DEVELOPING A METHODOLOGY TO FIND OUT APPROXIMATE LOCATIONS OF STUDENTS IN A SPATIAL INFORMATION TRACKING SYSTEM CASE STUDY: FACULTY OF AGRICULTURE, UNIVERSITY OF RUHUNA, SRI LANKA

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KEY WORDS: Centroids, Google Maps API, IMS, LAMP, Spatial Information Tracking, University MIS, WebGIS

ABSTRACT: A Student Spatial Information Tracking System (SITS) provides additional value for a University Management Information System (MIS). Both systems together leads to process of decision making much easier. A Web based Student SITS was developed as a module of the University MIS of Faculty of Agriculture, University of Ruhuna, Sri Lanka. The module is a Web based Geographical Information System (WebGIS), which is based on 3-tier architecture running on Linux, Apache, MySQL, PHP (LAMP) stack and Google Maps Application Programming Interface (API) used as the Internet Map Service (IMS). At the beginning of the system, there weren't any locational tags of students stored in the database. Therefore, a different methodology is used to find out an approximate location of a student until the student will update correct location to the system. Grama Niladhari Divisions (GND) Map of Sri Lanka was used for the preparation of approximate locations and projected it to WGS84 coordinate system because Google Maps uses WGS84 to overlay it. Then calculated centroids of GND are stored in the database to find out approximate location of a student after comparing the GND of the student. Later the student can easily update the correct location within the boundary of the GND of the student. This method was successfully used to find out approximate locations of students in the Student SITS of the University MIS.

1 INTRODUCTION

Faculty of Agriculture, University of Ruhuna (Latitude: 6.060337° N, Longitude: 80.568148° E) is located in Mapalana, Kamburupitiya, Sri Lanka. The Faculty is one of the premier Agriculture Faculties in Sri Lanka which contributes to human capacity development and agricultural technology generation in the country. The Faculty has seven academic departments and offering three undergraduate degree programs. Total number of courses offered by all the academic departments is more than 50. Also the Faculty is offering few postgraduate degree programs. Total student population of the Faculty is more than 800 and the academic staff population of the Faculty is more than 100 (Faculty of Agriculture 2014). Therefore, it was very difficult to manage the academic program without having a Management Information System (MIS). To overcome the difficulty, the Faculty introduced a web based MIS which enabled the Faculty to manage the academic program smoothly and efficiently. The MIS has modules for Student Information Management, Course Management and Examination Management (Priyankara, Kumara et al. 2016). However the MIS manages only students' attribute data. In other words, there is no provision to manage spatial information of students in the MIS. Generally, students are coming from various locations of the country. Therefore, it is very important to manage spatial data such as locational data of students other than their attribute data through the MIS. Because it will be greatly helpful for administrators, academics, students and other researchers as a tool to visualize students' home locations by provincial/district/divisional levels, find shortest path to their home locations from the faculty,

calculate distance to their home locations from the faculty and visualize academic performance of students by provincial/district/divisional levels. Also this may be useful to compare home locations/performance of students in different academic years and allocation of hostels among students considering distance to their home locations. Therefore, this can be used as a Decision Support System (DSS) by analyzing spatial data of students (Priyankara, Kumara et al. 2016).

As a solution to manage spatial data of students, a web based Student Spatial Information Tracking System (SITS) was developed as a module of the MIS of Faculty of Agriculture, University of Ruhuna, Sri Lanka. The module is a Geographical Information System (WebGIS), which is based on 3-tier architecture running on Linux, Apache, MySQL, PHP (LAMP) stack and Google Maps Application Programming Interface (API) used as the Internet Map Service (IMS) (Priyankara, Kumara et al. 2016). At the beginning of the system, there was a problem to determine home locations of students. Because, there is no provision to collect locational details of students in the current MIS (Priyankara 2016). The locations are very important to develop the Student SITS. Therefore, the objective of the study is to develop a methodology to find out approximate locations of students to use in the Student SITS. Then a student can access the approximate location and easily update the correct location through the Student SITS.

2 MATERIALS AND METHODS

The process of finding approximate locations of students is divided into three stages. The stages are given in Figure 1. Each of the stage describes below.

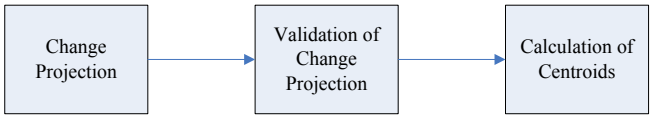


Figure 1: Process to find out approximate locations of students

Change Projection

Grama Niladhari Divisions (GND) map of Sri Lanka was used for the preparation of approximate locations. Since Google Maps API was used as IMS in the Student SITS, it was necessary to change the existing coordinate system of GND Map of Sri Lanka. The Geographic Coordinate System of the GND Map is GCS_Kandawala. Google Maps uses WGS84 as the Geographic Coordinate System. Therefore, it was needed to convert the coordinate system of the GND Map from GCS_Kandawala to WGS84. Figure 2 shows the process of Change Projection.

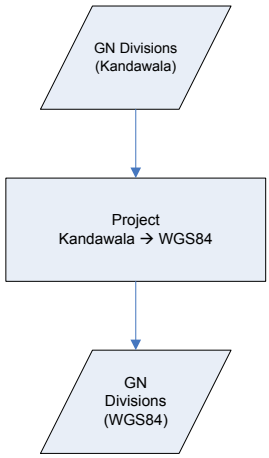


Figure 2: Process of Change Projection

Validation of Change Projection

Subsequently it was required to validate the change projection done in the above step by opening the new layer in Google Earth. To do that it was required to convert the layer into KML which can be then opened in Google Earth and check whether the converted KML is properly overlaying with Sri Lanka Map in Google Earth or not. If it is correctly overlaying then the projection change is correct. Otherwise it is required to repeat the change projection process until the KML is correctly overlaying with Sri Lanka Map in Google Earth. Figure 3 shows the process of Validation of Change Projection.

Calculation of Centroids

As the next step, it is required to calculate the coordinates of centroids for all GND. Because, we are going to use centroids of GND as approximate locations of students. Figure 4 shows the process of Calculation of Centroids.

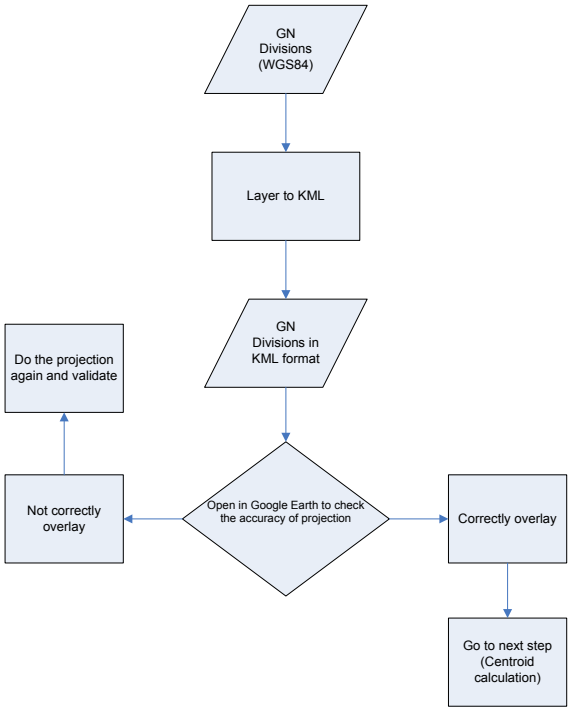


Figure 3: Process of Validation of Change Projection

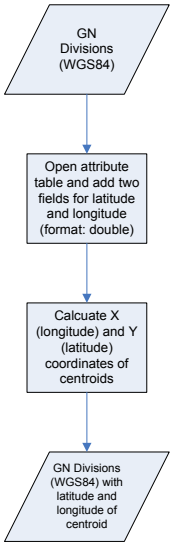


Figure 4: Process of Calculation of Centroids

3 RESULTS AND DISCUSIION

According to the Methodology, there were several stages used to calculate approximate locations of students. The following results were observed in each of the stage.

Change Projection

Figure 5 shows the conversion of GND Map from GCS_Kandawala to WGS84.

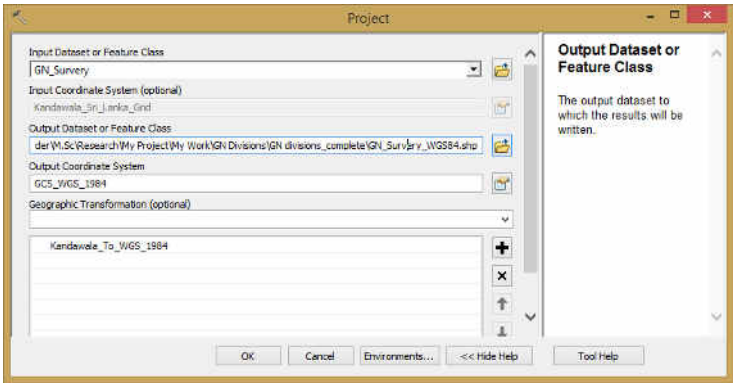


Figure 5: Change Projection of GND Map

Validation of Change Projection

Figure 6 shows the conversion of newly projected GND Map to KML.

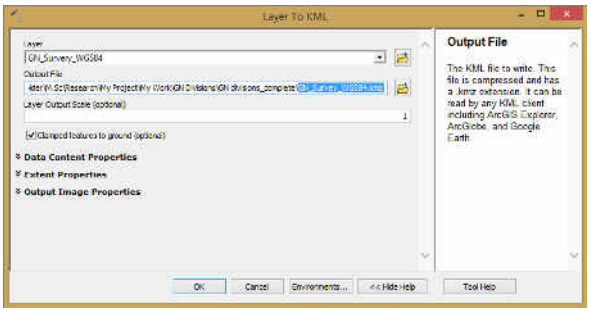


Figure 6: Convert to KML

Figure 7 shows the verification of change projection by overlaying the newly created KML with Google Earth.

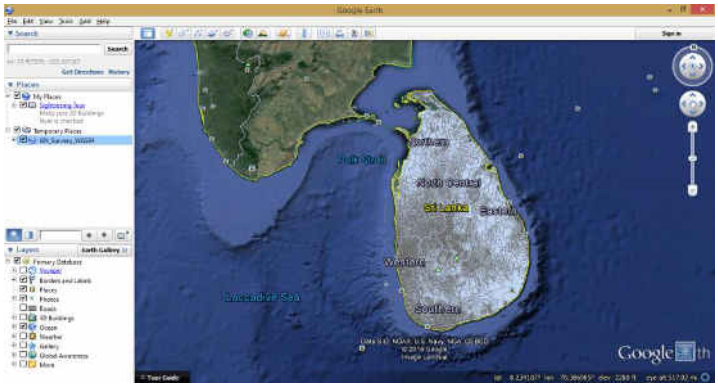


Figure 7: Verification of Change Projection

According to the Figure 7, the KML is correctly overlaying with the map of Sri Lanka correctly. Therefore, it is verifying that the Change Projection is correct.

Calculation of Centroids

This is the final step of the calculation. It is required to add two new fields in the attribute table to store Latitude (Y) and Longitude (X) coordinates of centroids of GND. Then calculate centroid of GND by using calculate geometry tool.

Figure 8 and Figure 9 show the calculation of Latitude (Y) and Longitude (X) of centroids of GND respectively.

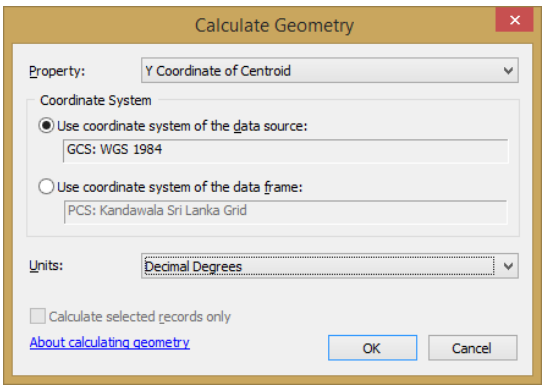


Figure 8: Calculation of Latitude of Centroid

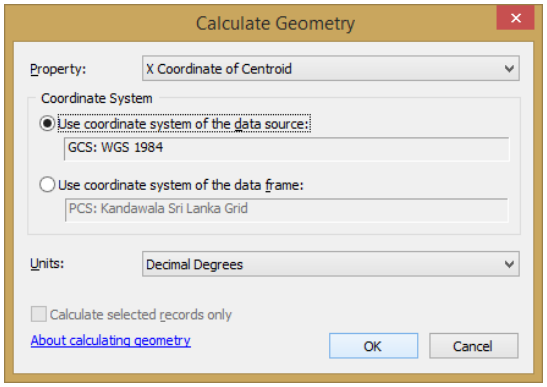
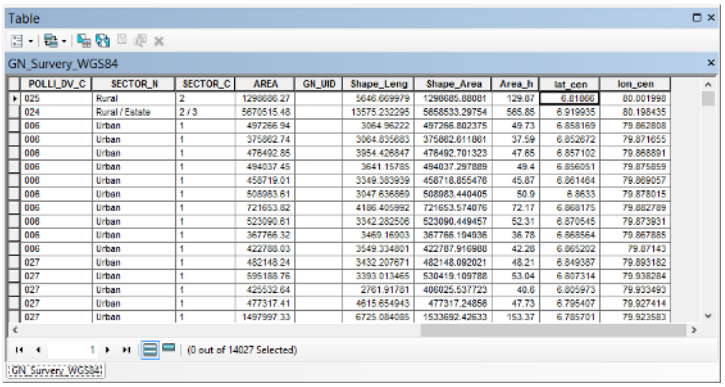


Figure 9: Calculation of Longitude of Centroid

Figure 10 shows the attribute table of GND Map after calculation of centroids.



POLLI_DV_C	SECTOR_N	SECTOR_C	AREA	GN_UID	Shape_Leng	Shape_Area	Area_h	lat_cen	lon_cen
025	Rural	2	1296686.27		5646.669979	1296685.88081	129.67	6.81966	80.001999
024	Rural / Estate	2 / 3	5670515.48		13575.232295	5658533.29754	565.85	6.919935	80.198435
006	Urban	1	497266.94		3064.96222	497266.802375	49.73	6.858169	79.862808
006	Urban	1	375862.74		3064.835683	375862.611861	37.59	6.852672	79.871655
006	Urban	1	476492.85		3954.426847	476492.701323	47.65	6.857102	79.868891
006	Urban	1	494037.45		3641.15785	494037.297889	49.4	6.856051	79.875859
006	Urban	1	458719.01		3349.383939	458718.855476	45.87	6.861464	79.869057
006	Urban	1	508983.61		3047.636869	508983.440405	50.9	6.8633	79.878015
006	Urban	1	721653.82		4186.405992	721653.574076	72.17	6.868175	79.882789
006	Urban	1	523090.61		3342.282506	523090.449457	52.31	6.870545	79.873931
006	Urban	1	367766.32		3469.16903	367766.194936	36.78	6.868564	79.867885
006	Urban	1	422788.03		3549.334801	422787.916988	42.28	6.865202	79.87143
027	Urban	1	482148.24		3432.207671	482148.092021	48.21	6.849387	79.893182
027	Urban	1	595188.76		3393.013465	530419.109788	53.04	6.807314	79.938284
027	Urban	1	425532.64		2761.91781	406025.537723	40.6	6.805973	79.933493
027	Urban	1	477317.41		4615.654943	477317.24856	47.73	6.795407	79.927414
027	Urban	1	1497997.33		6725.084085	1533692.42633	153.37	6.785701	79.923583

Figure 10: Attribute table after calculation of centroids

4 CONCLUSION

Calculated centroids of GND are stored in the database to find out approximate location of a student after comparing the GND of the student. Later the student can easily update the correct location within the boundary of the GND by using Student SITS. This method was successfully used to find out approximate locations of students in the Student SITS of the MIS.

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