

# Preparation Of Need Based Open Source Gis Software For Geospatial Techniques: A Case Study For Watershed Analysis

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**Abstract—** Geographical Information System (GIS) is an important tool for spatial analysis which is widely used for various purposes. Different organizations have prepared software with particular license and these are very much costly for individual uses and also for academic purposes. Few open source license free software are available but these are designed for specific uses. By viewing these, the authors have prepared the need based open source GIS programme for common uses. The detail programme of the software is not possible present in the paper and for this reason it is already uploaded in .pdf mode in the link URL <http://www.docdroid.net/12qll/codings-for-prepare-an-object-base-gis-software.pdf.html>

**Index terms -** GIS, spatial analysis, licensed, open source, free software.

## I. INTRODUCTION

The Geographic Information System (GIS) approach has been extensively used for spatial modeling in a variety of application areas in different fields. It has been successfully used in monitoring, scheduling and estimating various kinds of underground phases. GIS based management for various projects determines essentially the requirement of resources at various phases. Besides the already implemented GIS tools, functions and extensions provide a basis for mathematical modeling. The Visual Basic or Visual Studio programming environment running under GIS helps the programmer to develop and implement their own functions and tools. This paper presents a preparation of specific need oriented open freeware GIS software with the particular objectives.

The utility of GIS in different fields is increasing day by day but the number of human resource with knowledge in GIS is very less. So, there also exists need of software having essential limited functionality. A person having very little knowledge of GIS can do his specific need of analysis with the software.

GIS software is used to design spatial database, making maps and doing analysis on the GIS database. All these need proper training. So, keeping in mind, those people who have very little knowledge in GIS but want to do some analysis on GIS data, this software tries to make it as much as user friendly as possible. This paper shows preparation of a need based GIS software using objects of the freeware GIS software in .NET frameworks platform.

## II. BACKGROUND OF OPEN SOURCE SOFTWARE

The free software was launched in 1983, but there existed earlier projects which fit (or almost fit) the modern definition of free software, that is, software which all users are free to use, study, modify and redistribute ("free as in freedom"). Earlier projects provided these freedoms either for practical reasons or social reasons but were not part of an organized movement to spread the practice or the philosophy.

The movement was launched by Richard Stallman (1980) as a reaction to the growing trend of developers blocking these freedoms by only publishing the run-able version of the software and not the modifiable source code.

Stallman argues that this is a social imperative for all distributed software, rather than a technical choice which just happens to have a practical value in some contexts. In 1998, people who advocated free software but disagreed that it was a social imperative began using the term "open-source software for the software and presenting it has having technical advantages.

Open-source software (OSS) is computer software with its source code made available and licensed with a license in which the copyright holder provides the rights to study change and distribute the software at no cost to anyone and for any purpose. Open-source software is very often developed in a public, collaborative manner. Open-source software is the most prominent example of open-source development and often compared to (technically defined) user-generated content or (legally defined) open-content movements.

## III. IMPORTANT GIS SOFTWARE

Some important GIS software in the market which can be used in development purpose, are introduced as below:

- ❖ **ESRI ARCGIS:** - ESRI's ArcGIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic

information in a range of applications; and managing geographic information in a database.

The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web. But this software is not freeware.

- ❖ **TNTmips:** - TNTmips is a geospatial analysis system providing a fully featured GIS, RDBMS, and automated image processing system with CAD, TIN, surface modeling, map layout and innovative data publishing tools. TNTmips has a single integrated system with an identical interface, functionality and geo-data structure for use on Mac and Windows operating systems. The interface, database text content, messages, map production, and all other internal aspects of TNTmips have been localized for use in many languages, including, for example Arabic, Thai, and all roman languages. But this software is too not freeware.
- ❖ **Map Window GIS:** - Map Window GIS is an open source GIS (mapping) application and set of programmable mapping components. It has been adopted by the United States Environmental Protection Agency as the primary GIS platform for its BASINS (Better Assessment Science Integrating Point and Nonpoint Sources) watershed analysis and modeling software. Map Window GIS is distributed as an open source application under the Mozilla Public License distribution license; Map Window GIS can be reprogrammed to perform different or more specialized tasks. There is also plug-ins available to expand compatibility and functionality.

The application is built upon Microsoft .NET technology. Updates for Map Window GIS are regularly released by a group of student and volunteer developers.

#### IV. OBJECTIVES OF THE PRESENT STUDY

- i. To prepare GIS software for the users who want to do specific GIS analysis.
- ii. The software should be user friendly.
- iii. The software should be license free and can be installed in any platform or OS.
- iv. The software should be light weight and have limited specific operation tools according to user need.
- v. The software should make analysis easier to save time and resources.
- vi. The software should reduce workload.

#### V. REQUIREMENTS FOR SOFTWARE DEVELOPMENT

##### a. Software requirements:

- ❖ Visual Studio 2008 and 2010.
- ❖ Microsoft .NET Framework 4.0 and 3.5.
- ❖ Map Window.
- ❖ Dot Spatial minimal and extended.
- ❖ 32 or 64 bit Operating System (Windows – XP/ Vista/ 7/ 8).

##### b. Hardware requirements:

- ❖ Physical Memory (RAM) – 1 GB recommended.
- ❖ Disk Space – Hard Disk Space 2 GB minimum.
- ❖ CPU Processor – 1 GHz.
- ❖ Video Adaptor – 256 colours.

#### VI. REQUIREMENTS FOR RUNNING THE SOFTWARE

##### a. Software requirements

- ❖ .NET Framework 3.5 and 4.0 or above.
- ❖ Operating System Windows 98, Windows XP, Windows Vista, Windows 7, Windows 8 etc any OS running on .exe.

##### b. Hardware requirements:

- ❖ Physical Memory (RAM) – 1 GB recommended.
- ❖ Disk Space – Hard Disk Space 2 GB minimum.
- ❖ CPU Processor – 1 GHz.
- ❖ Video Adaptor – 256 colours.

#### VII. NEED FOR DOT NET FRAMEWORK

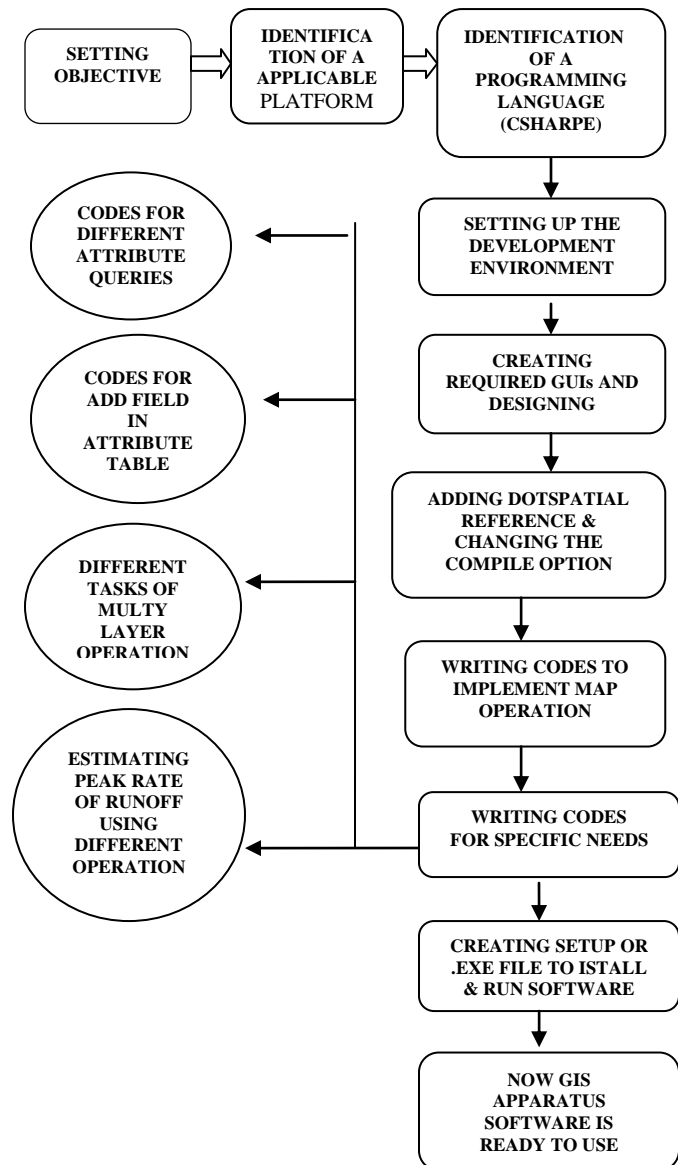
Choosing the programming platform is the essential for developing software. Different open source GIS software support different programming language as they are developed in different platforms. The software in this project is developed in .NET technology with C# coding considering the following aspects:

- ❖ .NET is language independent, so if the team has multiple skill expertise C#, VB.NET, C++ developers can still work on the same project with different skill set.
- ❖ MS technologies provide rapid application development to deliver project faster.
- ❖ Excellent Windows integration, including access to all standard GUI functions and other libraries.
- ❖ Debugging is very effort less therefore can fix the bugs quicker.
- ❖ Deployment is very easy and simple.
- ❖ Ajax implementation is simple and easy.

#### VIII. METHODOLOGY

MapWindow and Dot Spatial provide object library for development in .NET platform. The

objects can be found in website as well as on installation of the MapWindow software. Adding these objects to Visual Studio as reference gives several tools for development. MapWindow and Dot Spatial object need .NET Framework 4.0 or above for development. Visual Studio 2010 has in-built .NET Framework 3.5 and 4.0. The steps required to create our desired software are as follows:



Object-oriented programming (OOP) is a programming paradigm that represents concepts as "objects" that have data fields (attributes that describe the object) and associated procedures known as methods. Objects, which are usually instances of classes, are used to interact with one another to design applications and computer programs.

In this analysis both Visual Studio and the .NET Framework. The variety of form controls and base class libraries to create simple Graphical User Interfaces (GUIs). The work covers variables, relational operators, decision statement classes and methods, and additional topics that have provided a foundation on which one can build the knowledge of object-oriented design concepts and the C# programming language.

In connection with this project the following were done:

- Code solutions and compile C# projects within the .NET framework.
- Create and manipulate GUI components in C#.
- Construct classes, methods, and accessory and instantiate objects.
- Demonstrate knowledge of object-oriented concepts such as encapsulation and polymorphism.
- Design user experience and functional requirements for a full-fledged C#.NET project.

From beginning to end, I have learnt Visual Studio and .NET Framework-based projects for preparation of need based GIS software.

## IX. SETTING UP DEVELOPMENT ENVIRONMENT

The toolbox provides a way to drag and drop controls onto the design surface of a form. When a control is dropped onto a form, Visual Studio will generate code necessary to instantiate the control, and add any required references to the project. The control could not be instantiated without using the designer by writing the appropriate code and making any necessary references.

- ❖ Create a new GUI and create a new tab in the Visual Studio Tool Box.
- ❖ Right Click on the tool box and add Dot Spatial items.
- ❖ Navigate to the Dot Spatial folder and Select the Dot Spatial. Controls from Dot Spatial folder.
- ❖ The Dot Spatial. Controls will be shown in the Visual Studio Tool Box.

Adding References –

- ❖ Now add the required Dot Spatial references in the Visual Studio development environment.
- ❖ Add all references like Dot Spatial Controls, Dot Spatial Data, Dot Spatial Data Forms, Dot Spatial Serialization, Dot Spatial Symbology, Dot Spatial Topology etc.

## X. USER MANUAL

This is user-friendly software and it is also open source. How this software works with is given below:

**a. How to add a shape file**

- ❖ At first go to **File** and select **Open** option.
- ❖ File dialog box is open and search file to select and open it.
- ❖ Now show the Shape File map.

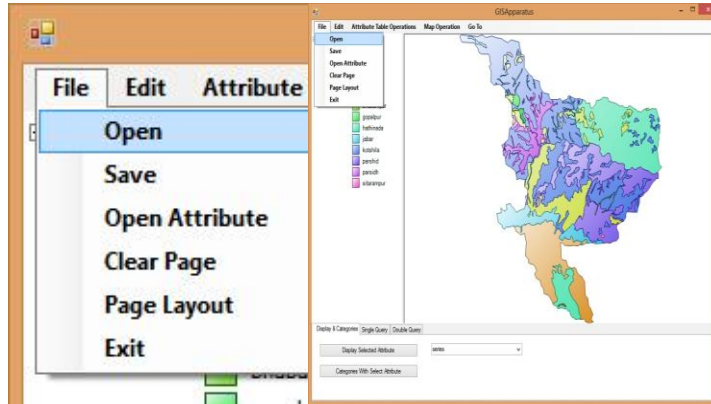


FIG. 1

**b. How to open attribute table, zoom in and out, and pan:**

- ❖ To open attribute table go to **File** and select **Open Attribute** or go to **Attribute Table Operation** and select **View Table**.
- ❖ To zoom in and zoom out go to **Edit** and select **Zoom In** and **Zoom Out**.
- ❖ To pan go to **Edit** and select **Pan**.

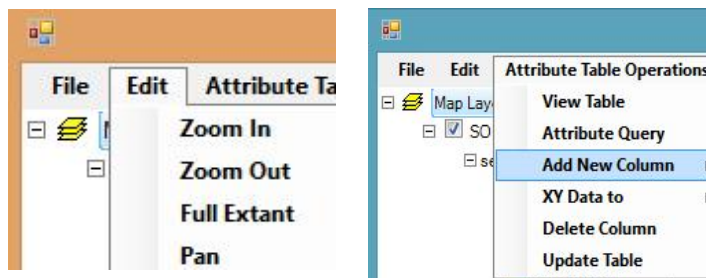


FIG. 2

**c. How to save and clear page and print out–**

- ❖ To save the open file go to **File** and select **Save**.
- ❖ To clearing the current pages go to **File** and select **Clear Page**.
- ❖ To print page go **File** and select **Page Layout**.

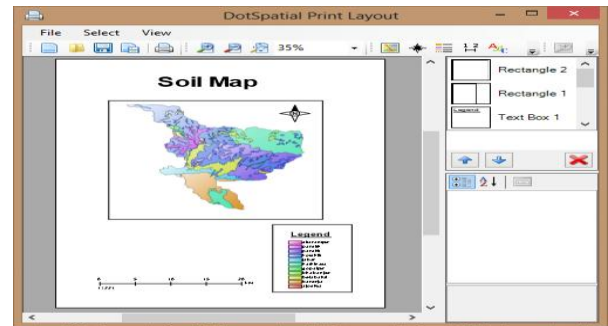
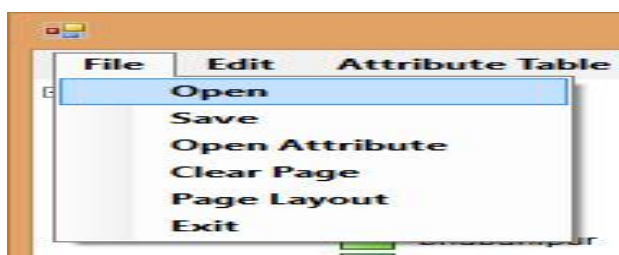


FIG. 3

**d. Attribute table operation –**

- ❖ To add a new column in existing data table go to **Attribute Table Operation** and go **Add New Column** and select respectively **Addition of Tow Fields** for addition, **Subtraction of Tow Fields** for subtraction, **Multiplication of Tow Fields** for multiplication, **Division of Tow Fields** for division, **Add Text Column** and **Add Numeric Column** for add new column.
- ❖ To delete a column go to **Attribute Table Operation** and select **Delete Column**.
- ❖ To permanently save different attribute table operation go to **Attribute Table Operation** and select **Update Table**.

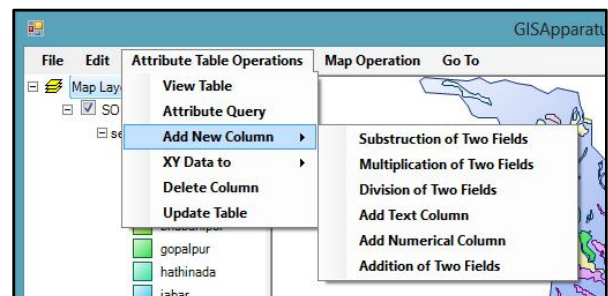


FIG. 4

**e. How to create xy data –**

- ❖ Go to **Attribute Table Operation** and go **XY Data** and select **Point**, **Line**, **Polygon** for creates Point, Line, and Polygon respectively. But here input **.xlsx** Excel Format data with input the X and Y value.

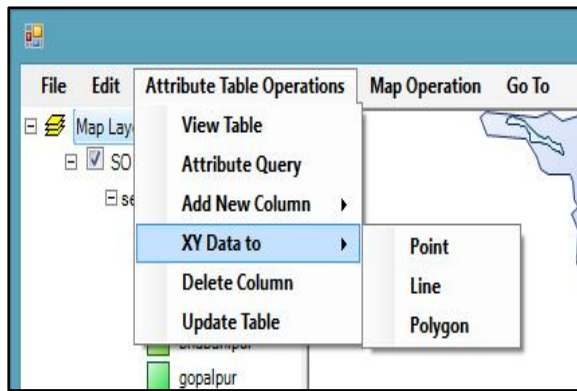


FIG. 5

*f. Merge operation:*

Go to **Map Operation** and go **Merge** and select **All Features in a Shape File** and **Intersection Features In a Shape File** for all and intersection features merge.

*g. Intersection operation –*

- ❖ Select **Intersection** in **Map Operation**.
- ❖ Open dialog box and choose a shape file and ok.
- ❖ After that again open a dialog box and select a shape file which are intersected.
- ❖ Then open a save dialog box open and put the name of intersect shape file and press the save button.

*h. Buffer operation:*

- ❖ Select **Buffer creates** in **Map Operation**.
- ❖ Open dialog box and choose a shape file which convert in buffer area and ok.
- ❖ Open another dialog box and choose field and value in meter and ok.
- ❖ Then save dialog box open and save this in a specific name.

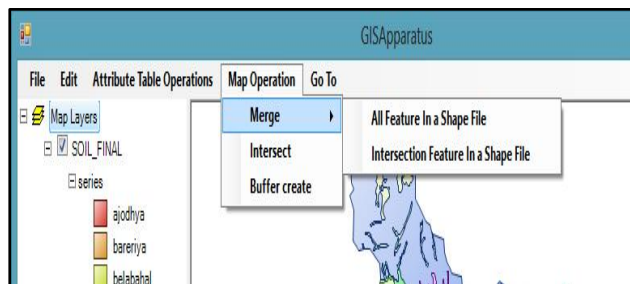


FIG. 6

*i. Data queries:*

At first open shape file and go below the map and choose fields and its value to fulfill the queries and then press ok button. Similarly user may do every query (single, double).



FIG. 7

**XI. An example of carrying out a specific need based task**

Computation of peak rate of runoff with SCS Curve Number method -

- ❖ Click on **Go To** and select **Peak Rate of Runoff to SCS Curve Number Method**.
- ❖ Open a window and select two layers which are describe there and fill all box.
- ❖ Then press **Go** button.
- ❖ Then go to **Data View** page.
- ❖ Select **Export Data to Excel Format** only for calculation data extraction.
- ❖ Then browse **Main Watershed Map** and select **Join Runoff Table in Watershed** to join both above table.
- ❖ Then if you want to export all data in excel, you also press the **Export Data to Excel Format**.

FIG. 8

FIG. 9

## XII. CODING

The steps for preparing the license free coding to make object base GIS software are given below and the detail programme has already uploaded in the URL <http://www.docdroid.net/12qll/codings-for-prepare-an-object-base-gis-software.pdf.html> because the detail programme is not possible to present within the limited space. The coding steps are given below:

- Coding behind Form1: Form1.cs – code written for the different controls of Form1
- Coding for open a shape file or a map
- Coding for declaration of different combo-boxes
- Coding for save the open shape file or map
- Coding for clear open page or map
- Coding for exit hole setting
- Coding for using form1 properties
- Coding for layout open page
- Coding for zoom in to map
- Coding for zoom out to map
- Coding for full extent of map
- Coding for pan to map
- Coding for select to a map
- Coding for clear to select map
- Coding for identify to feature
- Coding for open attribute table
- Coding for another view table
- Coding for display attribute value on map
- Coding for filling the combo box with attribute values
- Coding for queries
- Coding for addition of two column
- Coding for subtraction of two column
- Coding for multiplication of two column
- Coding for division of two column
- Coding for XY data to point, line & polygon
- Coding for delete column
- Coding for update table
- Coding for selected combo boxes value to another combo box
- Coding for merge on a shape file
- Coding for intersect with two shape files
- Coding for add text column
- Coding for set buffer creation area
- Coding for add numeric column
- Coding for showing of latitude and longitude value



- Coding behind Addition\_Of\_Two\_Fields: Addition\_Of\_Two\_Fields.cs – code written for the different controls of Addition\_Of\_Two\_Fields
  - Coding behind Substruction\_Of\_Two\_Fields: Substruction\_Of\_Two\_Fields.cs – code written for the different controls of Substruction\_Of\_Two\_Fields
  - Coding behind Multiplication\_Of\_Two\_Fields : Multiplication\_Of\_Two\_Fields.cs – code written for the different controls of Multiplication\_Of\_Two\_Fields
  - Coding behind Divition\_Of\_Two\_Fields: Divition\_Of\_Two\_Fields.cs – code written for the different controls of Divition\_Of\_Two\_Fields
  - Coding behind Delete\_Column\_From\_Table: Delete\_Column\_From\_Table.cs – code written for the different controls of Delete\_Column\_From\_Table
  - Coding behind Curve Number Form: Curve Number Form.cs – code written for the different controls of Curve Number Form
9. <http://en.wikipedia.org/wiki/TNTmips>.  
10. <http://stackoverflow.com/questions/4980467/export-dataset-to-excel>.  
11. <http://www.mapwindow.org/phorum/read.php?13,18433>.  
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### XIII. CONCLUDING REMARKS

The objective of this project was to develop user friendly GIS software. This software mainly used whose person having very few or no knowledge of GIS. Looking throughout the project it can be said that the objective is partially successful. Although the software created in this project have several functionalities they also lack many other functionalities. Raster operations cannot be done in this software. Several spatial vector operations can be done in this software. But checking out the .NET Framework Programming and the object libraries on the open source GIS software, it can easily said that these operations may be developed in .NET Programming. We can conclude that software with limited functionality, free of license, user friendly and light weight can be developed and persons can use this software for their specific need.

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