International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 4 (2015) pp. 9415-9423

http://www.ripublication.com

# Comparison of A New Gis-Based Method and A Manual Method For Determining Boundery Basin: Zayandeh Rood Basin In Iran

**Dr. Maryam Marani Barzani**[1]
*Prof. Dr. Khairulmaini Bin Osman Salleh*[2]
*Department of Geography,University of Malaya (UM),marani82@yahoo.com,*
*Department of Geography,University of Malaya (UM),khairulo@um.edu.my*

## Abstract

We aimed coparision hydrologic model in a GIS as a means to determine the boundary of the basin and to compare by means of a hand drawing the boundary of Zayandeh Rood Basin, Iran. In this paper, the Arc GIS 9.3 software was used and the data included SRTM and 1:25000 topographic maps with a contour interval of 25 meters. The differences between the determining boundaries basins were derived from the two methods used for the basin. The study revealed that determining the exact boundaries of the basin on the contour maps is limited by the map scale and contour interval. In this study, the results are an exact boundary of the basin by GIS method. Gathering and analyzing the basin data for studies in mature regions have historically required the tedious and time-consuming manual process of the boundary of the basin shown on topographic maps.

**Keywords:** Basin, GIS Model, Zayandeh Rood Basin, Digital Model Elevation.

## Introduction

The first step of geo-hydrological process study is to determine the boundary of the water shed. Land measurement which is surrounded by heights is referred to as the pouring water basin. Therefore, the running water which is the result of rain concentrates on the deepest surface and exits from the point that includes the lowest height watershed depends on the unit for planning. Rainfall and water resource produce the human units and human activities in the basins. Most human units are near the outlet or floodplain, especially in arid zones near quant or springs and the area is important for agriculture and settlement. Hillcrests are the boundary of basin in hydrology in close basins; water flow enters the ground and is saved as groundwater. The elevation data in a grid format can be used to delineate the drainage

basins, create stream networks and compute the drainage basin data (Christopher M. Smemoe, 1997 and E. James Nelson, 1994). The hydrological data development is the process of delineating a watershed and its sub-basins computing the geometric sub-basin parameters from the delineated basins (Christopher. M. Smemoe 1997).

The Geographic Information System (GIS) software such as Arc/Info has had the capability to perform hydrologic modeling for several years. The elevation data in a grid format can be used to delineate the drainage basins, create stream networks and compute the drainage basin data (M. Smemoe, 1997). GIS technology provides the means for analyzing the spatial distribution of geographic information; modeling its interactions and finding patterns and relationships in the data that may be overlooked by previously-used techniques (Szukalski, 2002, Julie c.et.al, 2004).

## Study Region

The Zayandeh Rood Basin (Z.R.B.) is located in the central region of Iran (Fig. 1). The basin is about 42,000 km-$^2$ (Khodagholi.M, 2006). Z.R.B is one the most important river basins in Iran. The central part of the basin is known for its economic activities such as historical places, industrial factories and settlement area.

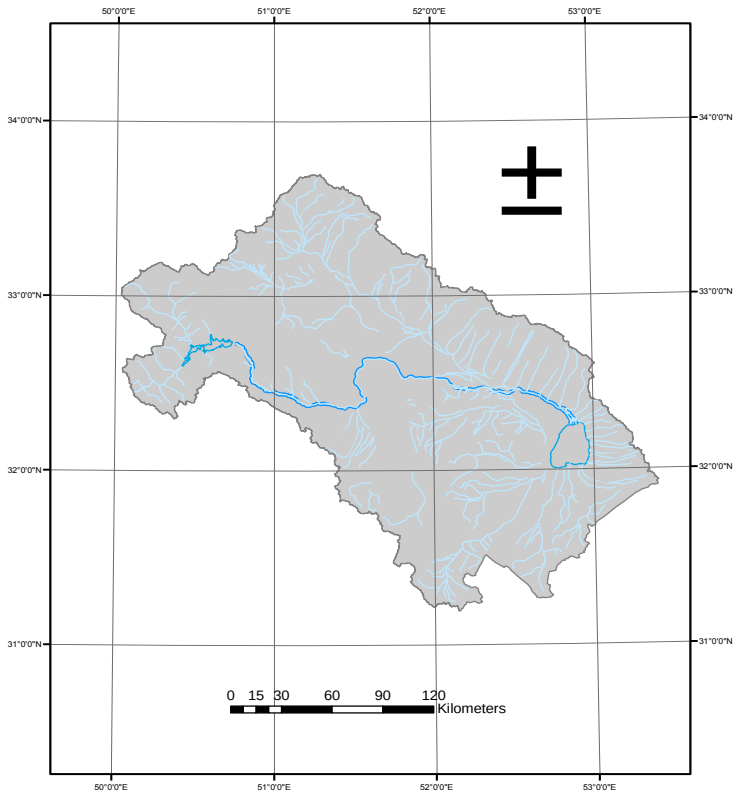


**Figure 1:** location of Z.R.B based on coordinate

## Method

In this study, SRTM (Shattel Rada Topography Mission) was used to determine the spatial analysis of the River basin in GIS environment. Determining the boundary of the basin was prepared by an SRTM image and then checked by a contour map using the GIS-based method from digital map of the study area.

This section will focus on the following steps involved in developing the geometric hydrologic data for a watershed. The boundary basin delineation using elevation grids was to process the SRTM (Shuttle Radar Topography Mission) and determine the geometric parameters such fill, flow direction grid and boundary basin delineation using an elevation grid.

The first step in this project is defining the basin boundaries. These boundaries normally fall along the ridges in a watershed. On one side of the ridge, water flows into the watershed, while on the other side of the ridge, water flows into a separate watershed.

Three steps are involved in defining these drainage basin boundaries from an elevation grid:

Fill any pits in the elevation grid, compute the flow direction grid using the elevation grid and make polyline coverage of the watershed.

A pit forms when a grid cell is lower than all its neighboring grid cells. Before computing a flow direction grid, it is necessary to fill any pits in the elevation grid. Flow directions would be undefined for all unfilled pits (Fig 2). Further, when the watershed is delineated, the grid cells surrounding a pit will not belong to a defined watershed.

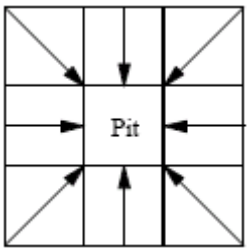


**Figure 2:** Flow paths to a pit. (Christopher M. Smemoe1997)

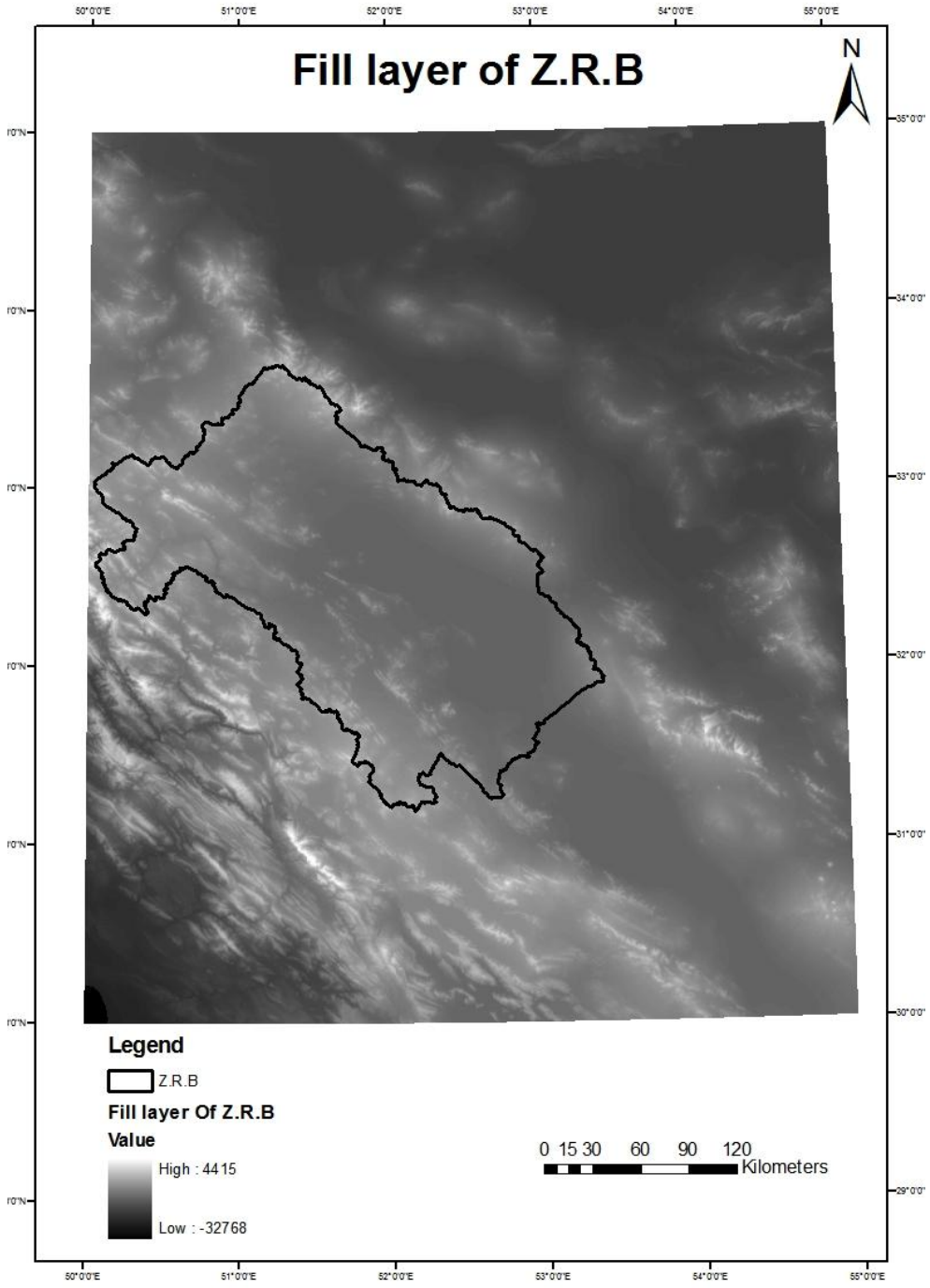


**Figure 3:** Shows overlaid boundary of Z.R.B and Digital Elevation Map

Computing the flow direction grid using the elevation grid a flow direction grid has is one of the eight values for each grid cell. The possible values are up, down, right, left, lower right, lower left, upper right, and upper left. These flow directions for each grid cell are computed from the elevation grid.

## Discussion

The manual boundary of Z.R.B was determined by Natural Resources Organization in Isfahan. An automate boundary of the basin was determined by this research. The automate boundary of Z.R.B was tested using a contour map and control point. Compared the two layers (manual and automate boundary) are more consistent with the actual boundary. The difference between the two boundaries of the basin is more significant in the West-East part of the basin. Fig 4 shows the Z.R.B boundary on the SRTM image. The boundary was determined by means of some software. Due to the low elevation in the Eastern part of Z.R.B, identification of the boundary involves errors that are corrected by contour map.

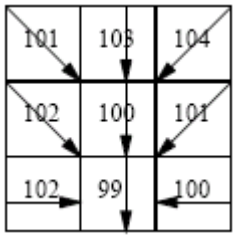


**Figure 4:** Flow directions computed from an underlying elevation grid. (Christopher M. Smemoe, 1997)

Fig 5 shows the Z.R.B polygon layer on the converted SRTM image on the polygon layer in the GIS environment. In fig 6, the polygon compared with the manual polygon, shows that some parts of the boundary basin are coincident.

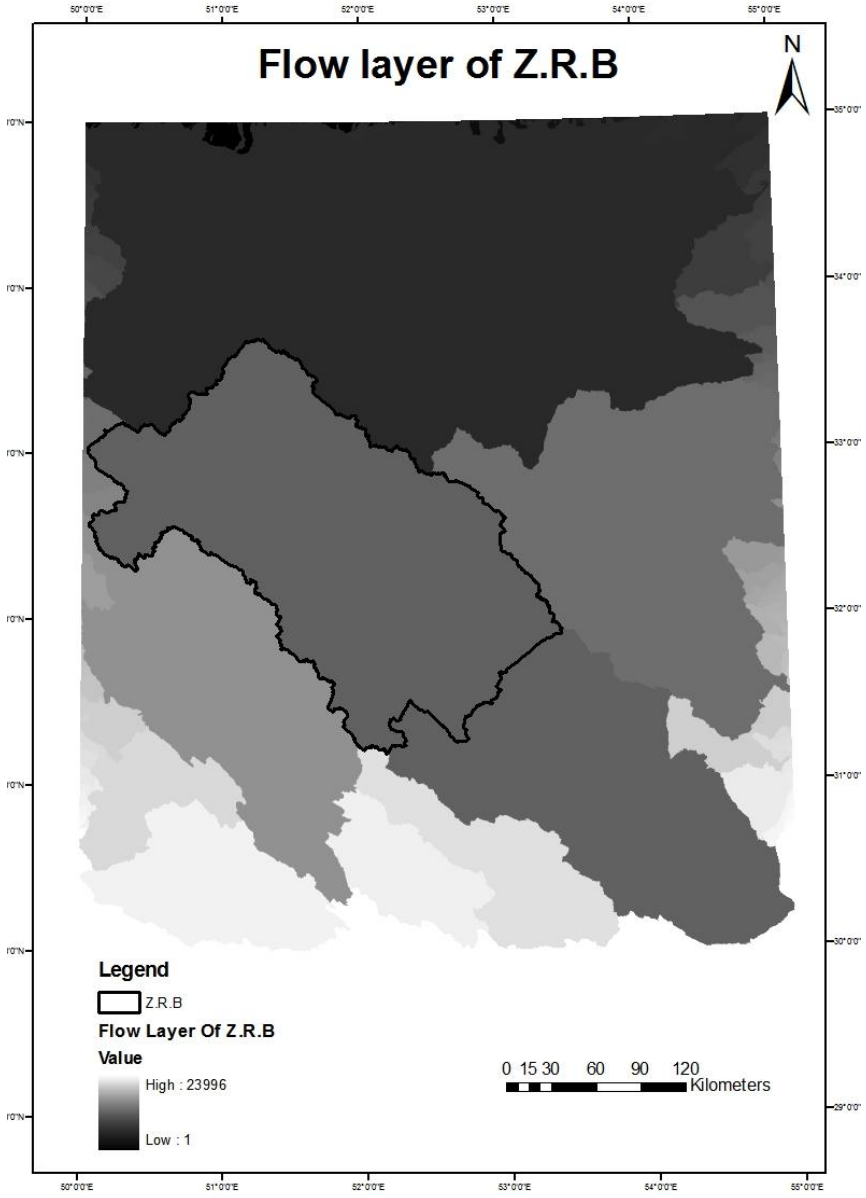


**Figure 5:** Shows determined boundary of Z.R.B on SRTM image

Fig 6 shows overlaid the manual and automate boundary of Z.R.B. Depending on the shape file in the surroundings, the basin boundaries coincide. The automate boundary was checked by a contour map. These two boundaries can be of different distances by more than a hundred kilometers on the land surface. Considering the fact that basins are important geomorphologic landform, basins are as a base structure for developing human activities and that most organizations use a basin map for research and projects. Therefore, the automate boundary map of basins can be used with a great degree of precision.

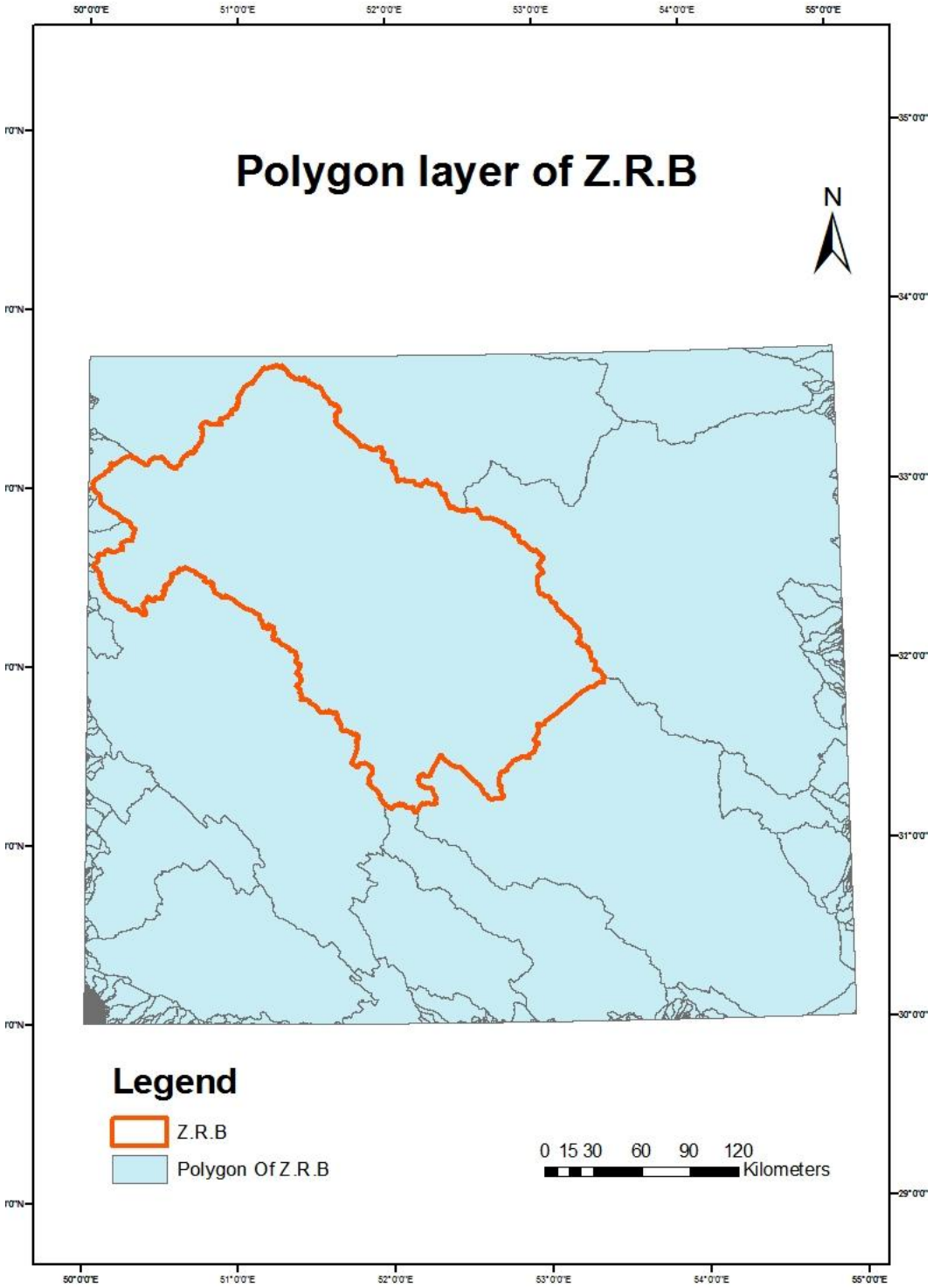


**Figure 6:** Shows boundary of Z.R.B by polygon on vector layer

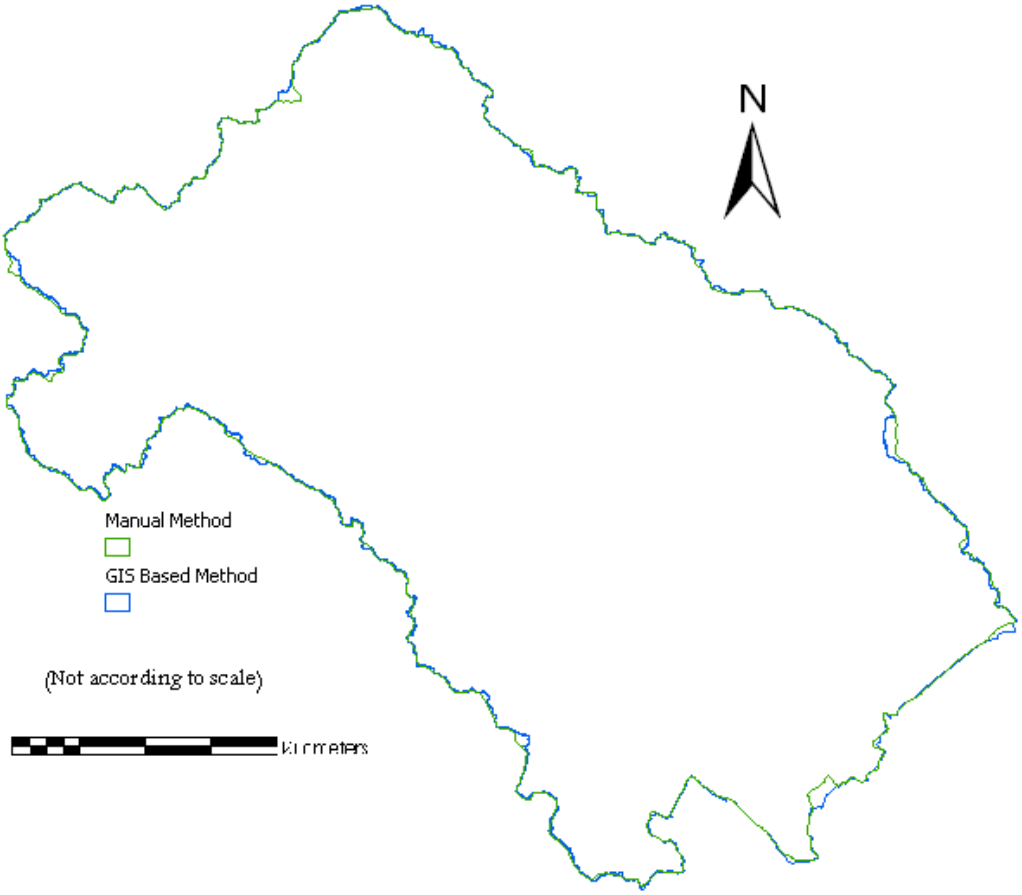


**Figure 7:** Boundary of Z.R.B by manual method and GIS Based Method

## Conclusion

The automate method was tested for two types of basin: open and close. For the open basin, the automatic method is applied because there is a mountainous section and the outlet is the sea point. The semi-automate method is used for the close basin because the outlet of this kind of basin is marsh or some lake; thus, some hillcrests are not very clear and they have to be checked by a topographical map or survey such that they can be referred to as the semiautomatic method. The hydrological method is used because it can save the time determining the boundary of the basin using DEM or SRTM and it is not necessary to have a topography and hydrological map. On the other hand, this method is very precise especially for the open basin; hence, it could produce accurate results without using a survey or a topography map for Z.R.B but the boundary of the basin can be determined and the time talen for the analysis could be minimized. (1) Checking the boundary in the eastern part of the basin might be necessary to go for the fieldwork. (2) Saving time for gathering the data and doing work using the GIS method. (3) The map is more beneficial to analysis and other purposes and. (4) There is some difference between the close basin and the open basin.

## Reference


[1] Alam, Mohammad Khursheed; Basri, Rehana; Purmal, Kathiravan; Sikder, M.A.; Saifuddin, Mohammed; Iida, Junichiro. Craniofacial Morphology of Bangladeshi Adult Using Tweed's and Wit's Analysis. *International Medical Journal (IMJ)*, 2013; 20 (2): 197-200. ISSN: 1341-2051.

[2] Alam, Mohammad Khursheed; Basri, Rehana; Purmal, Kathiravan; Sikder, M.A.; Saifuddin, Mohammed; Iida, Junichiro; Cephalometric Lip Morphology in Bangladeshi Population. *International Medical Journal, (IMJ)*, 2013; 20 (2): 201-3. ISSN: 1341-2051.

[3] Alyamani, Helmi A.; Ismail, Noorliza M.; Khan, Rafeaah A.; Alsanabani, Amal A.; Ismail, Abdul R; Comparison of Adhesive Remnant Index of Light-Emitting Diode and Tungsten-Quarts-Halogen Using Image Analyzer after Orthodontic Bracket Removal. *International Medical Journal,(IMJ)*, 2012; 19 (1): 58-60. ISSN: 1341-2051.

[4] Christopher M. Smemoe. (1997). Linking GIS Data to hydrological ,Models Brigham Young University. *American Water Resources Association (AWRA*), Utah Section.

[5] Dastorani M.T. (1998). Cartography Guideline, Natural Resources Faculty, *PhD Thesis*, Yazd University. http://srtm.csi.cgiar.org.

[6] Hassan, Rozita; Azmi, Aiman; Zreaqat, Maen; Yusuf, Asilah;Measurements of Facial Morphology in Normal Malay Children Using a Stereo Photogrammetry, 3dMD System. *International Medical Journal, (IMJ)*, 2011; 18 (1): 70-3. ISSN: 1341-2051

[7] Husseini Ebary, S.(1999). Zayandeh Rood from upstream until Marsh, *book*, Isfahan publishes.

[8] Julie C. et al. (2004).Comparison of a new GIS-based technique and a manual method for determining sinkhole density: an example from illinois' sinkhole plain Illinois State Geological Survey, Natural Resources Building.,Sinkhole plain. *Journal of Cave and Karst Studies,(JCKS)*, v. 66, no. 1, p. 9-17.

[9] Nakamura, Koji; Seto, Hikaru; Okino, Shinji; Ono, Kazuya; Ogasawara, Makiko; Shibamoto, Yuka; Agata, Toshihiko; Nakayama, Kazuhiko;Prevalence of Computers around the World and Depressive Tendency in IT Experts: A Comparison with Other Professions. *International Medical Journal, (IMJ)*, 2012; 19 (3): 186-7. ISSN: 1341-2051.