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ICT application for calculation of formulae of hydrograph by using visual studio 2017

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Abstract
A Hydrograph is the Curve which shows the relation between the discharge and time of any stream at a point. Hydrograph may be used to show how to water flow in a drain age basin respond to period of rain. The factors affecting shape of hydrograph that is antecedent rainfall, Impermeable rock type, size of drainage basin, vegetation etc. A Runoff Hydrograph is a graph showing the rate of flow verses time past a specific of river, and channel, or conduit carrying flow. A Unit Hydrograph is a direct runoff hydrograph resulting from one unit of constant intensity uniform rainfall occurring over the entire watershed.
A Synthetic unit hydrograph retains all features of the unit hydrograph but does not require rainfall data and its purpose to simulate basin diffusion by estimating the basin lag based on a certain formula. A dimensionless hydrograph method is a simple easy to use technique for simulating an average hydrograph correspond to a given peak discharge. Visual Studio 2017 software is used to calculate the formulae. Microsoft Visual Studio is an Integrated Development Environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. In Visual Studio Software C sharp Language and .NET Framework is used, operators perform simple calculations and similar functions. Thus, the calculations are completed in a very short span of time as they are pre-defined in the software. By entering the values, the formulae for Hydrograph were calculated. The results thus obtained were verified with the manual calculations and found that the results were accurate. Thus, this software is very efficient for calculating formulae for open channel flow.

Keywords: Hydrograph, visual studio, runoff, discharge, synthetic hydrograph etc.

Introduction

Application of new and contemporary information and communication technologies (ICTs) for rural and agricultural development in the Asia-Pacific region has been advancing quite rapidly over the last decade (FAO.). Agriculture plays a significant role for economic and social development in most undeveloped countries. Information of adequate quality is a necessary condition for improvement of all areas of agriculture. With the rapid development of Information and Communication Technologies (ICTs), data and information can be effectively generated, stored, analyzed, disseminated and used to support farmers and farming communities to improve agricultural productivity and sustainability.

With the introduction of agricultural informatization, the traditional agriculture has been reformed by advanced ICTs, eventually contributing to the significant improvements in agricultural productivity and sustainability. Agricultural informatization is a long-term stimulus for agricultural development and also an important indicator of agricultural modernization. Information services for farmers at the national and regional level are a promising new field of research and application in the emerging field of e-agriculture. United Nations reported that (1999) ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries, documentation network-based information services, and other related information and activities. The field of education also has been affected by ICTs, with teaching, learning, and research (Yusuf, 2005). The agriculture and the education departments are two elements where the ICT can play the very important role in the development of the country (Jadhav, 2018). The Agriculture and the education departments are two elements where the ICT can play the very important role in the development of the country (V. D. Jadhav, 2019) [9].

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Existing System
The Existing system is completely manual. The hydrograph Calculation contains different formulas for calculation. These formulas are very complex to calculate with the use of calculators. It is purely paper based to store the records of the one-time calculated values of those formulas. The calculations are done with calculator by entering each value of formula manually in the calculator.

Limitations in Present System
There are certain limitations in system, which areas follow:-
1) There are various steps or formulae involved in Calculation for hydrograph, so it is difficult to handle manually.
2) Manually calculations are difficult to estimating various factors of methods and also more time required.
3) For recording purpose, it should be note down in some paper, thus chances of losing the data are increases.
4) It is difficult to search the old record of data.
5) Manually calculations include more errors with less accuracy.

Proposed system
The proposed system is deals with the Calculation of formulae for hydrograph by using visual studio 2017. To remove the complexities, errors and difficulties the proposed system is developed. Today the digitalization is directly coming with computerization, so the students, researchers are coming under the one roof to learn about digitalization and computerization. Calculation of hydrograph formulas manually on the paper are very complex method to find the accurate value of each factor. Since these works does manually thus it takes more time and there are chances of errors such as wrong details, wrong value at wrong place, etc.

Advantages of Proposed System:-
1. Calculations are done very fast and it saves the time.
2. It stores the old data, so data recovery is possible easily.
3. No need to data note down on the paper because it stores digitally in computer.
4. Modified the data as per requirement.
5. System includes the various security features.
6. System should be window based, user-friendly and efficient.
7. Appropriate master tables must be present to record relevant data.
8. Accuracy can be maintained

3. Objectives
1. To get acquainted with software Visual Studio 2017
2. To simplify the calculation of formulae for hydrograph.
3. To reduce the time required for computation of formula for hydrograph by using visual studio 2017.
4. Maintain the old database of the hydrograph calculations.

Review of Literature
The topic deals with review of literature covering related software's and related information of SWCS. Maria Joao Correia De Simas (1996), The research represents the lag time characteristic in small watershed.
Saralees nandarajah (2007), Drive the expression for parameter in term of peak time (tp), peak discharge (qp), base time (tb), etc and provide simple maple programs for calculating these expressions.
Dr. M Seth and B.C. Patwary (2010), Develop software geographical instantaneous unit hydrograph for leska basin. Software such as ELWIS, ARC/INFO.
P.K. Bhuny and S.N. Panda (2011), The research represents the probability distribution function like peak discharge, peak rate flow, time to peak for synthetic unit hydrograph. Also discuss about parameter affect graph.
S. Kumar and J. Jena (2015), The research on SUH based on geomorphology used to produce flood hydrograph and collection of parameters from survey of Indian maps and GIS geographical information system.
E. Nagy, P.Torma, K.Bene (2016), The research represent the comparing method for computing the Time of Concentration in a medium sized Catchment.

Material
This deals with calculation of formulae for hydrograph. It includes different formulae and sub-formulae those were used while developing the software. It also encapsulates the configuration of the system and information about the used to develop software utility.

System Requirements
Hardware Requirements

RAM	Min 4GB
Hard Disk	Min 250GB
Processor	1.0 GHz (Intel/AMD)

Software Requirements for Development
- Microsoft visual studio 2017
- SQL Server 2017
- Microsoft SQL Server Management Studio 2017

About the Platform
- SQL Server 2017
- Microsoft SQL server Management Studio 2017

Methods and Formulae
A. Unit Hydrograph
a) No. of days $= 0.83(A)^{0.2}$
b) DRO= TRO-BFO
   TRO= Total runoff ordinate
   BFO= Baseflow ordinate
c) Depth of Rainfall= Volume of water /Area
d) Net rainfall= SUM (DRO)*t/A
e) UHO= DRO/ Pnet
   a. UHO= unit hydrograph ordinate

B. Synthetic Hydrograph
a) Basin lag=Cr(L*Lca) 0.3
   Cr = regional constant
   L = Basin length
   Lca= Distance from gauging station
b) Recession time (Tr)= Tp/ 5.5
   Tp= Basin lag
c) Peak discharge (Qps)=2.78 *Cp *A/Tp
   Cp = Regional Constant
d) Base time=72+3*Tp
e) W50= $\dfrac{5.87}{q^{1.08}}$
f) W75=W50/1.75

C. Dimensionless hydrograph
a) Lag + Semi duration factor = ER/2+ Lag time
b) X ordinate = Time/ Lag +Semi duration factor
c) **Y ordinate = Discharge*(Lag + Semi duration Factor / volume)**

Source Code
Home page

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;

namespace Hydrograph_Formulae_Home
{
public partial class Form1 : Form
{
public Form1()
{
InitializeComponent();
}
private void formula1ToolStripMenuItem_Click(object
sender, EventArgs e)
{
simple_hydrogrph sh = new simple_hydrogrph();
sh.Show();
}
private void
syntheticUnitHydrographToolStripMenuItem_Click(object
sender, EventArgs e)
{
Form2 f2 = new Form2();
f2.Show();
}
 private void
dimensionlessUnitHydrographToolStripMenuItem_Click(obje
ct sender, EventArgs e)
{
Form3 f3 = new Form3();
f3.Show();
}
private void introductionToolStripMenuItem_Click(object
sender, EventArgs e)
{
Form4 f4 = new Form4();
f4.Show();
} } }
```

Source Code for Simple hydrograph:

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.Data.OleDb;
```

```
using System.Data.SqlClient;
namespace Hydrograph_Formulae_Home
{
 public partial class Form4 : Form
{
SqlConnection con = new SqlConnection("data
source=DESKTOP- OA20QBH\\sqlexpress;Initial
Catalog=hydrographproject;Integrated Security=True;");
SqlCommand cmd = new SqlCommand();
public Form4()
{
InitializeComponent();
}
private void button1_Click(object sender, EventArgs e)
{
try
{
// OleDbConnection con = new OleDbConnection(constr);
 con.Open();
cmd.CommandText = "insert into Simple_hydro values (N'" +
T.Text + "',N'" +D.Text + "')";
cmd.Connection = con;
cmd.ExecuteNonQuery();
//OleDbCommand cmd = new OleDbCommand(q, con);
//cmd.ExecuteNonQuery();
MessageBox.Show("Record Added Successfully!!!!!");
con.Close();
}
catch { }
}
private void button2_Click(object sender, EventArgs e)
{
graph_new1 gn1 = new graph_new1();
gn1.Show();
}}}
```

Source Code for Unit Hydrograph:

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
//using CrystalDecisions.CrystalReports.Engine;
//using CrystalDecisions.Shared;
using System.Drawing.Printing;
using System.Data.OleDb;
using System.Data.SqlClient;
namespace Hydrograph_Formulae_Home
{
public partial class simple_hydrogrph : Form
{
SqlConnection con = new SqlConnection("data
source=DESKTOP-OA20QBH\\sqlexpress;Initial
Catalog=hydrographproject;Integrated Security=True;");
SqlCommand cmd = new SqlCommand();
public simple_hydrogrph()
{
 InitializeComponent();

}
```

```
private void button1_Click(object sender, EventArgs e)
{
double area, no_of_days;
area = double.Parse(a.Text);
double r1 = Math.Pow(area, 0.2);
no_of_days = 0.83 * r1 *24 ;
no_days.Text = "" + no_of_days + "";
}
private void button2_Click(object sender, EventArgs e)
{
double TRO, BFO, DRO;
TRO = double.Parse(tro.Text);
BFO = double.Parse(bfo.Text);
DRO = TRO - BFO;
dro.Text = "" + DRO + "";
dD.Text = dro.Text;
}
private void button3_Click(object sender, EventArgs e)
{
double DRO, TimeInterval, Area, NetRainfall;
DRO = double.Parse(d.Text);
TimeInterval = double.Parse(time.Text);
Area = double.Parse(area.Text);
NetRainfall = DRO * TimeInterval * 0.36 / Area;
rainfall.Text = "" + NetRainfall + "";
}
private void button4_Click(object sender, EventArgs e)
{
double DRO, Pnet, UHO;
DRO = double.Parse(dD.Text);
Pnet = double.Parse(net.Text);
UHO = DRO / Pnet;
uho.Text = "" + UHO + "";
}
private void button5_Click(object sender, EventArgs e)
{
double Volume, Area, Depth;
Volume = double.Parse(volume.Text);
Area = double.Parse(aA.Text);
Depth = Volume / Area;
depth.Text = "" + Depth + "";
}
private void button6_Click(object sender, EventArgs e)
{
graph1 g1 = new graph1();
g1.Show();
}
private void button7_Click(object sender, EventArgs e)
{
try
{
// OleDbConnection con = new OleDbConnection(constr);
con.Open();
cmd.CommandText = "insert into UnitHydrograph values
(N'" + tro.Text + "',N'" + bfo.Text + "',N'" + dro.Text + "',N'"
+ d.Text + "',N'" + time.Text + "',N'" + area.Text + "',N'" +
rainfall.Text + "',N'" + dD.Text + "',N'" + net.Text + "',N'"+
uho.Text+"', N'"+timed.Text+"')";
 cmd.Connection = con;
 cmd.ExecuteNonQuery();
 //OleDbCommand cmd = new OleDbCommand(q, con);
//cmd.ExecuteNonQuery();
MessageBox.Show("Record Added Successfully!!!!!");
con.Close();
}
catch
{ }
}

private void button8_Click(object sender, EventArgs e)
{
db_form db = new db_form();
db.Show();
}
}}
```

Results and Screen Layouts

Fig 1: Home Page

Fig 2: Runoff Hydrograph

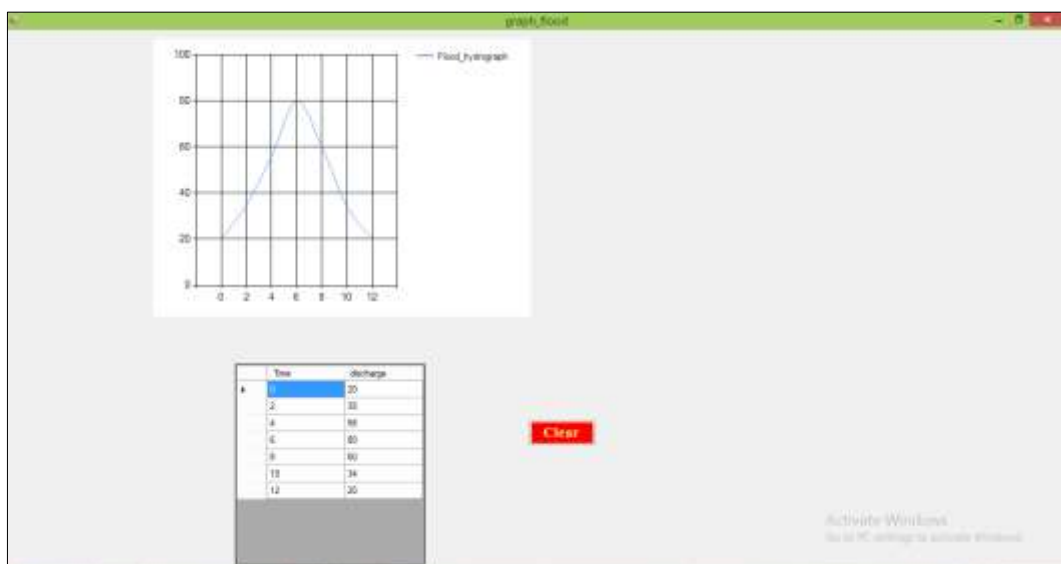**Fig 3:** Unit Hydrograph
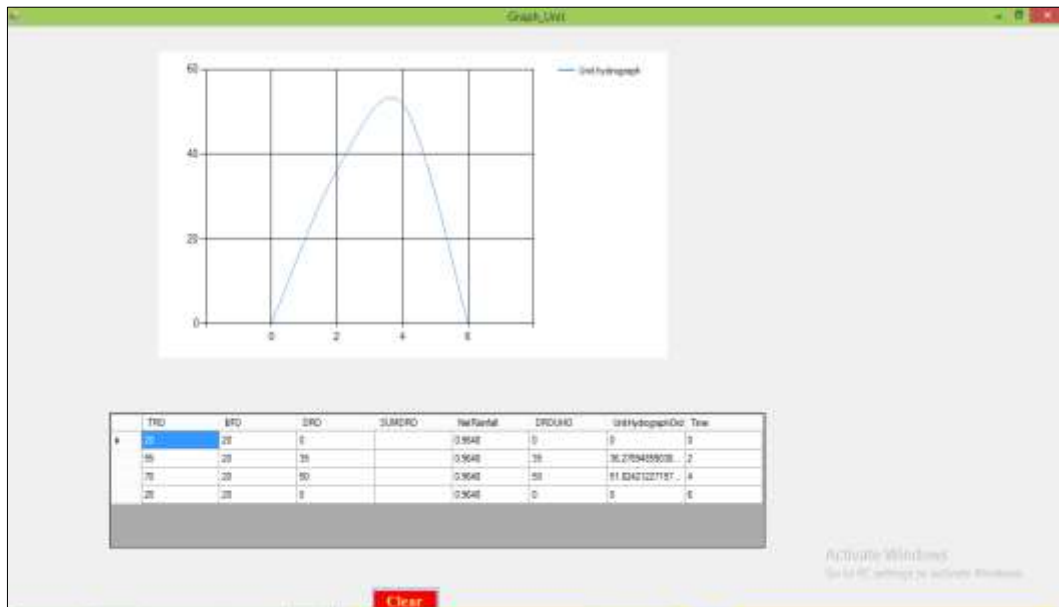

Fig 6: Graph of Runoff Hydrograph

Fig 7: Graph of Unit Hydrograph

Conclusion
This study deals with the Calculation of Formulae for Hydrograph by using ICT application. Therefore, development the software for Calculation of formulae for Hydrograph of includes the calculations of the various formulae. It also encapsulates the configuration of the system and information about the used to develop software. The system is developed in the computer languages i.e., Microsoft Visual Studio 2017, SQL Server 2017, Microsoft SQL Server Management Studio 2017.

The use of information communication technology is now growing in the various industries. So, it is necessary to increase the use of ICT to facilitate hydrograph calculations easily. This software calculates the formulae for Hydrograph. System is platform independent. software is user Friendly. And calculated values were found nearest to that on paper values.

The software was developed for different structures using C sharp (c#) as programming language. It will be very useful software for the calculation work.

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