Tool for Collecting Spatial Data with Google Maps API

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Abstract. In this paper, we develop tool for collecting spatial data based on Google Maps API. The tool is implemented using AJAX and XML technology. It helps marking the maps in various forms. Then, after the users define the regions in the maps, the associated data can be described and stored in the database. The data can be further analyzed and displayed in the GIS. The tool supports the KML and NMA files where the user specification can be export and the offline data in such a form can be imported to the system as well. We demonstrate a case of using the tool to collect the spatial data in agriculture area.

Keywords: Google Maps API, Spatial data, AJAX, XML, NMEA.

1 Introduction

The popularity in GIS applications leads to development in various GIS tools. The software helps manage geographical information in many ways such as collecting associated data for landmark in traveling and directions. Google maps become popular tools which provide maps as well as tools for user data. With its open technology, the users can share information, ideas, or develop their owns applications using Google maps API [3].

Also, there are others GIS technology. Though they are powerful, some of them are commercials which are still expensive. To develop applications based on them will be costly and complex.

Various applications are developed based on Google Maps such as the work by NECTEC [2]. This work proposed a way to estimate the travel time in Bangkok using Google Maps. The work by WLHP [9] presented a GIS application to display pollution. Hrvoje Podnar et.al. [1] visualize the students population using Google Maps. Shinji Kobayashi et.al. [6] use Google Maps to refer the patients to the nearest hospitals. Bruce A. Ralston [8] presents a tool to generate areas using KML for population survey in the United States.

In this work, we take advantage of the Google Maps API , including the online maps, and geographical coordinates. We develop the tools to record GIS data from various sources such as user inputs, and from KML as well as NMA formats. Then, the data is recorded in the database for further development in GIS applications.

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2 Backgrounds

In this section, we briefly describe the necessary backgrounds in GIS technology as it is related to our work.

Geographical information systems are the systems which take advantages of spatial data and define the relationships to the interest issues. The information may be the home address, for example, which is mapped to the spatial data such as the latitude and longitude. Then the database further stores more information about the address.

The important part in developing the GIS applications is the data capture and storage. The data which includes the spatial coordinate and associative database needs to be provided in any valid means. The spatial data may be imported from interactive equipments or files. Then the coordinate is converted appropriately. Many applications are available to help import data such as ArcInfo (http://www.esri.com/software/arcgis/arcinfo/index.html), ArcView (http://www.esri.com/software/arcview/index.html), Mapinfo (http://www.mapinfo.com), ERDAS (http://www.erdas.com) etc. After that, the associated database is imported by any normal program. To store spatial information, it is common that the vector format is used. The storage may keep only points, lines, or areas [3].

Google Maps [5] is an open technology that provides maps. The user can use the web browser to look at the maps. Several convenient tools are built-in such as zooming in and out, marking, view satellite data, etc. While Google maps provide map information, Google Earth [4] is a software to view satellite data in high resolutions. It can save the data in KML file. The KML file is extended from XML which is used to describe the data[11-12]. The KML file can be used together with the Google as shown in Figure 1. Besides the KML file, NMEA 0183 is a standard for GPS data. It is the protocol used by GPS producers to communicate with other devices [13]. In this work, we also consider to import data from GPS device as well.

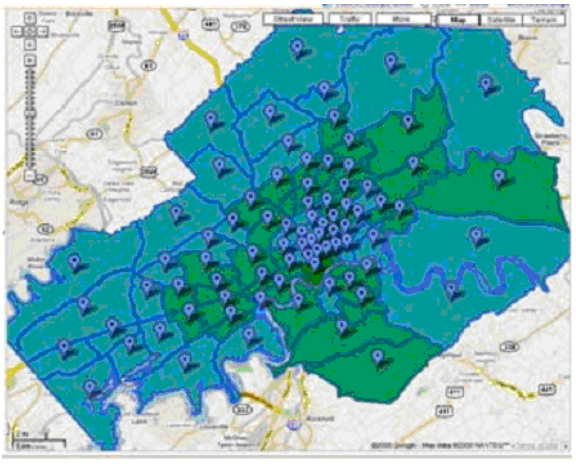

Fig. 1. KML used in Google Maps [8]

3 Tool Architecture

In the development tool, it contains 5 modules as in Figure 2.

1. User module: it is to communicate with the users by importing or exporting spatial data in NMA files or KML files, or by user input specification.
2. GPS module: it is used to store data from GPS devices and convert NMA files to XML files for display.
3. Converter module: it is to convert KML files to XML files for the display purpose.
4. Presentation module: it takes the spatial data in the database table and convert to XML for display. When converted to XML, we also tag whether it is a point, line or area.
5. Drawing model: it will take the XML files from other modules to overlay on Google Maps in various forms according to the coordinate specified in the database.

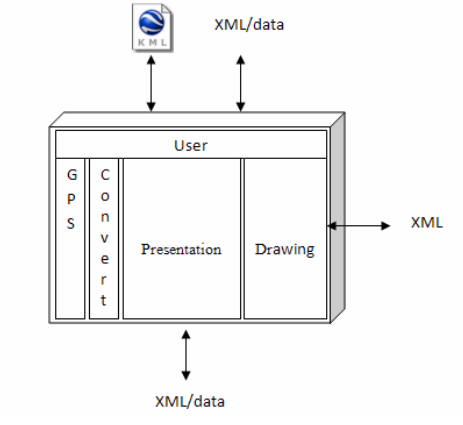

Fig. 2. Architecture of the tool

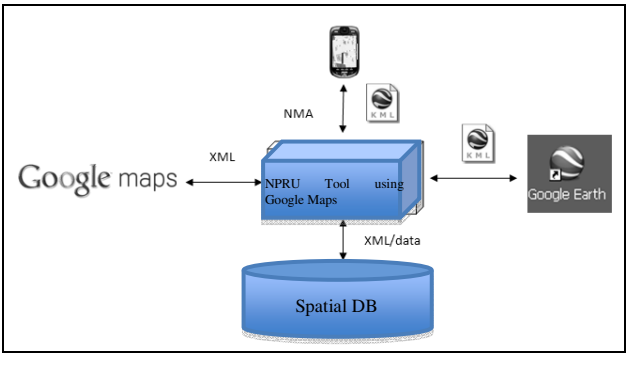

Fig. 3. Overview of the tool interaction

Figure 3 presents how the tool interacts to the other parts. It will invoke the online map from Google Maps and use XML to creates markup. It communicates with Google Earth using KML files. It also reads the data from to the GPS receivers via NMA files.

4 Results and Discussion

Our developed tool is called NPRU tool. We test the usability of the tool for each function as shown in Table 1. It is seen that the user can specify using points, lines and areas. These inputs support the functions specified in each column.

Table 1. Functionality of the tool

Function	Add	Delete	Update	Save	Import	Export	Display	Symbol	Attributes	Data
points	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
lines	☑	☑	☑	☑	☑	☑	☑		☑	☑
area	☑	☑	☑	☑	☑	☑	☑		☑	☑

The comparison of our tool and others are shown in Table 2. Column "Network connection" means the tools required network connection or not. Column "Satellite View" implies the tool can show satellite view. Column "Data Format" implies the data format that is supported by the tools. Column "GPS Support" implies the tool can read data from GPS or not. It is seen that our tool is capable about the same as Google Maps except that we are interested in the support of KML and data can store locally where it can be manipulated easily.

Table 2. Comparsion of the tools

Tool	Network Connection	Satellite View	Data Format	GPS support (NMA)
Google Maps	100%	Yes	RSS, data stored on google server	Mobile support, Yes
ArcGIS	Some	Plugin	.SHP,db,*KML	Yes
MapInfo	Some	Plugin	.SHP,db,*KML	Yes
Google Earth	Some	Yes	KML, KMZ	No
Point Asia	100%	Selective	Cannot record	Yes
NPRU	**100%**	**Yes**	**KML, data stored in database**	**Yes**

We use our tool to develop GIS for agriculture in Nakorn Pathom area. In the area, it is the province that contains 25 sub-district and 217 villages.

Figures 4-5 show the user interface where a user can overlay on the Google Maps. The user uses the provided drawing tools to create the overlays. The coordinates are extracted from the Google Maps and stored in the database. Figure 6 displays the coordinate displayed from the database.

Fig. 4. Defining regions

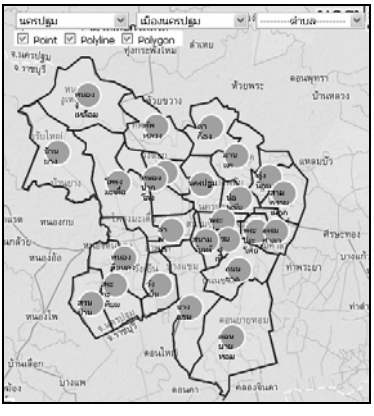

Fig. 5. Define sub-regions

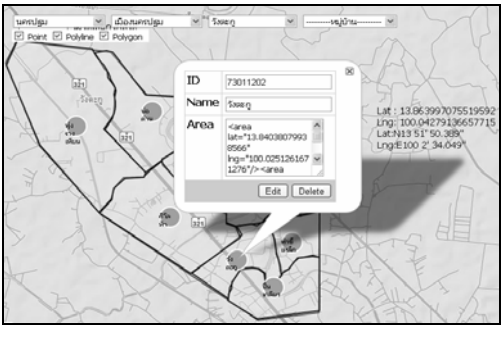

Fig. 6. Coordinate display

From the tool, the satellite view can be shown Figure 7. The user can create his own database to store their local data. In the application, we are interested in the agriculture product in the area. The production data are given in the database. Then, it can be linked and displayed in many ways. Figure 8 shows the production by regions. Figure 9 shows the production by types.

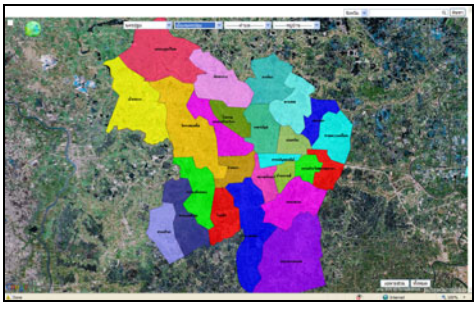

Fig. 7. Satellite view overlays

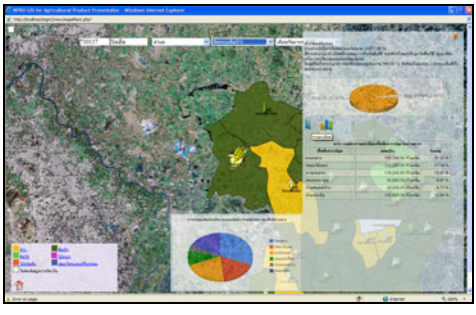

Fig. 8. Production by regions

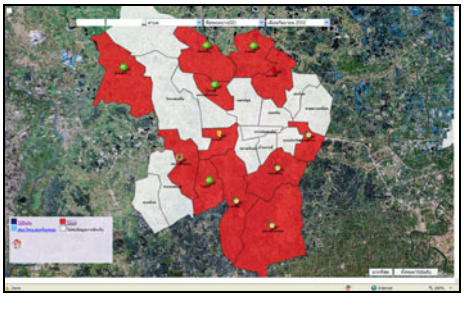

Fig. 9. Production by types

5 Conclusion

In this paper, we present a tool to help gather the GIS data. We take advantages of Google Maps so that we can define coordinates in various forms. Also, the spatial data can be gathered from user input, GPS receivers, or Google Earth. Thus, the tool can import the data from these sources using the KML or NMA format. We compare the functionality of the tools and demonstrate the usage of the tool to develop the agriculture application. In the future, the tool will be revised accordingly: display geographical coordinates in many forms, communicate with the GPS device to get the coordinate online and exports the data for into local database for future uses.

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