Developing Software Which Automatically Plot Various Types of Profiles Using Road Survey Data

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Abstract— There is a lack of locally oriented software that generates profiles in a specific format which local organisations required, so professionals like Engineers, Surveyors face various kind of troubles. As a solution this research study was conducted for designing sub software (ProfileCAD), which will automatically plot several types of profiles using specific formatted Road Survey Data. This study was mainly focused on generating three types of profiles, such as Cross Sections, Longitudinal Section and a profile which is combination of both also this profile could be used as a plan so it is named as "ProfilePlan". ProfileCAD software contains set of programs which will allow user to input specific format data, after it will perform a data analysis then finally it will output a script file automatically. Then user has to run this script file in AutoCAD 2D/3D Environment. Cross Sections are usually plot using following data format "Chainage Offset Reduce-Level Remark", this data can be collected using Auto level, but it is also possible to plot them using Cartesian coordinate data format "Point-No X Y Z Code", this data can be collected by using Total Station. When designing program to plot Cross Sections using first data format is simple, but for second data format it is much complicated. Anyway lots of functions have to be used for second data format. Another important fact about this ProfileCAD software is, ability to convert from first data format to the other and vice versa, even internationally there are only very few number of software which has this ability. Longitudinal Sections are usually plot using following data format "Chainage Northing Easting Reduce-Level Remark". International software to plot this ProfilePlan is also rare. When inputting data first Road Centre Line Coordinates have to be input in this format "Change X Y Z Code", then the other coordinates have to be entered in this format as "Chainage Offset Reduce-Level Remark". Then the program will convert "Chainage Offset Reduce-Level Remark" data into Cartesian coordinate format, later program will automatically prepare a script file which containing instructions to plot ProfilePlan in AutoCAD environment. Finally using this Software product, the professionalism of people who are involved in the fields of Engineering and surveying can be improved.

Keywords— Profiles, Data Conversion, Automatic

I. INTRODUCTION

Profiles like Cross Sections and Longitudinal Sections are used frequently by professionals like Engineers, Quantity Surveyors, Land Surveyors and Draftsmen for road surveys.

With the development of software technology, software such as AutoDesk Civil 3D, Pythagoras etc., currently used for generating such profiles. But all the facilities necessary for local professionals are not included. They can use international software, which will generate profiles automatically when necessary data files were input to the software. But the problem is most of the software will not give exact format of the profile that is demanded by local Government Authorities such as Survey Department, Road Development Authority.

Therefore the professionals have to edit the particular profile manually. Sometimes there is large number of profiles to submit. As an example in road surveys, surveyors have to submit hundred cross sections for one kilometre. After that they have to edit large number of cross sections.

A. Cross Section

A cross section is the intersection of a body in three-dimensional space with a plane. It is a common method of depicting the internal arrangement of a 3-dimensional object in two dimensions. It is often used in technical drawing.

Cross sections can be plotted by using both "X,Y,Z" data and "chainage, offset, height" data formats with the help of ProfileCAD software. Figure 1 shows the sketch of the cross section of a road.
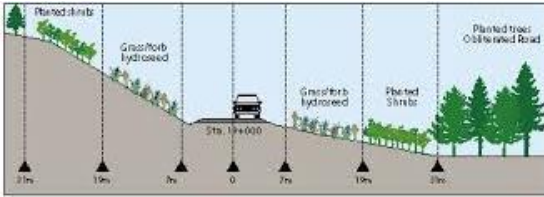
Figure1. Cross Section

B. Longitudinal Section
A longitudinal section is the representation of an object as it would appear if cut by the vertical plane passing through the longest axis of the object. This software can be plotted Longitudinal Section using X,Y,Z coordinates of the centre points along the road. Figure 2 shows sketch of a longitudinal sections
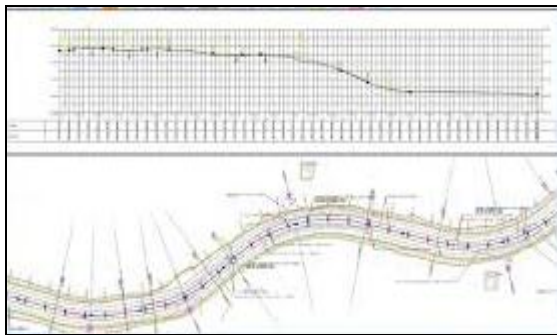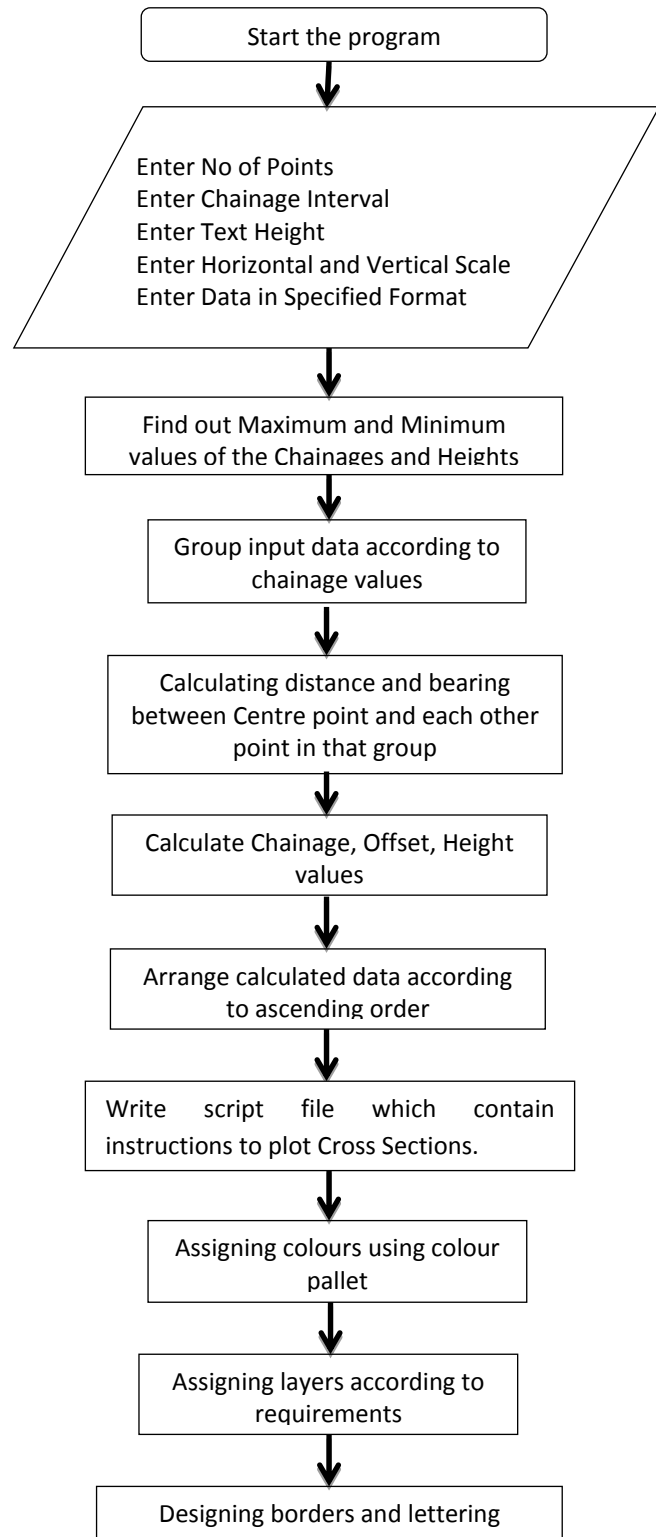

Figure 2. Longitudinal Section

C. Profile Plan
In additional to cross section and longitudinal section a new profile will be generated by this ProfileCAD toolbar. It is not a conventionally used profile but it is pretty useful for the professionals. It is a combination of both cross section and longitudinal section. It can also be used as a plan. When a surveyor collect data for cross sections using auto level those data are in "chainage, offset, height" data format, from that data a plan with X,Y,Z coordinate cannot be plotted directly. Therefore as a solution, in this software there are programmes that will do the conversion from "chainage, offset, height" format, to X,Y,Z format. After the conversion, program will write a script which contains instructions to plot the plan.

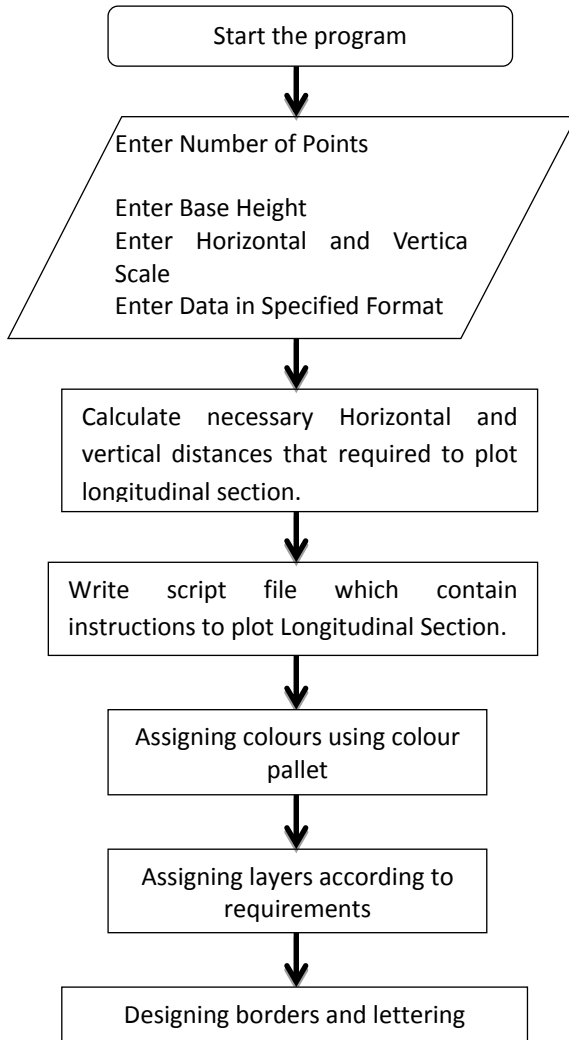II METHODOLOGY AND EXPERIMENTAL DESIGN
ProfileCAD Software was designed by C++ language and it was linked by AutoLISP programming language which is specially designed by AutoCAD designers to enable end user to design, his user interface as he prefer. All the AutoCAD commands were designed using AutoLISP language. C++ executable file was designed to input data in a specific order and process them and finally output a script file. When "Run Script" button was pressed that script file will run and profile will be generated automatically.
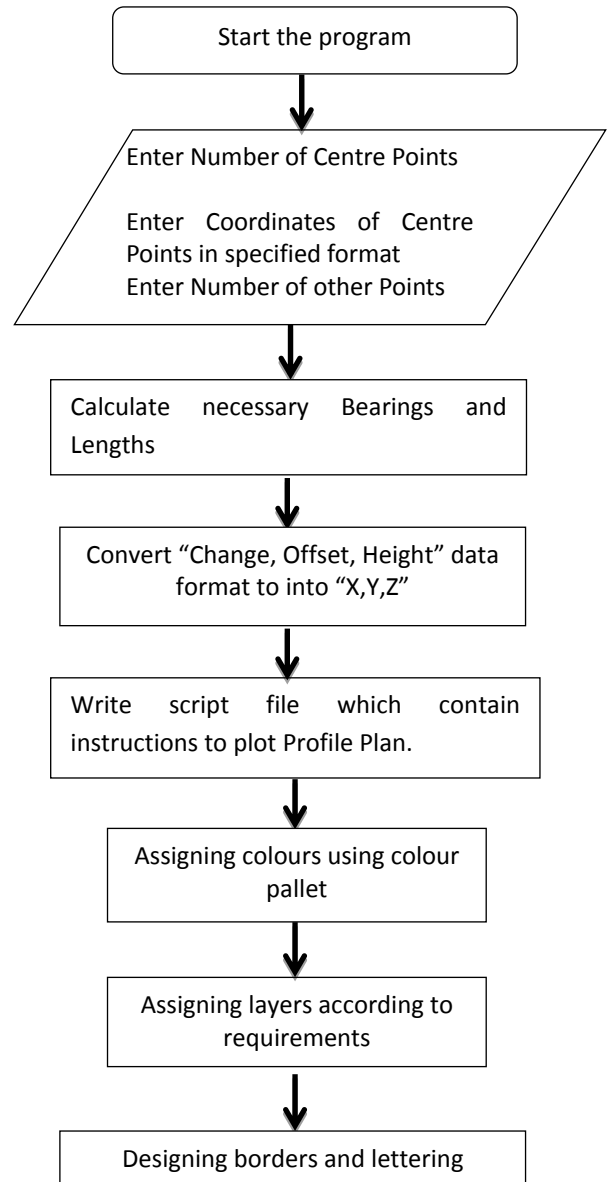
A. Cross Section Plotter

Start the program

⬇

Enter No of Points
Enter Chainage Interval
Enter Text Height
Enter Horizontal and Vertical Scale
Enter Data in Specified Format

⬇

Find out Maximum and Minimum values of the Chainages and Heights

⬇

Group input data according to chainage values

⬇

Calculating distance and bearing between Centre point and each other point in that group

⬇

Calculate Chainage, Offset, Height values

⬇

Arrange calculated data according to ascending order

⬇

Write script file which contain instructions to plot Cross Sections.

⬇

Assigning colours using colour pallet

⬇

Assigning layers according to requirements

⬇

Designing borders and lettering

Flow Chart 1

B. Longitudinal Section

Start the program

Enter Number of Points

Enter Base Height
Enter Horizontal and Vertica Scale
Enter Data in Specified Format

Calculate necessary Horizontal and vertical distances that required to plot longitudinal section.

Write script file which contain instructions to plot Longitudinal Section.

Assigning colours using colour pallet

Assigning layers according to requirements

Designing borders and lettering

Flow Chart 2

C. ProfilePlan

Start the program

Enter Number of Centre Points

Enter Coordinates of Centre Points in specified format
Enter Number of other Points

Calculate necessary Bearings and Lengths

Convert "Change, Offset, Height" data format to into "X,Y,Z"

Write script file which contain instructions to plot Profile Plan.

Assigning colours using colour pallet

Assigning layers according to requirements

Designing borders and lettering

Flow Chart 3

Flow Charts 1, 2, 3 describes how main program works internally.

III. RESULTS

After completing the study following results were able to achieve.
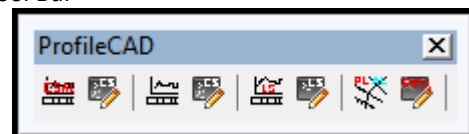
A. Tool Bar

Figure 3. Tool Bar

This tool bar shown in Figure 3 was designed by AutoCAD customize command. AutoCAD allows end user to customize graphical user interface with this command.
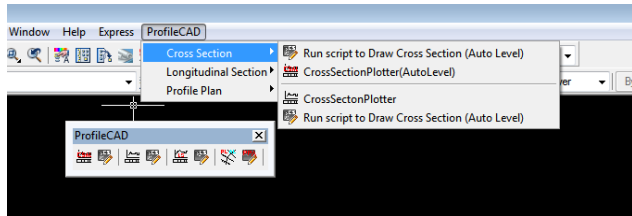
B. Menu Bar

Figure 4. Menu Bar

This menu bar shown in Figure 4 was also designed by AutoCAD customize command. AutoCAD allows end user to customize graphical user interface with this command
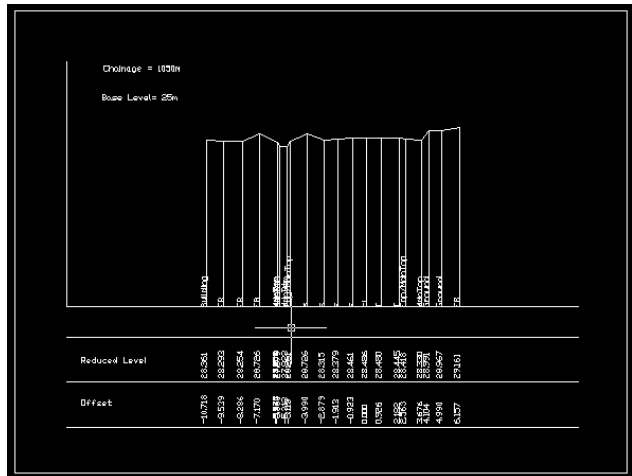
C. Cross Section

Figure 5. Cross Section

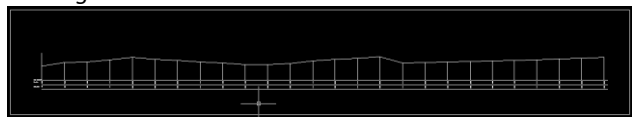Figure 5 shows the cross section generated by ProfileCAD software.

D. Longitudinal Section

Figure 6. Longitudinal Section

Figure 6 shows the longitudinal section generated by ProfileCAD software.
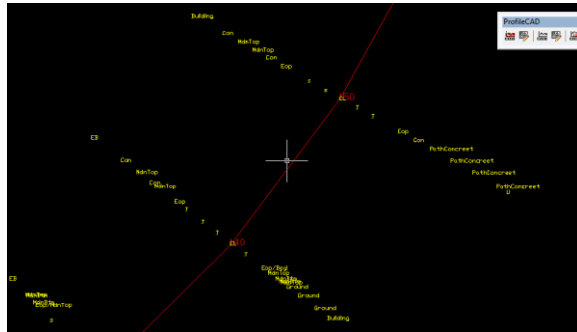
E. Profile Plane

Figure 7. Profile Plane

Figure 7 shows the Profile Plan generated by ProfileCAD software.

IV. DISCUSSION AND CONCLUSION

Data conversion between from "chainage, offset, height" format to "X,Y,Z" format and vice versa is a special unique feature of this software.

Even though, modern software like Autodesk Civil3D has the capability to generate cross sections and longitudinal sections. Those profiles are not in a format that is demanded by local authorities. ProfileCAD software is designed in a way which will fulfil demanded format that required by local authorities.

Another fact is, international software like Autodesk Civil3D is very expensive. Those high prices are usually unaffordable to individual professionals like engineers, surveyors, draftsmen. As a solution software like ProfileCAD can be designed as open source software or as affordable price software.

ACKNOWLEDGEMENT

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