ADVANCE ICT TOOL FOR MEASUREMENT OF PHYSICAL PROPERTIES OF SOIL

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ABSTRACT

The characteristics of soils affect by frequent use. The physical characteristics information about soils is known from by a different factor like water and other. These studies provided data on Water content, bulk density, Air content, specific gravity, Voids ratio, and Degree of saturation. Soils are the mixture of solids (minerals and organic matter), and pores which hold water and other. The bulk density of a soil sample can measure from volume is the weight of that soil sample divided by the bulk volume. The good soil contains air and water with good root penetration, the mineral soil particles would provide support and plant essential nutrients. Soil bulk density is a root soil property can affect some soil chemical and physical properties.

Thus, by using ASP.NET, the calculations are completed in a very short span of time as the formulae are pre-defined in the software. The complete design was done using ASP.NET in a very less time and with accuracy. Microsoft Visual Studio 2010 version was used for this purpose. It contains the main page where the formulae are given. By entering the values of each parameter, the physical properties of soil are determined within few minutes.

The results obtained were verified with the manual calculations and it was found that the results were accurate. Thus, this software programme is very useful for calculating physical properties of soil.

KEYWORD: *ICT Tool, ASP.NET & Soil etc.*

Received: Feb 13, 2018; **Accepted:** Mar 06, 2018; **Published:** Apr 09, 2018; **Paper Id.:** IJASRAPR201827

INTRODUCTION

Information and Communication Technology (ICT) is a term for Information Technology (IT) will know by all communities.

The term ICT is also used to as software, hardware and firmware there are large economic incentives to have an embedded system for management

However, ICT has no universal definition, this may depend upon the user experience for 21stst. The main use of ICT is to work with products (personal computers (PCs), digital television, emails and robots etc) which can store, transmit or receive the data in a digital form. There are many models for working with competencies for ICT professionals in the today's world.

A need of ICT: ICT is most usable in the Education system while there is increasing the use of digital properties for education (e.g. Podium, LCDs, and Projectors etc). There are many ways except education to make the use of ICT & its tools (Bus System, Hotel System, Lodge System etc).

The importance of ICT: Due to use of ICT and its tools people look at it attractively and use that tool very interestingly. ICT has changed the learning way that the traditional way to digital way. It gives priority to learn from anywhere and collaborative learning. There are multiple communication sources like Chat, Emails etc are increasing.

Programming Language as Tool: ASP.NET

Soil: Soil is a mixture of minerals, organic matter, gases, liquids, and countless organisms that together support life on Earth. The soil is a natural body called the pedosphere which has four important functions: it is a medium for plant growth, it is a means of water storage, supply, and purification, it is a modifier of Earth's atmosphere, it is a habitat for organisms and all of which in turn modify the soil.

Types of Soil

There are basically three types of soil (according to particle size)

- Sand
- Silt
- Clay

Figure 1: Soil Texture Triangle

But most soils aren't sure they are composed of a combination of three different types. **Phases of Soil:**

There are three phases of soil

- Solid
- Water
- Air

Figure 2: Phases of Soil

Necessity of Calculation of Physical Properties of Soil

The characteristics of soils affect by frequent use. The physical characteristics information about soils is known from by a different factor like water and other. These studies provided data on Water content, bulk density, Air content, specific gravity, Voids ratio and Degree of saturation. Soils are the mixture of solids (minerals and organic matter), and pores which hold water and other. The bulk density of a soil sample can measure from volume is the weight of that soil sample divided by the bulk volume. The good soil contains air and water to good root penetration, the mineral soil particles would provide support and plant essential nutrients. Soil bulk density is a root soil property can be affected by some soil chemical and physical properties.

The ICT Tool to Calculate the Physical Properties of Soil

By using ASP.NET, program (Spaanjaars 2012) the calculations is completed in a very short span of time as the formulae are pre-defined in the software.

The complete design use ASP.NET and it is accurate.

Objectives

- Collection of formulae of various physical properties of soil.
- To develop the computer based program for physical properties of soil.

METHODOLOGY

Hardware and software required to develop a program by using ASP.NET for measurement of physical properties of soil.

Configuration of the System

The selection of hardware is very important in the existence and proper working of any software. When selecting hardware, the size and requirements are also important.

The proposed system is developed on

Processor : Intel core i56 GB1 TB

About the Platform

Operating system : windows 7 - 10

Platform used: ASP.NET

Cross -Validation

Cross -Validation is done by manual calculating.

Physical Properties of Soil with Formulae (Punmia 2011)

- Moisture Content (W) (%) $W = \frac{w_w}{w_d} \times 100$ where, w_w = weight of water (kg) w_d = weight of solids (kg)
- Bulk Density (ρ) (kg/m^3) $\rho = \frac{M}{V}$ where, M= total mass of soil (kg) V= total volume of soil (m^3)
- Dry Density (ρ_d) (kg/m^3) $\rho_d = \frac{M_d}{V}$ where, M_d = mass of solids of the soil mass (kg) V= volume of soil (m^3)
- Density of Solids (ρ_s) (kg/m^3) $\rho_s = \frac{M_d}{V_s}$ where, M_d = mass of soil solids (kg) V_s = volume of soil solids (m^3)
- Saturated Density (ρ_{sat}) (kg/m^3) $\rho_{sat} = \frac{M_{sat}}{V}$ where, M_{sat} = total soil mass of saturated sample (kg) V= total volume of saturated sample (m^3)
- Submerged Density (ρ') (kg/m^3) $\rho' = \frac{M_{d,sub}}{V}$ where, $M_{d,sub}$ = submerged mass of soil solids (kg) V= volume of soil (m^3)
- Bulk Unit Weight (γ) (kN/m^3) $\gamma = \frac{W}{V}$ where, W= total weight of soil (kN) V= total volume of soil (m^3)
- Dry Unit Weight (γ_d) (kN/m^3) $\gamma_d = \frac{W_d}{V}$ where, W_d = weight of solids per unit soil mass (kN) V= total volume of soil (m^3)
- Unit Weight of Solids (γ_s) (kN/m^3) $\gamma_s = \frac{W_d}{V_s}$ where, W_d = weight of solids per unit soil mass (kN) V_s = volume of solids (m^3) Saturated Unit Weight (γ_{sat}) $\gamma_{sat} = \frac{(W)_{sub}}{V}$ where, $(W)_{sub}$ = saturated weight of soil (kN) V = total volume of soil mass (m^3)
- Submerged Unit Weight (γ') (kN/m^3) $\gamma' = \frac{(W_d)_{sub}}{V}$ where, $(W_d)_{sub}$ = submerged weight of soil solids (kN) V = total volume of soil mass (m^3)
- Specific Gravity (G) (No. of units) $G = \frac{\gamma_s}{\gamma_w}$ where, γ_w = weight of an equal volume of distilled water (kN)*both are at standard temperature = 27°C
- Degree of Saturation (S) (%) $S = \frac{V_w}{V_v}$ where, V_w = volume of water present in a given soil mass (m^3) V_v = total volume of voids (m^3)

- Percentage Air Voids (n_a) (%) $n_a = \frac{V_a}{V} \times 100$ where, V_a = volume of air voids (m^3) V = total volume of soil mass (m^3)
- Air Content (a_c) $a_c = \frac{V_a}{V_v}$ where, V_a = volume of air voids (m^3) V_v = volume of voids (m^3)
- Relative Compaction (R_c) $R_c = \frac{\gamma_d}{\gamma_{dmax}}$ where, γ_d = dry density (kN/m^3) (from compaction test) γ_{dmax} = maximum dry density (kN/m^3) (from compaction test)
- Voids R ratio (e) $e = \frac{V_v}{V_s}$ where, V_v = volume of voids (m^3) V_s = Volume of soil solids (m^3)
- Porosity (N) $N = \frac{V_v}{V}$ where, V_v = volume of voids (m^3) V = total volume of soil mass (m^3)
- Density Index (I_d) $I_d = \frac{e_{max} - e}{e_{max} - e_{min}}$ e_{max} = Voids ratio of soil in loosest state e_{min} = Voids ratio of soil in densest state = Natural voids ratio of soil

Source Code

```
using System;

using System.Collections.Generic;

using System.ComponentModel;

using System.Data;

using System.Drawing;

using System.Linq;

using System.Text;

using System.Windows.Forms;

namespace SoilOrganicCarbonApplication
{
    public partial class Main : Form
    {
        public Main()
        {
            InitializeComponent();
        }

        private void label1_Click(object sender, EventArgs e)
```

```
{  
}  
  
private void radioButton1_CheckedChanged_1(object sender, EventArgs e)  
{  
}  
  
private void radioButton2_CheckedChanged(object sender, EventArgs e)  
{  
}  
  
private void button1_Click(object sender, EventArgs e)  
{  
    if (radioButton1.Checked)  
    {  
        Watercontent b1 = new Watercontent();  
        b1.Show();  
    }  
    if (radioButton2.Checked)  
    {  
        Bulkdensity b2 = new Bulkdensity();  
        b2.Show();  
    }  
    if (radioButton3.Checked)  
    {  
        DryDensity b3 = new DryDensity();  
        b3.Show();  
    }  
    if (radioButton4.Checked)  
    {  
        SaturatedDensity b4 = new SaturatedDensity();  
        b4.Show();  
    }  
}
```

```

if (radioButton5.Checked)
{
    Submergeddensity b5 = new Submergeddensity();
    b5.Show();
}

if (radioButton6.Checked)
{
    BulkUnitWeight b6 = new BulkUnitWeight();
    b6.Show();
}

if (radioButton7.Checked)
{
    DensityofSolid b10 = new DensityofSolid();
    b10.Show();
}

```

Case 1

Water Content

```

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

namespace SoilOrganicCarbonApplication
{
    public partial class Watercontent : Form
    {
        public Watercontent()
        {

```

```

InitializeComponent();

}

private void radioButton1_CheckedChanged(object sender, EventArgs e)
{
}

private void radioButton2_CheckedChanged(object sender, EventArgs e)
{
}

private void radioButton3_CheckedChanged(object sender, EventArgs e)
{
}

private void button1_Click(object sender, EventArgs e)
{
float ww,wd,wc;

ww = float.Parse(waterweight.Text);
wd = float.Parse(solidweight.Text);
wc=(ww/wd)*100;

answer1.Text=" "+wc+" ";

}

private void BioclimateForm1_Load(object sender, EventArgs e)
{
}

private void button2_Click(object sender, EventArgs e)
{
float ww, wd, wc;

ww = float.Parse(waterweight.Text);

wc = float.Parse(answer1.Text);

wd = (ww / wc) * 100;

```



```
solidweight.Text = " " + wd + " ";  
  
}  
  
private void button3_Click(object sender, EventArgs e)  
{  
  
float ww, wd, wc;  
  
wd = float.Parse(solidweight.Text);  
  
wc = float.Parse(answer1.Text);  
  
ww = (wd * wc) / 100;  
  
waterweight.Text = " " + ww + " ";  
  
}  
  
private void answer1_KeyPress(object sender, KeyPressEventArgs e)  
{  
  
char ch = e.KeyChar;  
  
if (ch == 46 && answer1.Text.IndexOf('.') != -1)  
{  
  
e.Handled = true;  
  
return;  
  
}  
  
if (!Char.IsDigit(ch) && ch != 8 && ch != 46)  
{  
  
e.Handled = true;  
  
}  
  
}  
  
private void solidweight_KeyPress(object sender, KeyPressEventArgs e)  
{  
  
char ch = e.KeyChar;  
  
if (ch == 46 && solidweight.Text.IndexOf('.') != -1)  
{  
  
e.Handled = true;
```

```
return;

}

if (!Char.IsDigit(ch) && ch != 8 && ch != 46)

{

e.Handled = true;

}

}

private void waterweight_KeyPress(object sender, KeyPressEventArgs e)

{

char ch = e.KeyChar;

if (ch == 46 && waterweight.Text.IndexOf('.') != -1)

{

e.Handled = true;

return;

}

if (!Char.IsDigit(ch) && ch != 8 && ch != 46)

{

e.Handled = true;

}

}

private void button4_Click(object sender, EventArgs e)

{

waterweight.Text = "";

solidweight.Text = "";

answer1.Text = "";

}

}

}

e.Handled = true;
```

```
return;

}

if (!Char.IsDigit(ch) && ch != 8 && ch != 46)

{

e.Handled = true;

}

}

private void button5_Click(object sender, EventArgs e)

{

float G1, G2;

G1 = float.Parse(kg2.Text);

G2 = (G1 * 981) / 100;

N2.Text = "" + G2 + "";

}

private void kg2_KeyPress(object sender, KeyPressEventArgs e)

{

char ch = e.KeyChar;

if (ch == 46 && kg2.Text.IndexOf('.') != -1)

{

e.Handled = true;

return;

}

if (!Char.IsDigit(ch) && ch != 8 && ch != 46)

{

e.Handled = true;

}

}

}

}
```

RESULTS AND DISCUSSIONS

The chapter deals with the guideline to software developed during the experimentation to measure the physical properties of soil. The program is prepared in the ASP.NET Version Microsoft Visual Studio 2010. The details of the software developed to measure the physical properties of soil are shown in the Figure which is called main page.

Physical Properties of Soil: The program is tested for representative values of inputs for all nineteen parameters. Results obtained are as follows: Main Page option Window

Program Output of Water Content

Program Output for Bulk Density

SUMMARY

The measurement physical properties of soils. It includes different formulae and those are used while developing the software. It also encapsulates the configuration of the system and information about the user to develop software.

This is designed to measure the physical properties of soil. In this different properties are determined, i.e. Water content, bulk density, dry density, saturated density, a density of solids, submerged density, bulk unit weight, dry unit weight, saturated unit weight, etc. The software was developed for 19 physical properties of soil using ASP.NET Version Microsoft Visual Studio 2010.

CONCLUSIONS

- The system is platform independent.
- This is calculated to measure the physical properties of soil.
- Calculated values were found nearer to that of on-paper calculations.
- A Software is user- friendly.

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