Elderly database design for emergency routing plan using Open Data Kit and pgRouting

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ABSTRACT

Nowadays, smartphones are a part of everyday life. We can not deny that smartphones are part of the added factor of living. With the application of smartphone data collection using the elderly data, creating a form that co-designed with the health agency in the study area, Older people find that past health units collect data using paper questionnaires, making it difficult to find and adding tasks. When filling in the Excel program, the IT administrator at the agency must import the data from the surveyor. Importing another database makes it possible to analyze such insights. Distribution of disease Routes from elderly homes to health agencies. Using the ODK Collect application can reduce the workload of both administrators, administrators, and administrators. By collecting data, ODK Collect can send data directly to the database and the surveyor does not have to fill out the data. Access Excel program again because it can download data from the ODK Aggregate and the administrator of the agency can extract data from the database to analyze it. From above, it can be seen that ODK can reduce the work and application in the survey and collect information other than the older map, such as taxpayers' survey, old age pension, population survey, etc.

Keywords *Spatial Database, Elderly, Open Data Kit, Web GIS*

1.   INTRODUCTION

In the present, the number of the elderly has been increased and it is believed that it will be one-sixth (1/6) of the citizen who is over than 60 years old in 2020. This is because Thai people live longer, so to support the elderly to be able to take care for themselves will help them live properly in the society

Therefore, taking care of the elderly is very necessary because it has been found that the elderly mostly live alone or with their spouse. The next generations mostly work so far away from home that they cannot take care of their elderly. In the present day, almost all health care institute has surveyed the elderly data, but it is in the document folders which is difficult to update and search for the data. Some have collected in the database but still in the different types of database which is more difficult to merge the data. There was the experiment on health care

institutes collecting health data of the elderly. It was found that the data have been collected via a set of questionnaire and stored in Microsoft Excel file, which has been difficult to search for the data. This can be the problem when it is needed to analyzed for the in-depth data such as disease epidemic, the routes from the elderly's house to the health care institute, etc. Using ODK Collect can reduce the workload of the surveyor and system administrator because the data have been collected by ODK Collect and transferred directly to the database. Therefore, it does not need to do on Microsoft Excel because the data can be downloaded from ODK Aggregate. The administrators from the institute can access the data from database to analyze on a website.

There have been the development of Geographic Information System (GIS) and communication technology for several years, which could change the methods to access, update and delete the data. Despite the development of data management, many institutes in the world have yet been benefited from this advance technology. To fill in the gap, there have been an encouragement to the institutes to apply technology into work. This is not a new knowledge because it has been improved from extension of agriculture to disease prevention projects. Services that push forward and access the data in the development regions are the key factors for the development of the world. However, despite the several years of those services, it has been still the hard job because there are still paper-based works, which limited the framework and complexity of the services. Because of the growth of mobile phone usage in this region, it is possible to improve digital and service systems to be more effective and cheaper. This is challenging in many aspects including user limitation and basic structure.
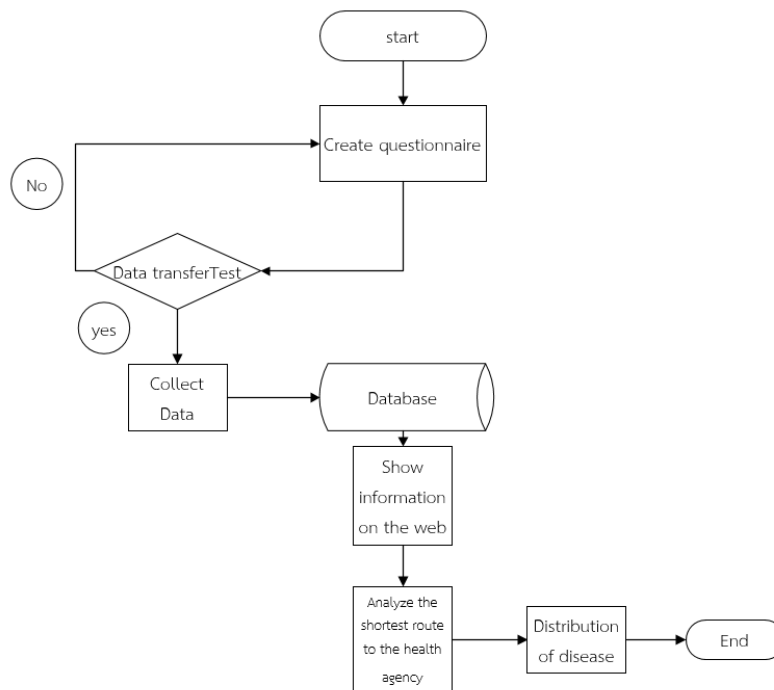

Figure 1 Objective plan

1.1 Tools and software

This study employed a smart phone with Android operation, data collecting server, QGIS program for GIS data management, pgAdmin III program for database management and SQL writing with SQL database, pgRouting for analyzing the shortest routes in the regular traffic.

2. METHODOLOGY

The research team went to Kho Rum Sub-district, Phichai District, Uttaradit Province, to consult with the health care institute about the design of questionnaire. The questionnaire was designed according to the ICF criteria and based on the institutes' demands. The data were shown on the website, which were analyzed for the shortest routes, and clients could select the conditions of showing each type of disease the patients have.

The analysis employed pgRouting to find the shortest route in the regular traffic. pgRouting works with PostgreSQL/PostGIS area-based database which adds the functions of network analysis and routing analysis (Rachakarn P. and Sunantha S., 2007). The calculation employed Dijkstra's calculating principle (1959) which takes graph theory, as shown in Figure 2, using vertex and edge to refer to the connecting roads and identifying the distance between each spot into the graph. This graph is called weighted graph, which means that every connecting line is the positive real number. (Peerawat K. and Suphet J. 2014). The graph can search for the shortest route from the starting point (start_vid) to the ending point (end_vid) which can be searched in both directed graph and undirected graph formats (pgRouting Contributors, 2013), as shown in the below equation G = (V,E); when V(G) is the set of vertex in the graph, and E(G) is the edge in the graph.

$$G = (V,E)$$

when

$V(G)$ = set of Vertex in graph
$E(G)$ = set of Edge in graph

$$\boxed{V(x) = \min\{V(x), W(x) + d(y)\}}$$

$d(y)$ = dist(v,y) | min { distance from node start to node y}
$W(x)$ = weight (i,j) | Distance from i to j : edge (i,j)

To collect data, the research team has studied on following processes:

designing a set of questionnaire with the health care institute in the study area by using ODK Build website; introducing the instructions of sending the answers, accessing and downloading the data; analyzing data by using pgRouting to search for the shortest route to reach the treatment.

Process of form building to collect data or ODK Build
   Clients can build the form to work in ODK by the following 2 ways:
1. Using Microsoft Excel consisting of 3 sheets:

- **Survey**, to fill the required field data including column **type** (to identify the type of data), **name** (to identify the name of parameter which must be different), and **label** (to show the data as in the form).

Building on https://build.opendatakit.org/ which clients must sign up to the system. Those who have not signed up yet must click "Don't yet have an account" and fill in the data.
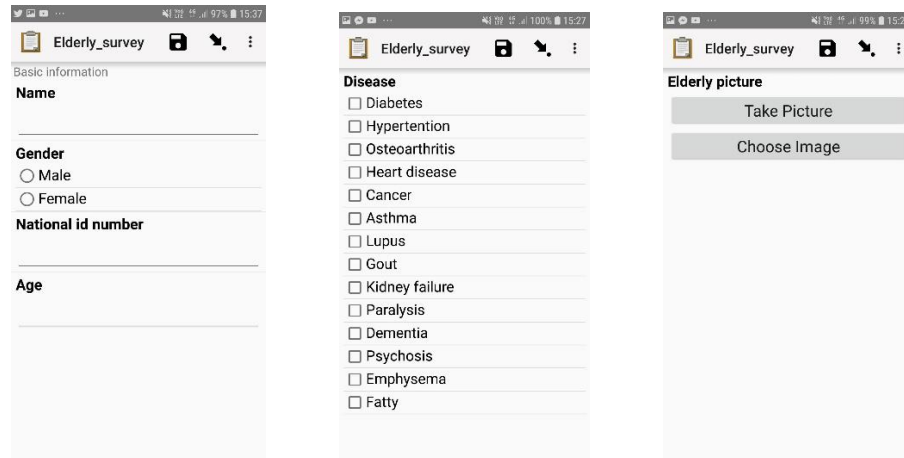

Figure 2 Example of ODK build form

2.1 Factors to be analyzed

Factors were analyzed for the disease epidemic from the elderly's data. This study chose the factors related to the routes between the elderly's residence and the health care institute, disease epidemic, and field services.

3. RESULTS AND DISCUSSIONS

Searching for the location the health care institute will work on the web browser screen. After the accident's location is tracked on the map, the client clicks "submit" to send the location data to the database. The system will search for all the nearest health care institutes to the accident and send back to the system. The system will select 1 nearest health care institute and show on the screen
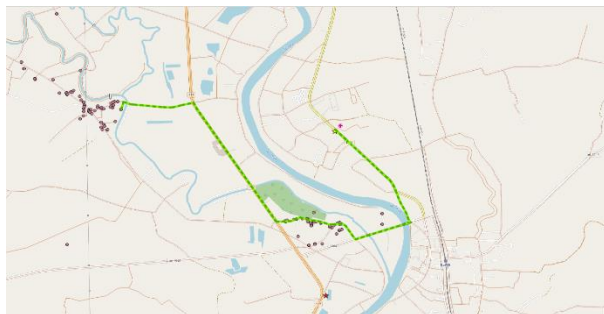

Figure 3 The distribution of people with the disease along the nearest route to the hospital.
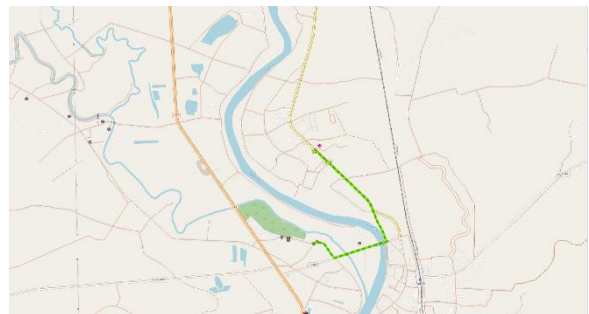

Figure 4 Distribution of the disabled along the nearest route to the hospital.

Maria Antonia Brovelli et el. (2016) has studied on using ODK to develop the collaboration with public sections such as pathway for disabilities showing on a website screen. According to that previous study, the research team has designed the website to apply pgRouting function to support the transportation to the elderly's residence.

4.   CONCLUSION

Data and database analysis aims to analyze and manage the database for searching for the shortest route from the residence to the health care institute.

Therefore, this study has developed the system to search for the shortest route and show on the online map, which will reduce the workload of the surveyors and administrators, by using ODK Collect to collect data. The program can send data directly to the database without filling the paper-based data into Microsoft Excel, because they can be downloaded from the database.

ODK Aggregate is the JAVA application type open source to collect, analyze and present the data. Surveying of XForm, that collects data by using ODK Collect or an application working with OpenRosa, has supported a number of data types and been designed to work well in every environmental condition. To host the data collection can be done by hosting an empty XForms at ODK Collect or other OpenRosa customers collecting or managing data in a simple graph and map. Data will finally be distributed in any kinds of format. Data can be hosted on Google App Engine, Amazon Web Services, local server, or cloud. In addition, the application can illustrate the picture based on the identified parameters being ready to operate in any computers.

pgRouting can improve the routing system effectively depending on the client's and administrator's purposes. The operation was improved to work similarly to some instruction sets such as shortest route searching instruction of ArcGIS program; however, pgRouting could search for the shortest route.

Open Source is the program being available for clients to develop by themselves. There are so plenty of program developers that the program is high effective and able to be edited the source code. Therefore, the clients are free to develop the software.

WebGIS is one of the GIS system technologies to communicate between elements in the system for the clients to collect, search, manage, and analyze data by themselves.

In conclusion, this system can support the decision making for the shortest routes to the health care institutes through internet network on a smart phone.

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