many core widgets; Edit, Overview Map, and Query widgets, were included in the application using ArcGIS API for Flex.



**Figure 4:** Published Map

#### 4.2 Mobile Application Configuration

The mobile application was configured with the portal and enabled functionalities such as Collecting, updating information in the field and accessing the portal to download the maps for updates. This configuration also enables one to see on the portal, the location of the mobile device, capturing photos to geotag them and upload to the portal.

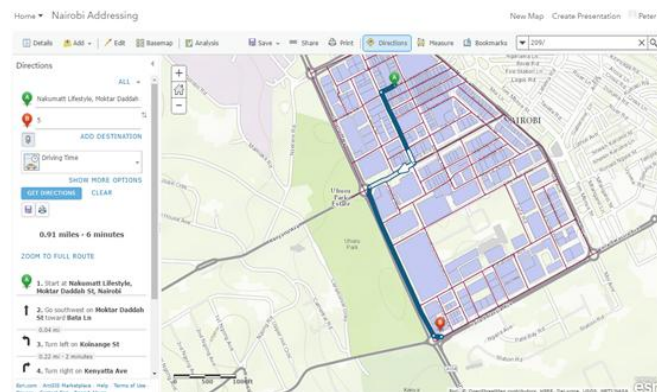


**Figure 5:** Mobile Application

#### 4.3 Development of Navigation Module

Getting directions is a key feature of any addressing system, this is where the user was able to input the address into the mobile application and the application gave the user directions to that address. The application was able to provide a turn-by-turn navigation in both offline and online modes. Users were able to enter a destination address, landmark, or business name, and then the app automatically calculates directions and distance to the destination. The application was customized on the online portal and can be

accessed via GPS android enabled phones, tabs or via web browsers depending on the gadget someone is using.



**Figure 6:** Navigation application

### 5. Conclusions and Recommendations

Physical addressing System has a lot of social economic and political benefits as detailed in this research. However, this study was only conducted to the level of primary addressing of street and property (parcel) which is not adequate as it has addressed formal cadastral parcels of land and on established street network.

Further research should be carried out to inform Secondary level addressing that will take care of multi-level building, rural and Informal settlements to have an address for everyone. Physical addressing system can be adopted as an e-commerce platform necessary to boost and spur economic growth for any country. This is made possible by many economic benefits associated with the system.

In feature development, real-time traffic data (where available) may also be factored and a prediction made on arrival time to the destination.

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