THE IMPORTANCE OF LOCALIZATION IN LARGE CONSTRACTION PROJECTS

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***Abstract*—** The basis for the construction of any project is a map, a map where the surveyor can determine the coordinates of the points on the ground by using the coordinates and using the total station, projects such as dams, roads, tunnels and pipelines, if the base points are determined using GPS prepared can create challenges for the surveyor to control.

First, we will examine some map projection on which the maps are designed, and a summary of their differences and the challenges that surveyors face in order to control them, because in order to build projects, we need real lengths and angles, so we have to use coordinates that provide us with the results of the calculations. We will examine some examples to understand the concept of localization so that the surveyor knows if he is facing a challenge or not and if he is faced with this challenge, how should he solve this problem.

***Keywords*—**UTM, localization, scale factor, CARTEZIAN, traverse.

I. Introduction

Let's take a look at Fig.1. In this picture, you can see three different types of Map Projection that maps are usually prepared in these three Map projection and In Mercator Fig.2, you can prepare and view a map of the whole world, the orbits are parallel, and the angles and lengths on this map are different from those on the ground, so you cannot use it to control the route of tunnels, roads, and various structures.

In Fig.1, you can see that in UTM and TM, the method of preparing the map is the same, with the difference that in the preparation of the map in UTM, every 6 degrees of longitude corresponds to a zone, from the map you use, you must know which zone it is in. because the coordinates of the x axis in each zone starts with the number 500000 and there is a coefficient of 0.9996 in the calculation of the coordinates. In this model, the angles are almost equal to the real angle, and to calculate the real length, you must calculate scale factor and apply it to the lengths. In Fig.4, you can see the map of Iran in 4 zones. In Transverse Mercator you can have IRAN map in 1 file and angles are almost equal to the real angle. In the coordinate calculation formula, the coefficient of .9996 is not used and distance in this map projection is not real but similar to Fig.3 you can have IRAN on one file.

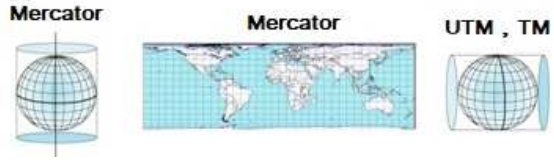

Fig.1 Three widely used Map projection

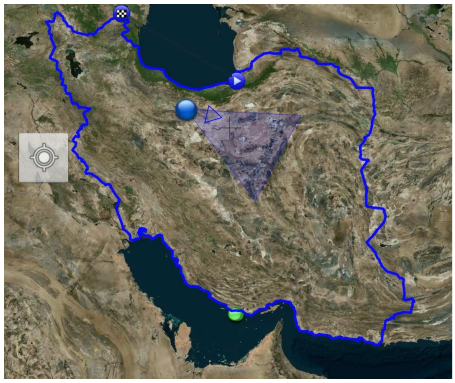

Fig.2 IRAN on mercator projection

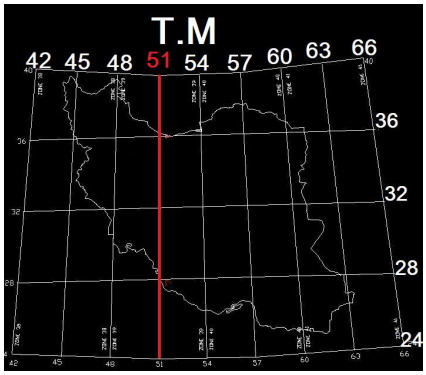

Fig.3 IRAN on transverse mercator projection

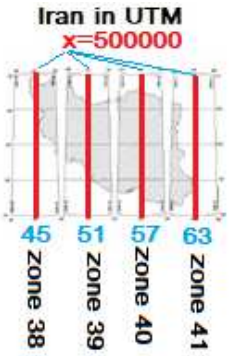

Fig.4 IRAN on UTM projection

Today, most maps are prepared on UTM, but its use can be associated with challenges due to the properties of this image system.

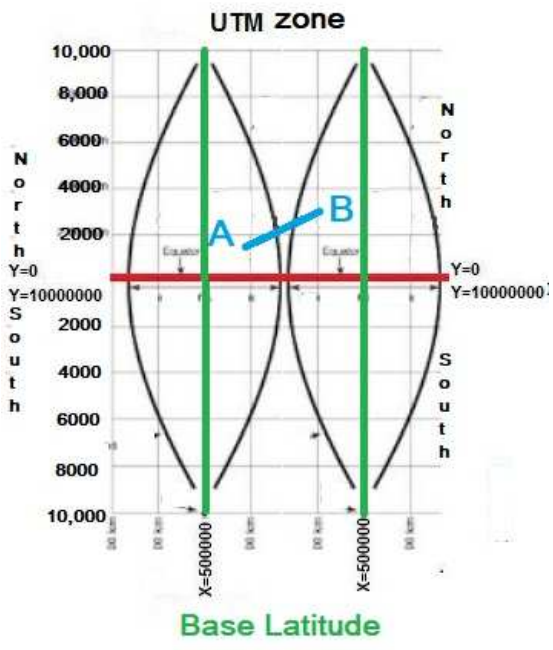

FIG.5 THE CHALLENGE IN UTM

FIG.6 KISH ISLAND AND UTM CHALLENGE

In Fig.6 this area is in two different of zone so if you want that in one map with real distance and real angle you must do localization. Also, in Fig.7, you can see the map of the tunnel route, which is located in two different UTM zones, and you cannot use coordinates. Also, in order to control the tunnel route, you need real angles and lengths. Fig.8 shows how localization is done.

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FIG.7 THE CHALLENGE IN UTM

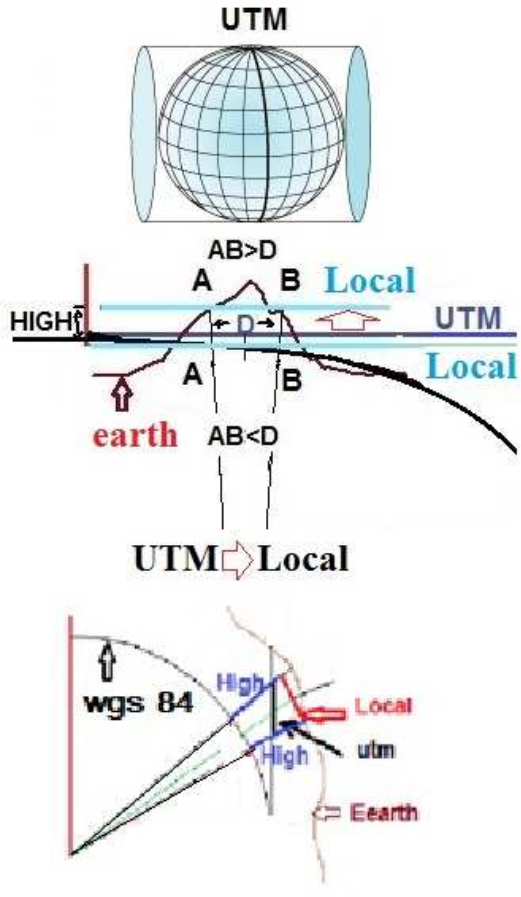

FIG.8 LOCALIZATION

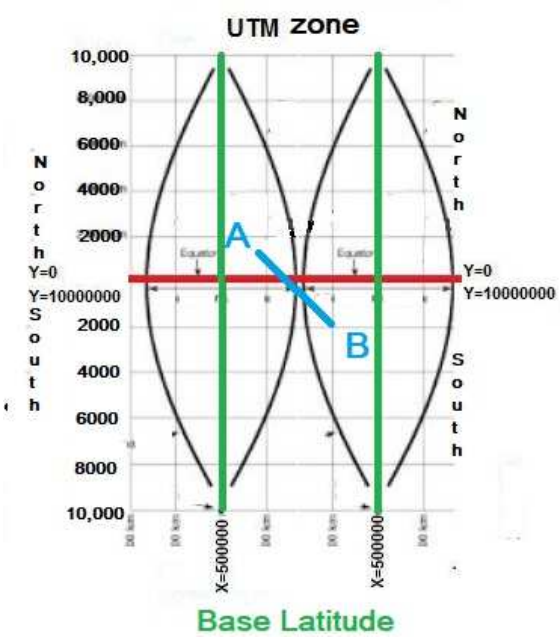

FIG.9 The challenge in UTM

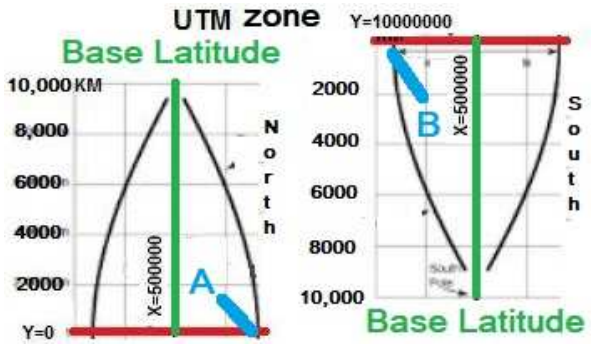

FIG.10 The challenge in UTM

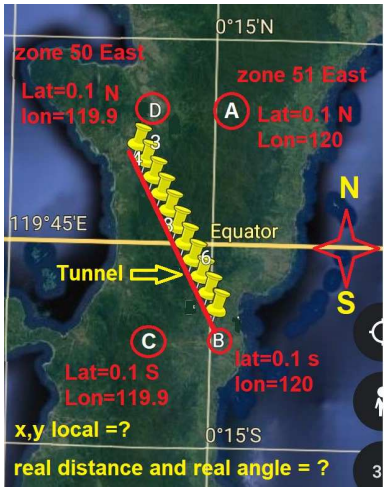

FIG.11 The challenge in UTM

In Fig.9, consider a tunnel that is located in two different zones in the northern and southern hemispheres. How can you use UTM coordinates to control and draw the tunnel in a map file? You also need real angles and lengths. In fig.11, the longitude and latitude of the starting and ending points of the tunnel and two mark points are given. When the coordinates are in the same zone, you can use UTM coordinates to calculate the real angles and use the scale factor to convert the lengths to the real length and calculate the local coordinates, which is called localization, but we can calculate the scale factor with Cartesian coordinates of the points. These coordinates will give us the real lengths. Fig.12 shows the Cartesian coordinate system.

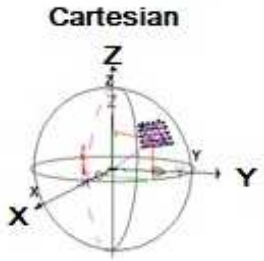

FIG.12 CARTESIAN COORDINAT

An Android program has been designed to calculate the scale factor, which has the following two references. [1], [2]

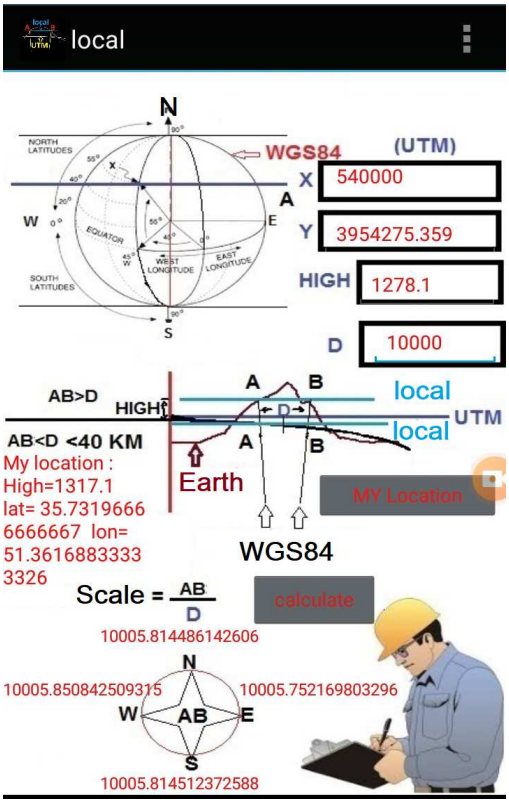

FIG.13 LOCAL APP AND SCALE FACTOR

In Fig.13, you can see the Android application that calculates the actual length in four different directions according to the height of the given point by entering the UTM coordinates and length. In order to calculate the actual length in the program, first the longitude and latitude coordinates are calculated, then using the length on UTM, the coordinates of the second point are calculated in four different directions, and after calculating the Cartesian coordinates of the points, the actual lengths are calculated, now you can use division Calculate scale factor of these two lengths in relation to each other in any direction you consider, as you can see, this scale factor is different in different directions. Also, by using the dist Android program, by entering the longitude and latitude of two points, calculate the direct distance between the two points at your desired height. Also, if the length is more than 20 km, due to the arc of the earth, the length on the arc is greater than the length of straight and the program is able to calculate both lengths. In this program, Cartesian coordinates are used to calculate the straight distance. Also, for lengths of more than 20 km, in order to calculate the actual length, you must specify that the length should be divided into several parts. The calculated length is real. [3].

The direct length between two points in this program is equal to 8947111.5954 meters, and if we divide this path into 1000 parts, the distance on the earth as a WGS84 arc is equal to 9911327.109 meters Fig.14. You can see the route between these two points in Figure 15. The program generates KML and GPX output to view the route on the map. [3].

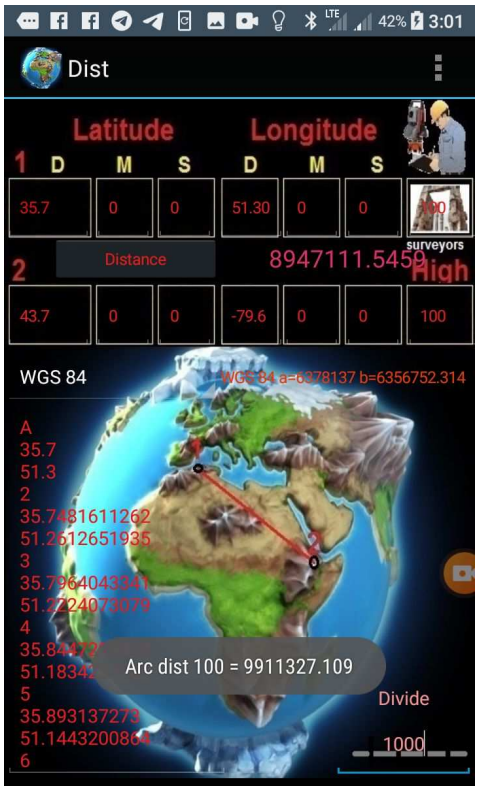

FIG.14 DIST APP AND READ DISTANT

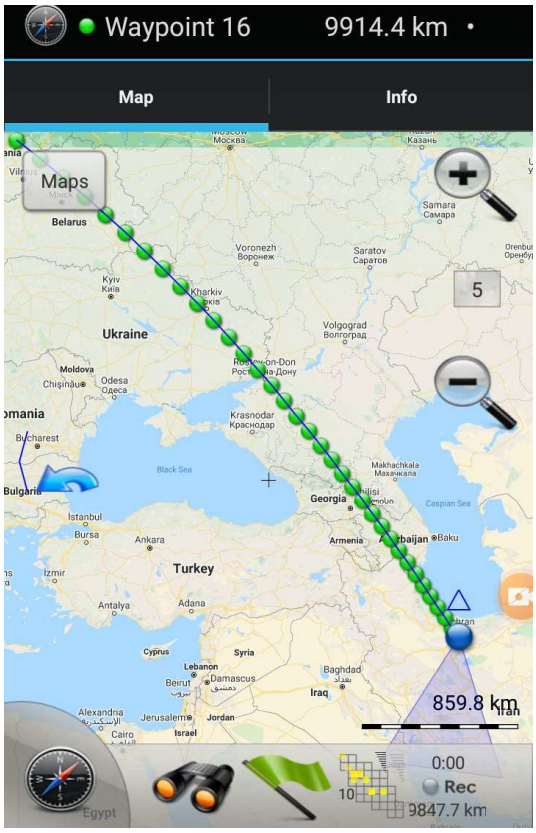

FIG.15 DIST.GPX ON GOOGLE MAP

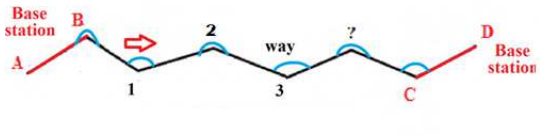

FIG.16 LOCALIZATION IN ROADS

If you plan to do a traverse like in Fig.16 and you have the UTM coordinates of the start and end points of the route, for localization, you can calculate the angles from the UTM coordinates and calculate the lengths from the DIST program to calculate the coordinates of the end of the traverse as the base points. In long tunnels where you do not have access to both sides of the tunnel to create a traverse and observe the length and angles, first you create two points at the beginning and two points at the end of the tunnel using a GPS device, then by localizing the coordinates, you can use the coordinates Use points to control the tunnel.

If your map is like Fig.9 or Fig.10, calculating the localization direction angle will be a challenge. By changing the base longitude in the UTM or TM coordinate system, calculate the required angles of the points. This calculation method is used in the Android localization program in Fig.17. By using programming, calculations can be done easily and the final result can only be seen. In the Android localization program, by entering the longitude and latitude of each point, the UTM, TM, CARTESIAN coordinates of the points are

calculated. From these coordinates, you can calculate the length and use the real angles of the points. Also, the program has the possibility to directly calculate and show the local coordinates by introducing the base point and the coordinates of other points. [4]

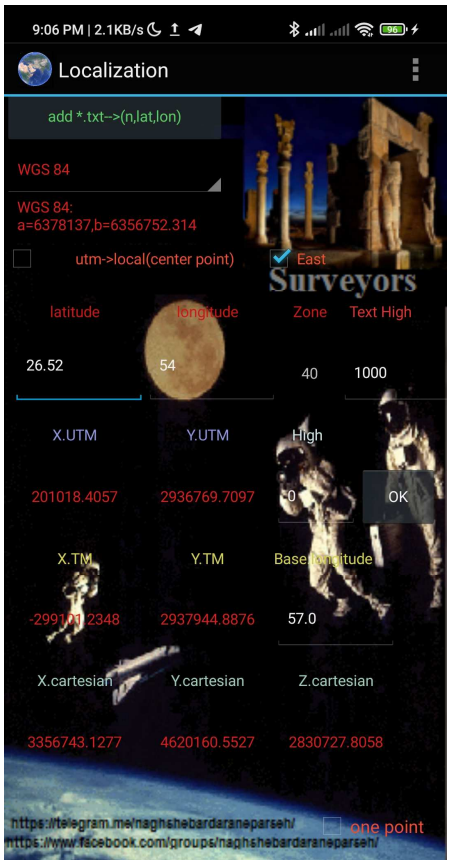

FIG.17 LOCALIZATION APP

In Fig.17, the longitude and latitude coordinates of a point are entered at an altitude of 1000 meters and three types of coordinates are calculated for localization. In figure 18, the program has calculated the coordinates of Fig.11, which is in a challenging position, the middle of the route is considered as the localization base point with zero latitude and 119.95 longitude, and points A, B, C, D are relative to These points are localized. The localized coordinates give us the actual length and angles between the points to control the tunnel. With these coordinates, you can control the tunnel. This program is used to control the 12 km tunnel of ALIGOODARZ, which is used in the example of the TRAVERSE Android application. [4]

In Fig.19, you can see the lengths and angles between the points designed using the Android localization application.

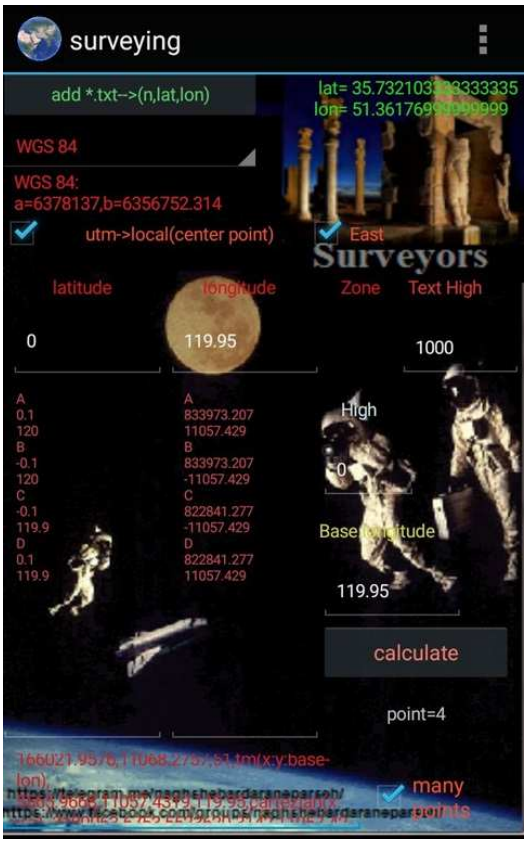

FIG.18 LOCALIZATION WITH APP

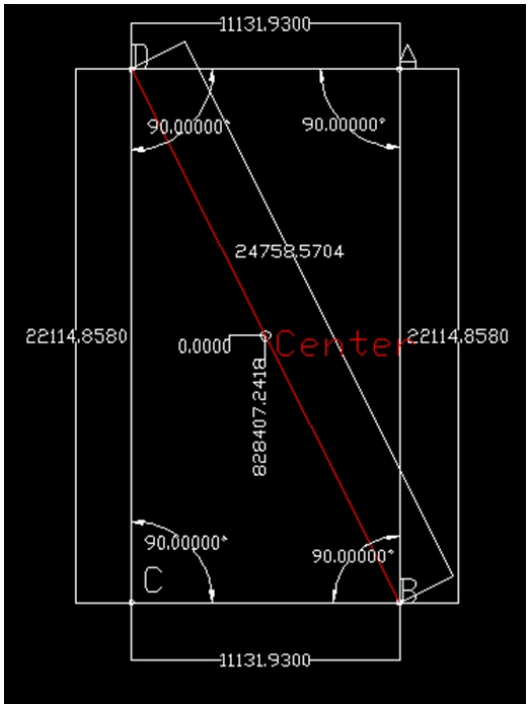

FIG.19 ACTUAL LENGTH AND ANGLE

FIG.20 LOCALIZATION WITH BASE POINT

In fig.20, the challenge related to fig.6 is calculated by the localization program of the local coordinates of the points. Fig.21 shows that if you have a file of geographical coordinates of points, you can enter it into the program and after introducing a point as a base point, localize the coordinates.

FIG.21 IMPORT DATA INTO APP

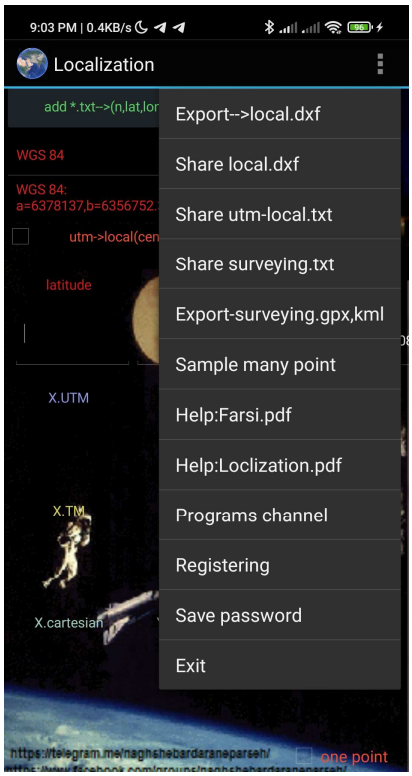

FIG.22 LOCALIZATION MENU APP

In fig.20, the challenge related to fig.6 is calculated by the localization program of the local coordinates of the points. Fig.21 shows that if you have a file of geographical coordinates of points, you can enter it into the program and after introducing a point as a base point, localize the coordinates. The program is able to provide you with other facilities. You can see other facilities in the program menu. Fig.22, all of the surveying apps there are in telegram channel [1]. Local app is in CAFEBAZAR [2]. DIST app is in CAFEBAZAR [3]. LOCAIZATION app is in CAFEBAZAR [4]. Traverse app is in PLAYSTORE [5].

REFERENCES

[1] https://t.me/naghshebardaraneparseh
[2] http://cafebazaar.ir/app/?id=local.parseh&ref=share
[3] http://cafebazaar.ir/app/?id=DIST.PARSEH&ref=share
[4] http://cafebazaar.ir/app/?id=surveying.parsehn&ref=share
[5] https://play.google.com/store/apps/details?id=traverse.parseh