Design of Survey Beacons Information System With Google Earth Being the Medium for Location Based Geo-Visualization; Case Study – Greater Accra Region of Ghana

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Key words: Web based database, survey beacons, Google earth, spatial location, cost-effective.

SUMMARY

This is a summary on the paper on design of survey beacons information system with Google earth being the medium for location based geo-visualization; case study – Greater Accra region of Ghana. This explains the latest developments in addressing the rising demand for cost-effective and easy access to survey beacons and their coordinates for land surveying purposes in Ghana.

In the effective and accurate execution of any land surveying project in Ghana, there is the need for the use of existing, reliable, accessible and accurate survey beacons. In the global world and in the advent of technology, time is of essence and therefore easy and quick access to survey beacons-and-their-coordinates is of uttermost importance, hence the need for a web base database to save time, cost and energy. Also locating these survey beacons on the Google earth will further enhance the use of modern and cost effective survey techniques to meet the rising demand for the land related positioning activities in the country.

This paper looked at providing a comprehensive database of survey beacons and over laying on Google earth for their spatial location and linking it to a website for easy access and retrieval. The record of some major survey beacons in Greater Accra from Records Section of Survey and Mapping Division in Hard copy, the Record of GRN beacons within the project area from GRN office of the Survey and Mapping Division - Hard Copy (War Office coordinates) and Soft Copy UTM coordinates and Google map of the project area - Digital were used to create database and generate the KML files.

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1. INTRODUCTION

The need to develop a comprehensive and accessible geodatabase of survey beacons in Ghana has been driven by the quest for the use of modern and cost effective survey techniques to meet the rising demand for the land related positioning activities in the country. These include general land administration and management, geotechnical investigations, traffic and transportation, meteorology, timing, survey and mapping, engineering, GIS, and other multidisciplinary applications.

In view of the above developments and other factors the Survey Department of Ghana, through the Land Administration Project (LAP), under the Ministry of Lands, Forestry and Mines of the Government of Ghana embarked on the establishment of the new Geodetic Reference Network, which is based on the ITRF to replace the old network based on the War Office 1926 Ellipsoid.

This demand-driven project has been divided into phases, with the first phase covering the Golden Triangle of Ghana already completed and the second phase which is supposed to cover the whole country is still ongoing in LAP 2 . The Golden Triangle of Ghana covers a little over a third of the area of the country and has high economic activity in the country. With the three largest cities in the country at the vertices, it has about 58% of the population, almost all the major existing mines, higher land value and many factors that required the use of this modern and efficient method for positioning.

The three permanently operating reference stations have been established at the vertices of this triangle with eighteen second order reference stations spatially well distributed in this area in question. A fourth permanent station has been co-located at the Takoradi Tide Gauge, under the GNSS Upgrade in Tide Gauges in Africa (GUITA) project for the definition of the vertical datum for Ghana. Some of the monuments used as reference stations are shown in figure 1.1 (Yaw Poku-Gyamfi *et al,* 2007). To be able to get easy and quick access to these reference station and the others a beacon information system was designed.

1.1 Aims and Objectives
- To provide a database of survey beacons over laying georeferenced orthophoto of thier spatial location and linking it to a website for easy access and retrieval.
- To publish the beacons onto Google earth for location base analysis.

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1.2 Limitation

This project does not guarantee the stability and accuracy of the position of the beacons on the ground. It is therefore necessary for every surveyor who want to use any points of departure to test the beacons before using them.

Figure 1.1: Monuments for the Permanent Stations

1.3 Project Motivation

What motivated the adoption of this project was the fact a similar system has been develpoed for City of Kent. Figure 1.2 shows the interface of beacons information system displaying beacons on ArcGIS online
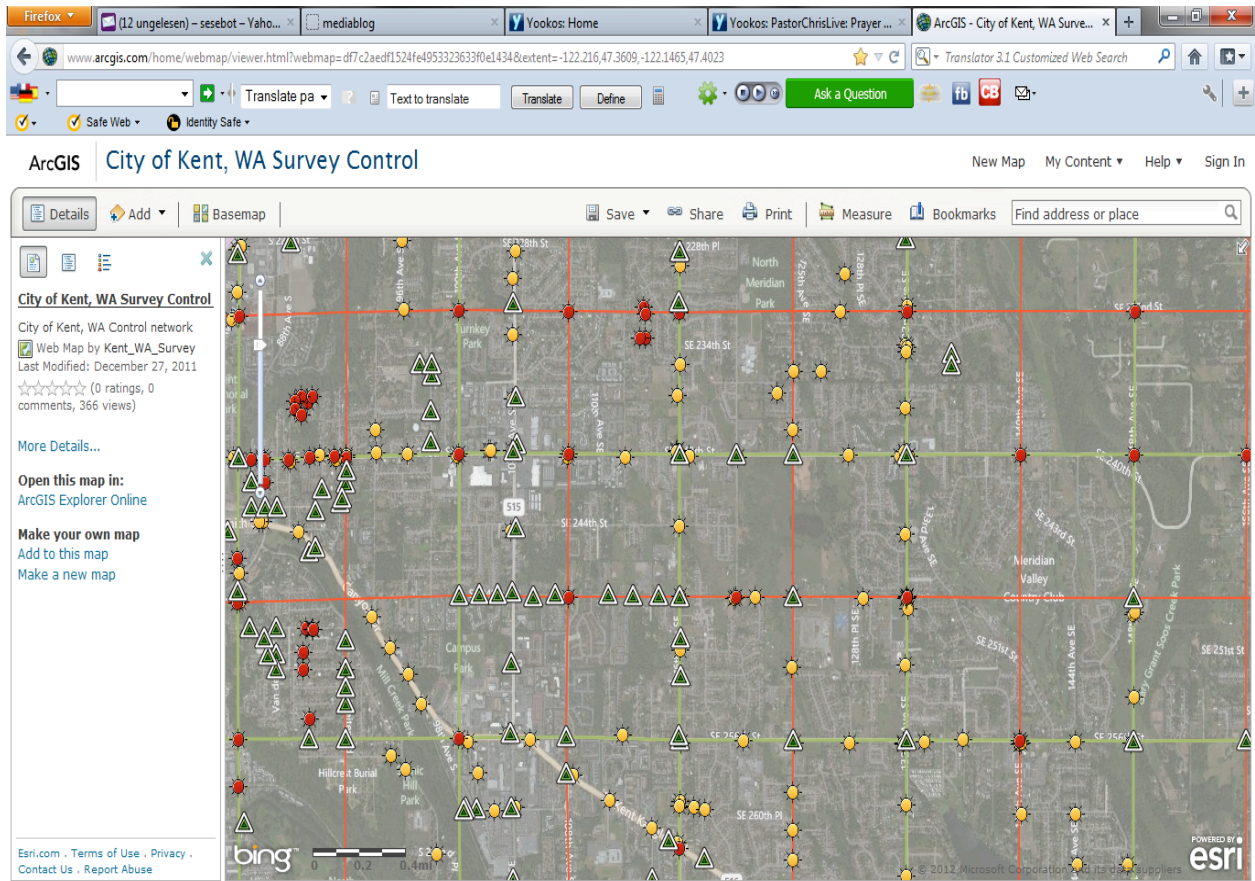
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Figure 1.2: City of Kent Beacon Information System

1.4 Study Area

The **Greater Accra Region** is the smallest of Ghana's 10 administrative regions in terms of area and on Latitude 5.7500° N, Longitude 0.0000° W, occupying a total land surface of 3,245 square kilometres or 1.4 per cent of the total land area of Ghana. In terms of population, however, it is the second most populated region, after the Ashanti Region, with a population of 2,905,726 in 2000, accounting for 15.4 per cent of Ghana's total population. The Greater Accra region also harbors the seat of government in the capital city of Accra. At least a beacon has been located in each major administrative district of the region for this project. Figure 1.3 shows the project area.

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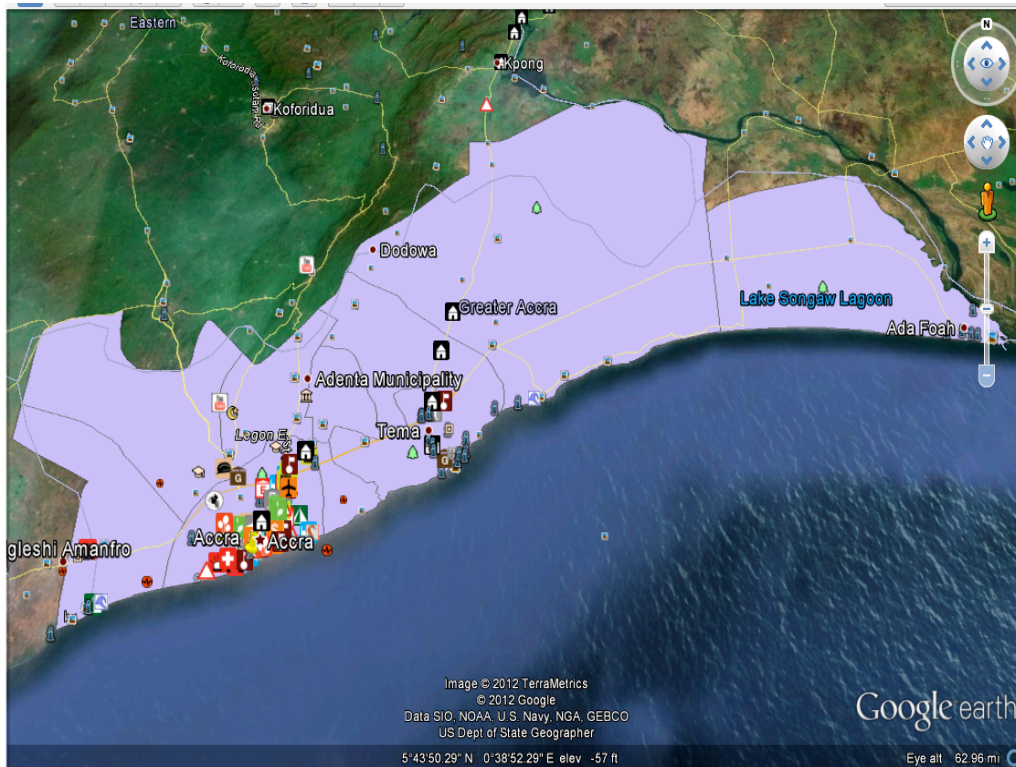Kuala Lumpur, Malaysia 16-21 June 2014

Figure 1.3: Greater Accra Region (Project Area) on Google Earth

2. PROJECT DATA SOURCE

- ✓ The record of some major survey beacons in Greater Accra from Records Section of Survey and Mapping Division - Hard copy
- ✓ The Record of GRN beacons within the project area from GRN office of the Survey and Mapping Division - Hard Copy (War Office coordinates) and Soft Copy (UTM coordinates
- ✓ Google map of the project area - Digital

2.1 Coordinate Systems Used

Projected Coordinate System**: -** Accra_Ghana_Grid (based on War Office spheriod)

Projected Coordinate System**: -** UTM_Zone30N (based on WGS 1984), for KML(KMZ)

Geographic Coordinate System**: -** WGS 1984 for ArcGIS online. Poku-Gyamfi Y, G. W Hein (2006)

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2.2 System Software and Hardware Used

- Computer - For all activities in the web application.
- Internet Connectivity - for researches, downloads and prototype testing of application
- Microsoft Excel - for structuring the data.
- ArcGIS (ArcMap & ArcCatalog)
- Dreamweaver CS4 - for creating the web application.
- Macromedia Fireworks - for modifying images for the website.
- MySQL - for database creation.

3. METHODOLOGY

The data collected was tested (visit to site to check the existence of pillars), structured in MS Excel and converted to shapefile for projection and conversion to KML file.

3.1 Data Structuring in Excel

After gathering the data, the data was structured in Microsoft Excel for a logical design of the database in MySQL

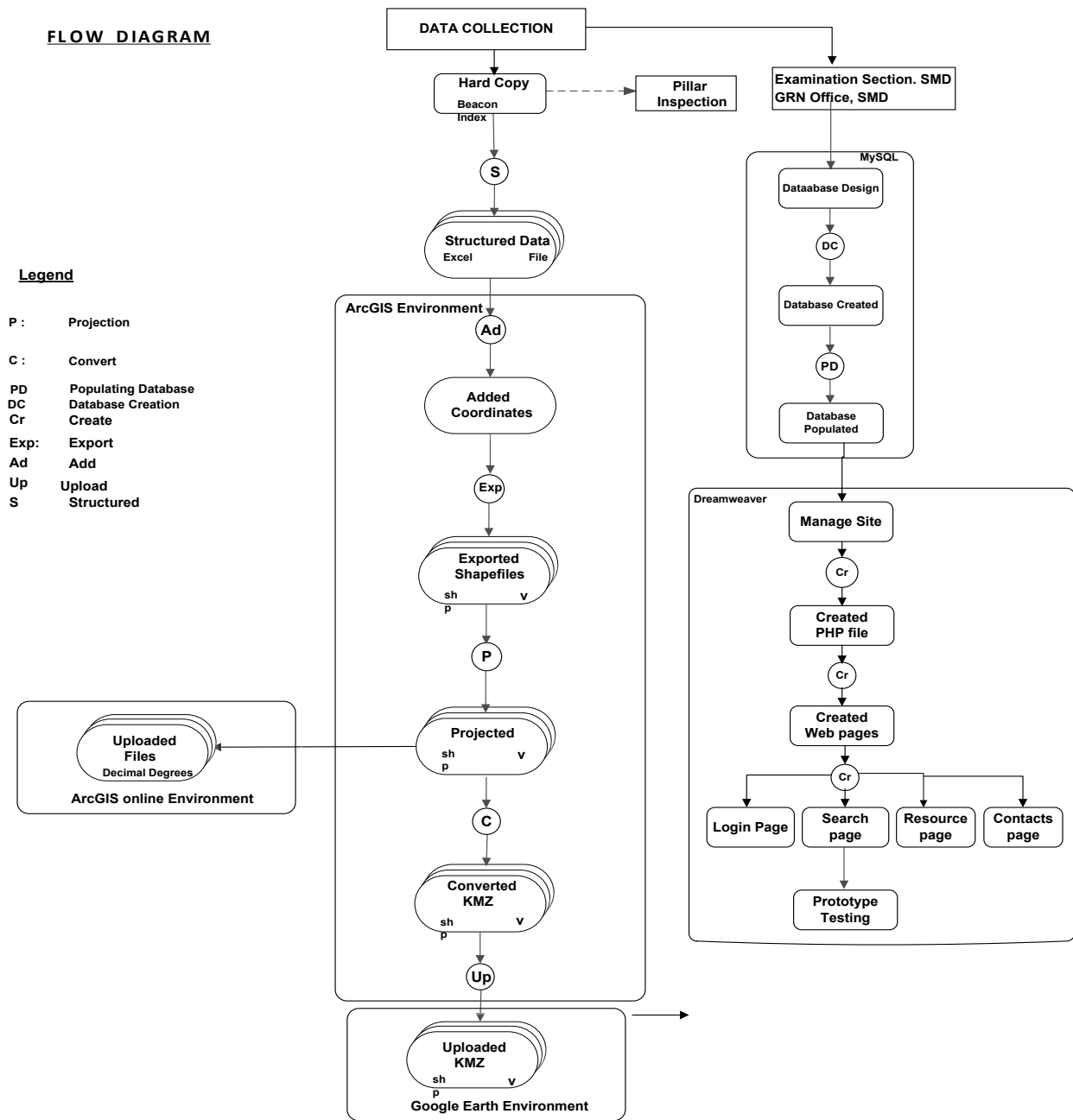Design of Survey Beacons Information System with Google Earth Being the Medium for Location
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Figure 3.1: Flow Diagram

ID	X	Y	Z	Location	Year Established	Unit_Meas	Projection	Speroid	Type	Existing	Adm_Dist	Dimension
SGGA6/90/68	439269.51	1225462.16	71.978	Dodowa	1990	Int_Feet	TM	War Office	C	Yes	Dangme West	3D
SGGA6/90/69	438990.16	1226269.12	69.349	Dodowa	1990	Int_Feet	TM	War Office	C	Yes	Dangme West	3D
SGGA6/90/70	437706.46	1227471.58	64.48	Dodowa	1990	Int_Feet	TM	War Office	C	Yes	Dangme West	3D
SGGA6/90/71	437397.02	1227935.58	62.37	Dodowa	1990	Int_Feet	TM	War Office	C	Yes	Dangme West	3D
SGGA1240/98/8	438781.217	1226518.485		Dodowa	1998	Int_Feet	TM	War Office	C	Yes	Dangme West	2D
TP3	334275.43	1196950.94	169.319	Survey School		Int_Feet	TM	War Office	A	Yes	Accra Metropolitan Assembly	3D
SS 66	334151.61	1197056.15	168.806	Survey School		Int_Feet	TM	War Office	C	Yes	Accra Metropolitan Assembly	3D
SGSS 11/96/1	334302.06	1196989.03	169.12	Survey School	1996	Int_Feet	TM	War Office	C	Yes	Accra Metropolitan Assembly	3D
SS 68	334527.53	1197428.76	168.597	Survey School		Int_Feet	TM	War Office	C	Yes	Accra Metropolitan Assembly	3D
SS 92	334509.5	1196871.565	168.372	Survey School		Int_Feet	TM	War Office	C	Yes	Accra Metropolitan Assembly	3D
SGGA203/99/CP2	415676.08	1218905.07		Oyibi	1999	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA203/99/CP3	416687.56	1219211.85		Oyibi	1999	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA203/99/CP4	417321.76	1219315.65		Oyibi	1999	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA712/99/1	382207.86	1204175.05		Fafraha	1999	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA712/99/4	382631.36	1204364.55		Fafraha	1999	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA16/93/1	326741.04	1159645.54		Mallam Junc	1993	Int_Feet	TM	War Office	C	No	Ga South	2D
SGGA16/93/2	326475.39	1159273.06		Mallam Junc	1993	Int_Feet	TM	War Office	C	No	Ga South	2D
SGGA28/92/CP12	326916.33	1159866.02		Mallam Junc	1992	Int_Feet	TM	War Office	C	No	Ga South	2D
SGGA08/221/2A	326631.431	1159310.155		Mallam Junc	1993	Int_Feet	TM	War Office	C	No	Ga South	2D
SGE13/73/20	369516.7	1209336.68		Ashale Botwe	1973	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGE13/73/21	368969.47	1209282.32		Ashale Botwe	1973	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA019/71/53	369055.35	1209296.48		Ashale Botwe	2008	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA019/71/9	368884.55	1210048.31		Ashale Botwe	2008	Int_Feet	TM	War Office	C	Yes	Adenta Municipal Assembly	2D
SGGA956/01/11	382001.895	1301986.567		Prampram	2001	Int_Feet	TM	War Office	C	Yes	Dangme West	2D
SGGA956/01/12	382022.465	1301720.539		Prampram	2001	Int_Feet	TM	War Office	C	Yes	Dangme West	2D
SGGA956/01/9	381335.439	1303316.526		Prampram	2001	Int_Feet	TM	War Office	C	Yes	Dangme West	2D

Figure 3.2: General structure of data collected in Excel

3.2 Creating Shapefiles in Arcgis

The data in Excel was imported into ArcGIS which was exported to shapefiles for the creation of KML to display on Google Earth.
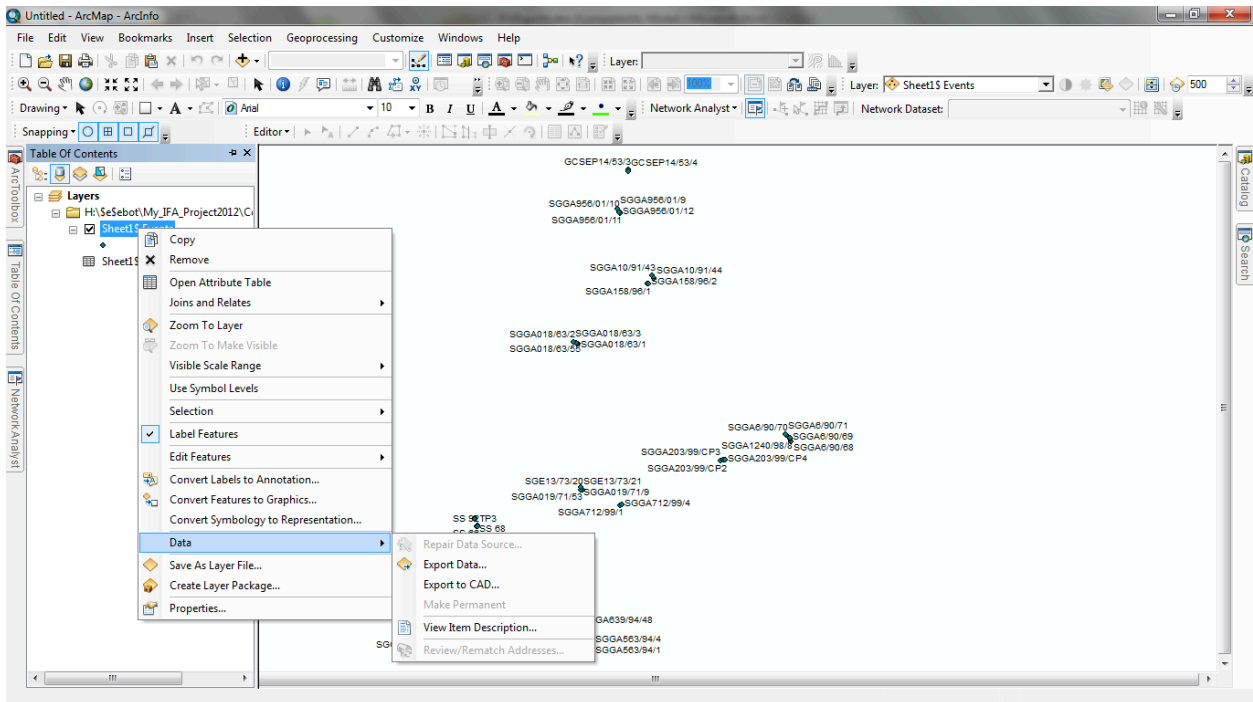
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Figure 3.3: Exporting data to shapefiles

3.3 Creating the KML (KMZ) File in Arcmap

NB. To see the pillars with IDs displayed on Google Earth, you must label the features in ArcMap (use the UTM projected data). Since KML file format is compatible with Google earth, the KML was created from the Conversion Tools in ArcToolbox of ArcMap based on the UTM projected data. Rolf A. de By, (2004)
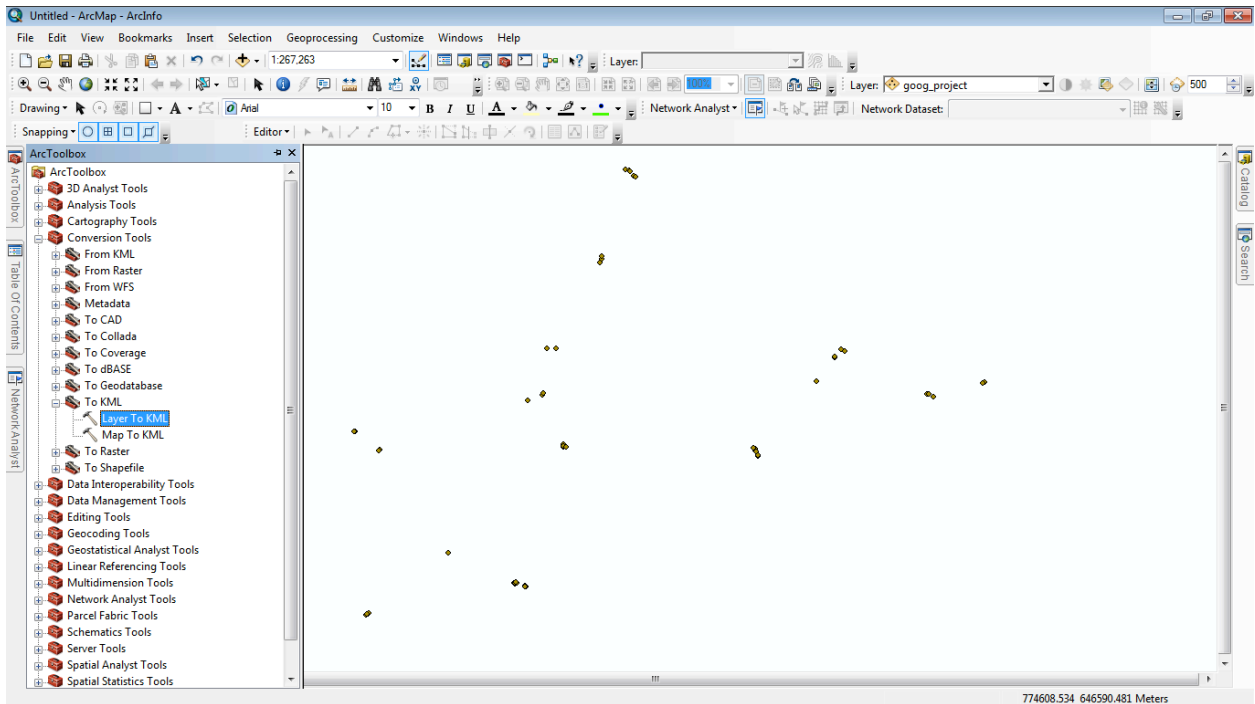
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Figure 3.3: Exporting data to shapefiles

Choose the projected shapefiles as the layer. For the output file, browse to the location you want to save the result type 2500 as the Layer output Scale and click ok. Now locate the kmz file its destination and double click to open. It will open directly in Google Earth. NB. You must have Google Earth software installed be you can see the results.
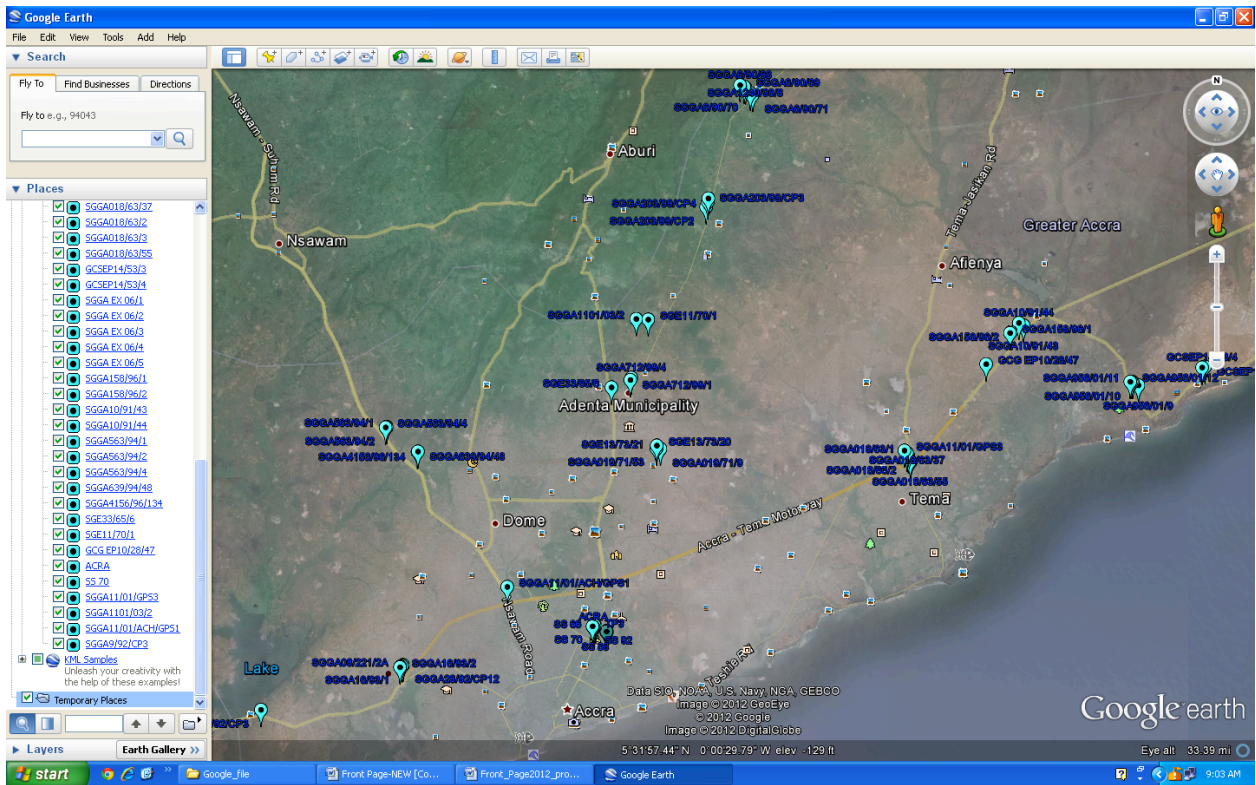
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Figure 3.4: Result of the kmz file in Google Earth
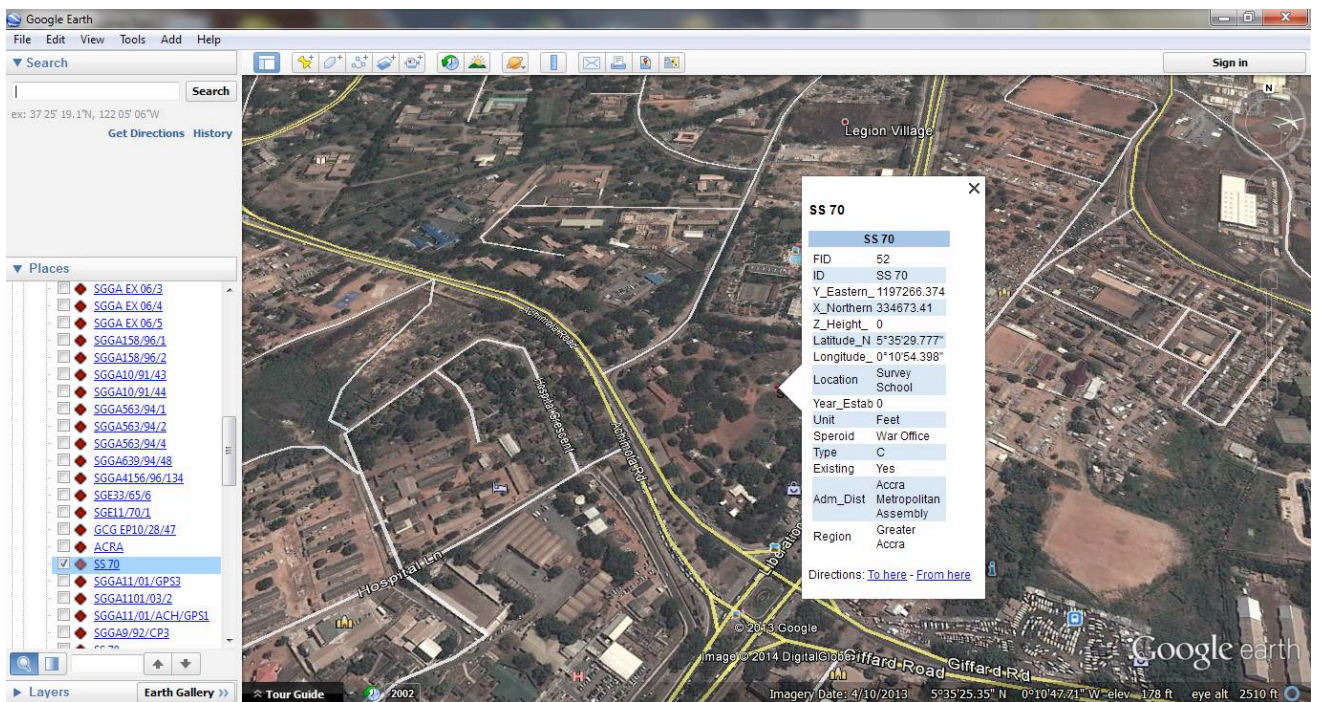
Figure 3.5: A Beacon with details in Google Earth

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3.4 Adding Data to the Map on Arcgis Online

To add data to ArcGIS online, you must first create an account.
You can either import data files or by Dragging and dropping a file.
The following steps can be used to add files.

- Open the ArcGIS.com map viewer, for example, by clicking the Map button.
- Click the Add button.
- Choose Add Layer from File.
- Locate the file on your computer.
- Click Import Layer field.
- If you add a delimited text file (.csv or .txt) with address information, choose to have the ArcGIS.com map viewer locate features using latitude-longitude or address information. Review the location fields and click a cell to change which location field or fields are used. See About CSV, TXT, and GPX files for more information.
- If you add a shapefile, choose to generalize the features for web display or keep original features.

In addition to importing your data file through the ArcGIS.com map viewer Add button, you can drag a file from your computer and drop it onto your map. The map viewer will handle the file as if you had used the Add button. Dragging and dropping .csv, .txt, .gpx, and shapefile (.zip) files is supported on Google Chrome and Mozilla Firefox browsers; it is not supported on Internet Explorer and Apple Safari.
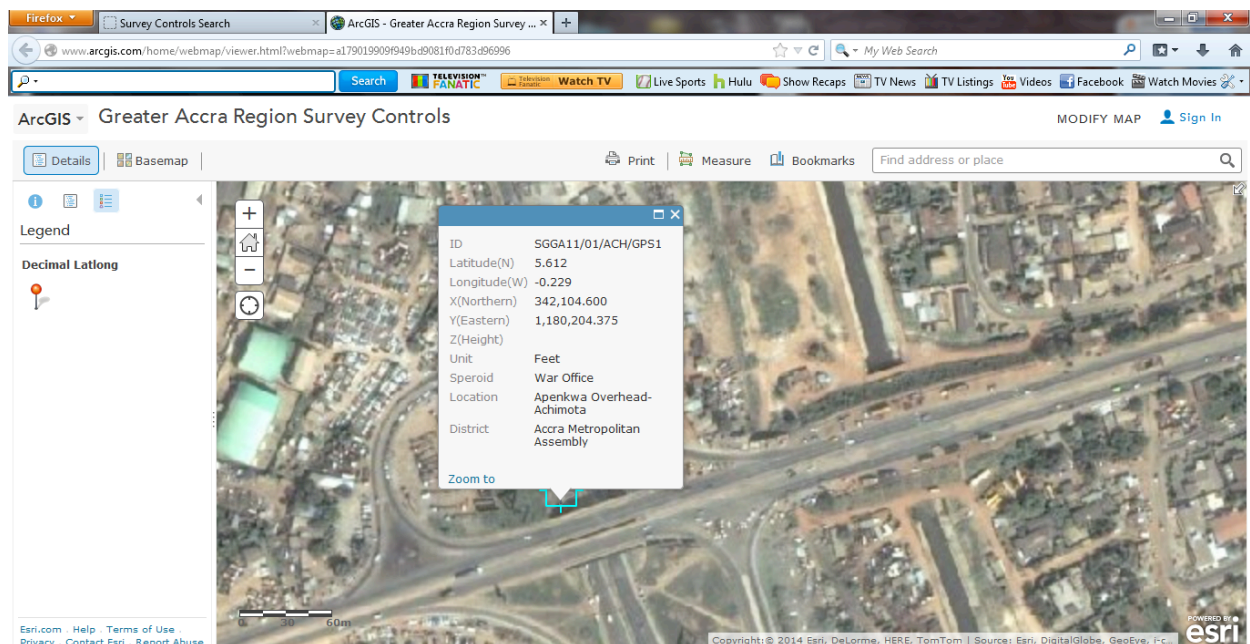
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Figure 2: Display of a beacon zoomed to its location with its details

3.5 Web Application

Database of the beacons was created and Navicat Premium was used to manage the database since it is easier to connect to MySQL and create tables. The database contains all necessary attributes of the beacons.

A website with and access interface was designed and linked to the database. The interface give the user the opportunity to create user account which enables him to access information on the beacons with permission from the system administrator. The system administrator can query the system to know the users of the system. Below are some of the results. Matt Zandstra, (2000),
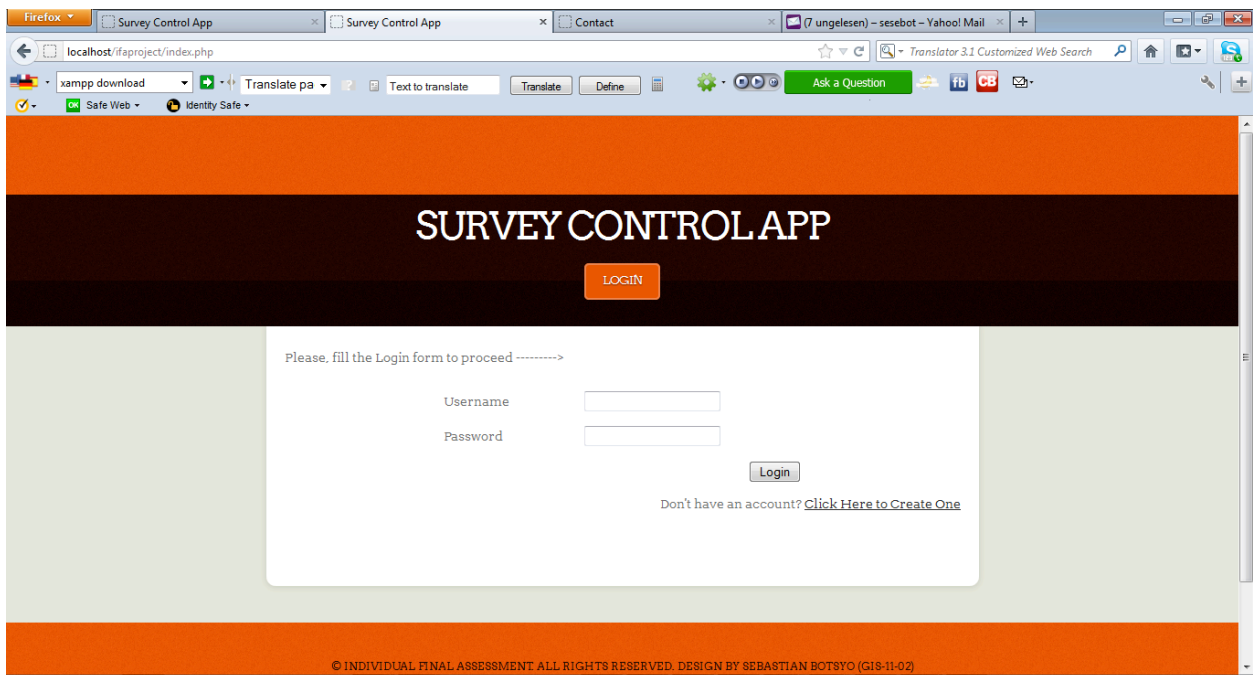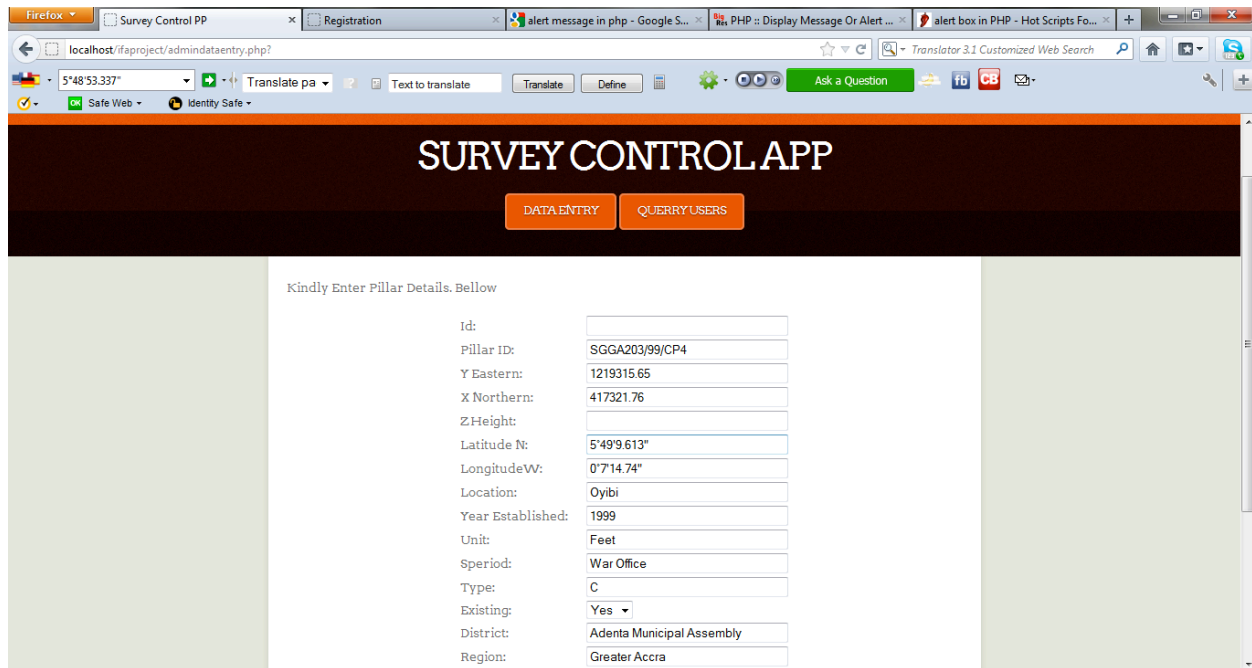

Figure 3.7: Registration Page

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Figure 3.8: Data entry into database

4. CONCLUSION

The first phase of this project has produced a web based application for easy access and retrieval of survey beacons included a comprehensive database covering the Greater Accra Region of Ghana. These survey beacons have also been launched on ArcGIS online and Google earth for location base view and analysis. The next phase intends to cover the rest of the regions in Ghana.

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BIOGRAPHICAL NOTES

– Surv. Sebastian Botsyo(MGhIS) is a very determined practical person with the ability to learn new skills quickly. He possesses enthusiasm, versatility and enjoys working well as part of a team, yet he is equally at ease working on his own initiative. He is currently offering Geomatic Engineering from Kwame Nkrumah University of Science and Technology. He holds a Technologist Diploma in GIS Operations from the faculty of International Institute for Geo-information Science and Earth Observation (ITC) of the University of Twente, Netherlands. He also holds a Higher National Diploma (HND) in Land Surveying from Ghana School of Surveying and Mapping (GSSM), Ghana. He is trained teacher with Certificate "A" in basic education from the University of Cape Coast, Ghana. He is a Technical Instructor and Geomatic Technician at GSSM. He gives instruction on Surveying and Mapping principles and practical use of Theodolites, Total Station, Leveling Instrument and Global Positioning System (GPS), Supervision of field practical in outstations. Production of cadastral plans for registration and anything related to surveying. He is a professional member of Ghana Institution of Surveyors (GHIS), a Planning Committee member of the Annual General Meeting for the Land Surveying Division of GhIS for 2013. He attended the FIG Working Week 2013 in Abuja, Nigeria

– Surv. Kwabena Boafo (MGhIS) obtained a membership diploma of Ghana Instutition of Surveyors in 2007. He is currently a lecturer at the GSSM/ITC school of Geoinformatics in Principle of GIS and Princeiples of Computer programming.

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