# Web Based Information System for Thematic Monitoring In Sri Lanka

By S.M.N.Nanayakkara

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A dissertation submitted in fulfillment of the requirement for the Degree of Bachelor's of Science In Physical Sciences Faculty of Applied Sciences Sabaragamuwa University of Sri Lanka

### Declaration

I certify that this dissertation does not incorporate without acknowledgement of any material previously submitted for the degree or diploma in any University, to the best of my knowledge and belief this does not contain any material previously published. Writing or orally communicated by another person where due references made in the text.

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Signature: - 12/05 Date

Affectionately dedicated to my loving parents

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# Abstract

The United Notion (UN) has been launching a programme called Millennium Development Goals (MGD), with collaboration of Ministry of Policy Development and Implementation (MPDI) to evaluate and compare the social status such as Underweight children aged under 5 years, Number of deaths due to Malaria, Tuberculosis within the divisions in Sri Lanka. Authorized persons were allowed to gather information by filling printed forms. The information was stored by the computerized system called Divisional Monitoring System (DMS). At a time only one person could enter the information to the Divisional Monitoring System. This was a time-consumed work and need more workers and also DMS provides only an evaluation of social status.

Thematic Monitoring System was a web-based information system implemented to overcome the drawbacks of DMS. Authorized persons from each and every division were given access to enter relevant information to the web-forms and submit it to MPDI through the web to increase the efficiency. Graphs were produced to compare these social statuses between specific divisions and specific years. Previous year's data for these statuses were retrieved. Any user, except entering data, could view every other feature.

All the user interfaces were created using Hyper Text Markup Language (HTML). Cascading Style Sheets (CSS) was used to give a good appearance to the interfaces. Visual Basic Script (VBS) and Active Server Pages (ASP) were used to validate the forms and to write the data to the database. SQL Server was used as database.

The outcome of this project was a web-based information system for thematic monitoring in Sri Lanka. Authorized users were given passwords to enter the values. After accessing to the site, it gave the guidelines to fill the forms one after another. Further the system produced comparison graphs for selected goals between specific divisions or specific years.

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### **1.** Introduction

#### 1.1 PricewaterhouseCoopers Lanka (Pvt) Ltd.

#### 1.1.1 Background

PricewatrehouseCoopers Lanka (Pvt) Ltd. (PWC) is a medium scale organization. The company is primarily an Information Technology (IT) consulting company within the PWC global network, which is the largest professional service in the world.

PWC's products and solutions provide to both private and public sectors in Sri Lanka. PWC's IT consulting services includes the full range of activities from strategic IT planning to implementation, both of package software and custom developed software. System development and integration has also been undertaken in response to specialized requirements.

# 1.1.2 Services

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The company has 2 divisions, the Consulting division and the Technology solution division.

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PWC's solutions are provided with comprehensive packaging that covers complete user manuals, installation guides, standard reports, a limited number of customized reports and training with competitive pricing.

Apart from the local staff, a global network involving some 150,000 professionals ensure that any gap in skills can be filled without difficulty.

1

#### 1.2 General Introduction

The United Nation (UN) has been launching a program called Millennium Development Goals (MDGs), with collaboration of the Ministry of Policy Development and Implementation (MPDI) to evaluate and compare the social status such as total number of deaths due to Malaria, Tuberculosis, number of Labor force divisionally.

The existing web based system of MPDI, called as Divisional Monitoring System (DMS) gives only an evaluation of social status. In addition to evaluation of social status they need to monitor issues of a multidimensional nature such as poverty, privatization, foreign direct investments, exports, macro economic performance and reforms. More over they need a comparison of these terms between particular divisions as well as between years. Currently this process is done manually. It is time-consuming and needed more workers.

#### 1.2.1 Objectives

The main objectives of this system is to carry out the defined set of operations as efficiently as possible and to provide a web based userfriendly information system to meet the above requirements by providing comparison graphs and numerical values.

#### 1.3 Theoretical Background

#### 1.3.1 Development Process

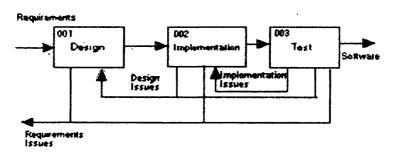
The set of activities, methods, and practices that are used in the production and evolution of software is called as a Development

2

which represent an attempt to bring order to an inherently disorder activity.

The basic element of the process model is the Unit Cell. A unit cell is defined to accomplish a specific task and is uniquely identified. Each cell has required entry conditions with inputs, task standards, procedures, methods, responsibilities, and measures. Exit conditions define the results produced, their level of validation, and any post-task conditions. Feedback is allowed to and from other unit cells.

(Humphrey, 1989)



Humphrey, p. 259

Fig. 1.1 Unit Cell Definitions for Process Model

Some software models are given below.

- Linear Sequential Model (Waterfall Model)
- Prototype Model
- Rad Model

#### 1.3.2 Linear Sequential Model

The waterfall model derives its name due to the cascading effect from one phase to the other as is illustrated in Fig. 2.2. In this model each phase well defined starting and ending point, with identifiable deliveries to the next phase.

1.3.2.1 Stages in a System Life Cycle

When designing an information system using the linear sequential model, there are number of steps to be followed. The number of steps can be changed according to the way that it is categorized.

1.3.2.1.1 Requirement Determination

This is the beginning of the Life cycle, which is to get a clear idea about the system. Simply, all the requirements that are needed by the user defined here.

#### 1.3.2.1.2 Requirement Specification

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This section provides an overview of the entire requirement document. This document describes all data, functional and behavioral requirements for software. As an example Overall goals, software objectives, major inputs, processing functionality and outputs, and any business or product line constraints that will impact the manner in which the software is to be specified, designed, implemented or tested. (http://www.rspa.com)

#### 1.3.2.1.3 System Analysis

System Analysis phase, the very beginning of a typical systems development project is fairly straightforward activity to carry out. Main purpose of this stage is to collect many systems facts and consolidate the new systems requirements from the existing users. The task demands much analytical skill and hardly any creative skill.

#### 1.3.2.1.4 System Design

Once the requirements have been collected and analyzed, it is necessary to identify in detail how the system will be constructed to perform necessary tasks. More specifically, the system design phase is focused on the data requirements (what information will be processed in the system?), the software construction (how will the application be constructed?), and the interface construction (what will the system look like? What standards will be followed? Whether the Test Plan is followed).

#### 1.3.2.1.5 Coding

Also known as programming, this step involves the creation of the system software. Requirements and systems specifications in the system design step are translated into machine-readable computer code.

#### 1.3.2.1.6 System Testing

As the software is created and added to the developing system, testing is performed to ensure that it is working correctly

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and efficiently. Testing is generally focused on two areas: internal efficiency and external effectiveness. The goal of external effectiveness testing is to verify that the software is functioning according to system design, and that it is performing all necessary functions or sub-functions. The goal of internal testing is to make sure that "the computer code is efficient, standardized, and well documented. Testing can be a laborintensive process, due to its iterative nature. (http://www.ctg.albany.edu)

#### 1.4 3-Tier Client- Server Application

Servers today are mainly file and database servers; application servers are the exception. However, database-servers only offer data on the server; consequently the application intelligence must be implemented on the PC (client). Since there are only the architecturally tiered data server and client, this is called 2-tier architecture.

The following diagram shows a simplified form of reference-architecture, though in principal, all possibilities are illustrated.

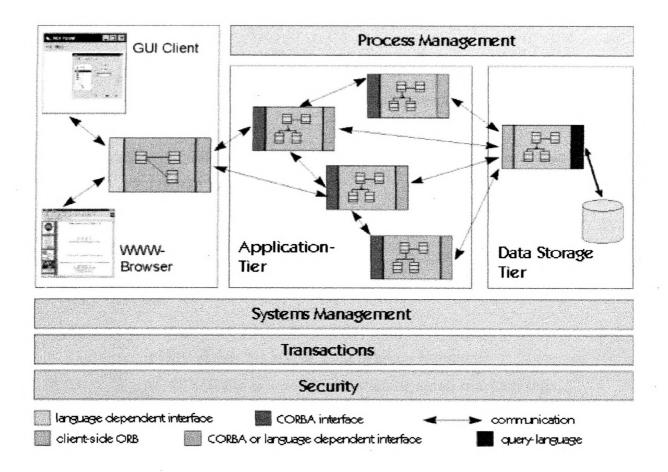


Fig. 1.2 3-Tier Architecture

# 1.4.1 Client-tier

Is responsible for the presentation of data, receiving user events and controlling the user interface.

#### 1.4.2 Application-server-tier

This tier is new, i.e. it isn't present in 2-tier architecture in this explicit form. This tier protects the data from direct access by the clients

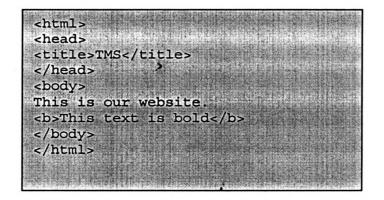
#### 1.4.3 Data-server-tier

This tier is responsible for data storage. Besides the widespread relational database systems, existing legacy systems databases are often reused here

1.5 What are HTML, CSS, ASP and VBS?

1.5.1 HTML

- HTML stands for Hyper Text Markup Language
- An HTML file is a text file containing small markup tags
- The markup tags tell the Web browser how to display the page
- An HTML file must have an htm or html file extension



# 1.5.2 CSS

- CSS stands for Cascading Style Sheets
- Styles define how to display HTML elements
- Styles are normally stored in Style Sheets
- Multiple style definitions will cascade into one

CSS is a breakthrough in Web design because it allows developers to control the style and layout of multiple Web pages all at once

#### 1.5.3 ASP

- ASP stands for Active Server Pages
- ASP is a program that runs inside IIS
- IIS stands for Internet Information Services
- ASP is a Microsoft Technology To run IIS you must have Windows NT 4.0 or later
- An ASP file is just the same as an HTML file
- An ASP file has the file extension ".asp"

When a browser requests an HTML file, the server returns the file. But when a browser requests an ASP file, IIS passes the request to the ASP engine. The ASP engine reads the ASP file, line by line, and executes the scripts in the file. Finally, the ASP file is returned to the browser as plain HTML. This is the difference between HTML & ASP

ASP can dynamically edit, change or add any content of a Web page, respond to user queries or data submitted from HTML forms, access any data or databases and return the results to a browser, customize a Web page to make it more useful for individual users. 1.5.4 VBS

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- VBS stands for Visual Basic Script
- VBScript is a scripting language
- A scripting language is a lightweight programming language VBScript is a light version of Microsoft's programming language Visual Basic

When a VBScript is inserted into a HTML document, the Internet browser will read the HTML and interpret the VBScript. The VBScript can be executed immediately, or at a later event.

# 2 TMS for ministry of Policy Development and Implementation

# 2.1 Project Plan

2.1.1System Development Life Cycle for this Project

The tasks involved in the development of the TMS are given below. It defines the steps involved in the project, the responsibilities of MPDI and PWC, deliverable and approval points during the project life cycle.

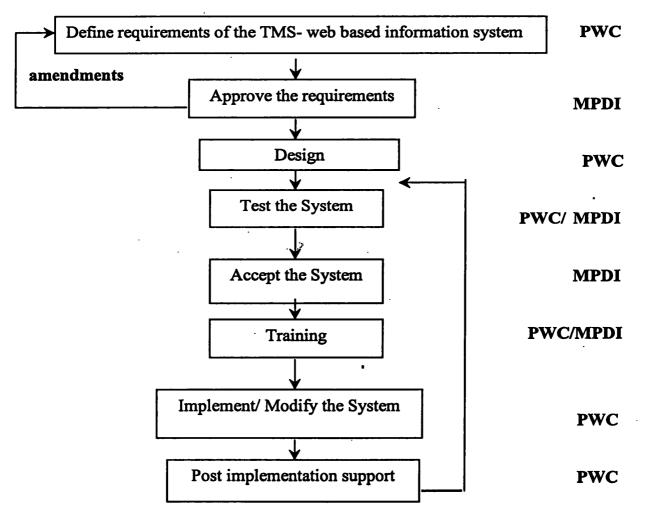


Fig. 2.1 TMS development life cycle

#### 2.2 Development

#### 2.2.1Development tools/ Software

The system was a 3-Tier Client-Server application, which was developed using *HTM*, *CSS* and *ASP* as front-end development tools and *VBS* as back-end development tool.

HTML was used to create the user-interfaces (forms)

CSS was used to give a good appearance to the web pages

ASP was used to validate the fields in the forms

VBS was used to write the data to the database, to catch some errors like whether the entering data is duplicate or out of range and to generate message boxes with information to the user The system uses the *Microsoft SQL Server* as the database

#### 2.2.2 Development Procedure

Development of the system was carried out as mentioned in the following steps, which are explained in the latter part of this document.

- 1) All the user interfaces & process flow diagram was created
- Since the access for the pages are granted only for specific people User Names and Passwords were created
- 3) Linking of the sub forms
- 4) Giving validation to each and every field in the form
  - 5) Writing the data to the database
  - 6) Retrieving the previous years data
  - 7) Retrieving current data if it has already been entered

Designing a screen layout and the process flow diagram is the 1<sup>st</sup> step that I did to develop the system.

There were altogether twenty categories of forms, which contain one main page, and some three to five sub forms. To make the explanation easier a main form called **Education** (Fig. 2.2) was used. The field called **Base Line** shows the previous years data. In all the main pages Base Line data is displayed in the form itself while there's link from the Sub form interface to view the Base line data, if it is required. The Fig. 2.2 illustrates the Base Line data for the first three values under **Question** field were set to NA (Not Applicable) to satisfy the requirement.

The Submit Button was created to submit the data to the database and the Refresh Button was created to delete the values in the fields.

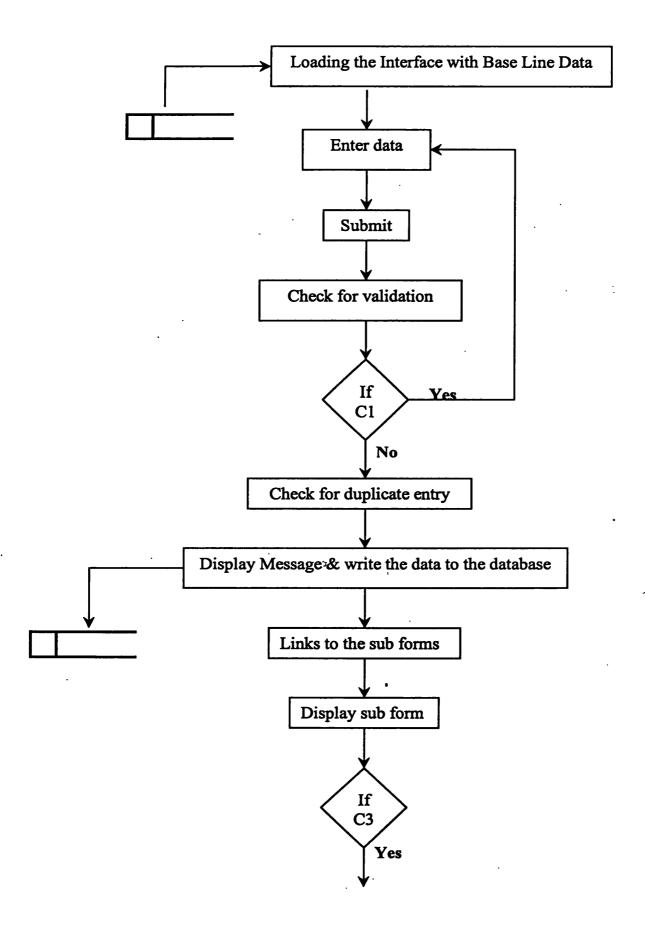
1 main form and 7 other screen layouts are included out of 20 main forms and 49 sub forms in the *Appendix-A* section of this document.

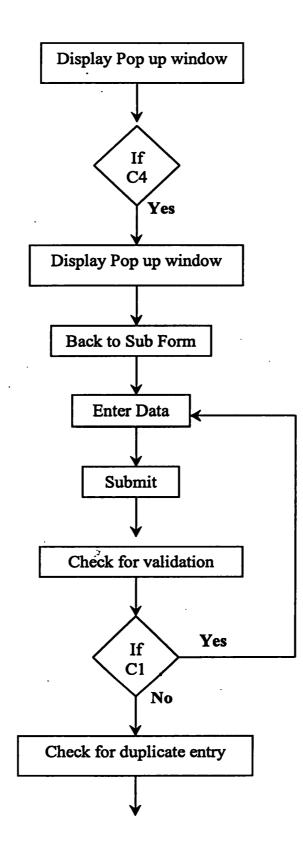
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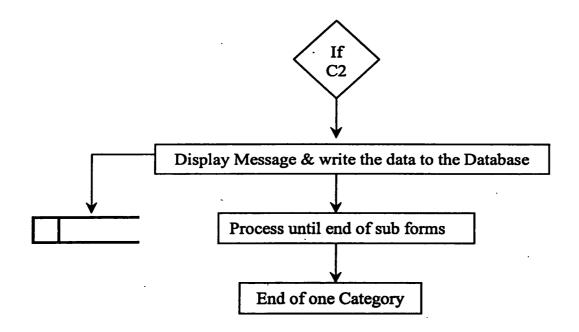
Fig.2.2 Education form from the TMS

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After designing the user-interfaces, next step was to design the process flow diagram. It has almost same structure for all unit programs. But the body of the process flow changes according to the fields. As an example the Fig. 2.3 illustrates the process flow of the Education Form.







C1- validation error

C2- duplicate entry

C3- base line data for sub form

C4- current data

## Fig.2.3 Flow diagram for Education form

2.2.2.2 Assigning User Name and Password for authorized users

Since TM questionnaire is to input some responsible values, it should be secured by unauthorized access. So, it was a must to create user name and passwords for authorized users divisionally. Every user name and password was unique to one person and for one division.

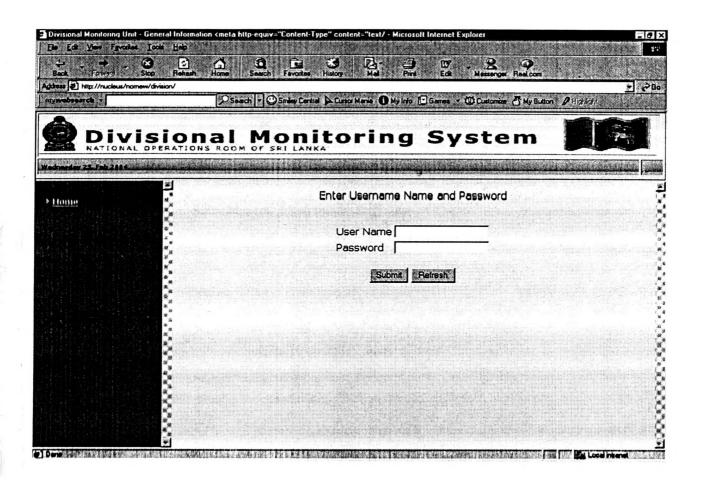


Fig. 2.4 Form to enter User Name and Password

### 2.2.2.3 Coding

The coding was done using the HTML, CSS, ASP, and VBS syntaxes.

HTML was used to create the screens with check boxes, text boxes, combo boxes, textarea, and links.

# Codes to create check boxes

<input type="checkbox" name="Marketing Problems" >

#### Codes to create text boxes

<input name="Priority Problem 1" size="25" TYPE="text" ID="P1" VALIDATE="blank"

VALUE="<%=server.htmlEncode(request("Pro1"))%>" onfocus="changeColor()">

#### Codes to create combo boxes

<select NAME="Category">

<%

SetobjRS= objConn.Execute("SELECT ltrim(str(catid) +'-'+ Category) as Category FROM Edu\_School\_Cat")

while not objRS.eof

%>

<option>

<%

```
response.write(trim(objRS("Category")))
```

objRs.moveNext

wend

%> >

</select>

## Codes to create text areas

<textarea name="Crop Damages" cols="35" rows="2" ID="cdamages" VALIDATE="blank"

VALUE="<%=server.htmlEncode(request("cdamages"))%>

</textarea>

# Codes to create Links

<a href="Education/Education.asp" TARGET="a3" > Education</a> CSS was used to give an attractive look to the interfaces.

VBS was used to validate the values.

ASP was used to write and retrieve the data to and from the database.

#### 2.2.2.3.1 Validation

In this section an assurance is given that the written data to the database is errorless. Different validity for different data was given. As an example, for "No. of Primary schools" field in Education form must be numeric. Therefore the Validate arribute of the relevant text box was set to "numeric".

<input name="No of primary School" size="10" TYPE="text" ID="NPS" VALIDATE="numeric"

VALUE="<%=server.htmlEncode(request("NPS")) %>" onfocus="changeColor()">

When considering to the Fig. 2.2, First 3 fields must be a text value, which should not be null. So the Validate field was set to "blank".

The different values of the Validate attribute are checked by VBS as follows.

1) The relevant field value is passed as "myValue" to the VBS function

function

2

validateField(myValue,myValidate,myPattern, itemname) 2) Then checks for numeric Validation and produce error message.

CASE "numeric"

if isNumeric(myValue) then

validateField = true

elseif myValue = "NA" or myValue = "na" then validateField = true

else

validateField = false
strError & space(5)&
itemname & "- Field must be numeric" &
vbcrlf

end if

7

If there are some errors, they must be displayed when the Submit button is clicked.

2.2.2.3.2 Writing data to the Database

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If the validation is checked and it's error free, all the values in the input areas will be saved to the database.

1) Defining the variable

dim txt21a1

2) Passing the value of the "No. of primary School" field to this variable

txt21a1= trim(request.form("No of primary School"))

3) Set the ADODB Recordset to Rs

Set Rs = Server.CreateObject("ADODB.Recordset")

#### 4) Opening the relevant Rs

Rs.Open "SELECT \* from Education where DivID =" & session("DivID") & " and EntryDate = " & session("period") & "/01", objConn, 1,3 5) Saving the data if txt21a1  $\diamond$  "NA" and txt21a1  $\diamond$  "na" then Definition of the second of th

Rs("No\_Primary\_schools") = txt21a1

#### end if

Here the system checks for the duplicate entry. i.e. if the record has already been entered, the system gives an error message.

Unless, once the data is entered the system shows the path to follow to enter data, until that category is finished.

#### 2.2.2.3.3Retrieving the previous years data

Once one main page is appeared, previous years data is retrieved from the database to the Base Line column. This does not apply for sub forms.

1)Defining the variable

dim No Primary schools

2)Set the ADODB Connection to objRS

SetobjRS=objConn.Execute("SELECTNo\_Primary\_schools,No\_Secondary\_schools,No\_National\_Schools,No\_Private\_Schools,No\_International\_Schools,No\_Piriven\_Schools,No\_Other\_rel\_Schools,No\_Voluntary\_staff,Non\_Schooling\_ChildrenEducation WHERE DivID=" & session("DivID") & "and EntryDate=''' & session("Base") & "/01" & "''')

3) Retrieve the previous year's data

while not objRS.eof

No\_Primary\_schools= objRS("No\_Primary\_schools") objRs.moveNext wend

2.2.2.3.4 Retrieving current data if it has already been entered

Assume the user is accidentally going to enter data for a form that he/she has already entered. To avoid these kind of circumstances and reduce the time consume, system will show the data in relevant data inputs.

1) Defining the variable

dim No\_Primary\_schools\_Current

2)Set the ADODB Connection to objRS

Set objRS = objConn.Execute("SELECT Prob1, prob2, No Primary schools, prob3, No Secondary schools, No National Schools, No Privat e Schools, No International Schools, No Piriven School s,No Other rel Schools,No Voluntary staff,Non Scho (select probID, problem as oling Children FROM prob1 from edu prob, education where priorityProb1 = probID) as t1,(select probID, problem as prob2 from edu prob, education where priorityProb2 = probID) as t2,(select probID, problem as prob3 from edu prob, education where priorityProb3 = probID) as t3.Education WHERE DivID=" & session("DivID") & " and EntryDate="" & session("period") & "/01" & "" and t1.probid = priorityprob1 and t2.probid = priorityprob2 and t3.probid = priorityprob3")

3) Retrieve the data while not objRS.eof No\_Primary\_schools\_Current=objRS("No\_Primary\_s chools") objRS.moveNext wend

At the end of this step the programmer should have a perfectly running program that satisfies the specification.

2.2.2.4 Unit Test Plan and Testing

When developing the test plan the programmer should consider all the possible inputs for the module and the expected output. , Sample Test:

1. Submit

In this section validation rules and the duplicate entries are take into consider. The Web Forms framework includes a set of validation server controls that provide an easy-to-use but powerful way to check input forms for errors and, if necessary, displays message to the user.

What we mainly consider was that the relevant field must be numeric or field cannot be blank. As to fulfill a requirement every numerically validated fields were set to allow NA (or na)

Field	Test description	Test Data	Expected Results
Priority Problem 1	Field with both textPriority Probleand numbers= Blank		Priority Problem 1 field cannot be blank
No. of Primary Schools	Field with numbers	No. of Primary Schools = text	No. of Primary Schools field must be numeric
Whole Set of Fields	Enter the same set for current year	Enter the same set for current year	Data is already been entered
Whole Set of Fields	Data for this year	Data for this year	Data successfully entered

Screen layouts for the expected results are shown in the in the Appendix-B section of this document.

After completing the code writing each and every unit was checked for validation, expected results that were gathered in the unit test plan.

 First, the unit, which validates the user name and password, was checked for the unauthorized access by entering inaccurate username or password. An interface with the error message appeared as shown in Fig. 2.5.

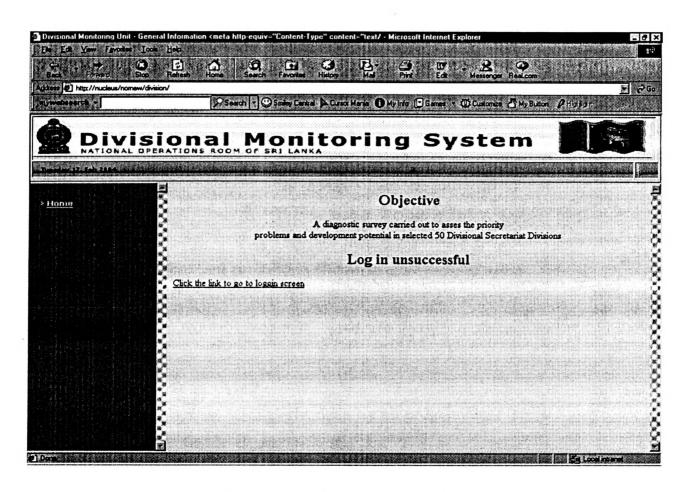


Fig. 2.5 Avoid Unauthorized access

- 2) Previous years data should be viewed in the Base Line data column
- 3) Then entering data to the fields
  - 1. Keep all the fields empty
  - 2. Keep one text field empty and all the rest is filled
  - 3. Keep one numeric field empty and all the rest is filled
  - 4. Keep one numeric field as "NA" or "na" and filling the rest
  - 5. Enter a text instead of numeric to numeric field
- 4) Try to submit the form by filling as mentioned above

All the steps gave an error saying, Field must be Numeric, Field must not be empty. And also all the fields those have errors were highlighted and vanished that when user clicked the relevant text field

- 5) Submit the form with valid inputs
  - 1. System checked for duplicate input

If this is the first entry, a new interface displayed and saying that " Data entered successfully " and the links for the rest of the sub forms

If that was a duplicate entry, system displayed a new interface saying, "Records are already been entered ".

- 6) Clicked the Refresh Button to empty all the fields
- 7) Repeat the steps from 3 to 6 with all the other forms

2.3 Testing

System testing was done by all programmers, project manager and a member of MPDI. TMS and TM questionnaire was developed to computerize the manually filled forms by each and every division. Therefore the testing was done using this document.

2.4 Training/ Implementation/ Support

There was a 2 days training at the MPDI with the participation of 2 members from each division. The system was described by showing how it functions, possible errors why this error message comes and alike.

### 3 Result & Discussion

A user-friendly web-based information was developed for MPDI, which should be user-friendly, simple and easy to use since less computer literate people use the system.

There's one whole column that includes links to all the Main and sub forms. Once the user comes to the form current year data is displayed, if it is already been entered, and a separate column is used to display the Base Line data. Apart from that there are only 2 buttons called Submit and Refresh, to maintain records in the TMS. **Submit Button** is to submit the data to be written to the database with all the validation and avoiding duplicate data entry and **Refresh Button** to clean all the values in the fields.

After a successful submission of datum, the user is guided to which form he/she should enter next datum.

Creating user interfaces (forms), validating the fields in the forms, saving or write the data to the database, retrieve the previous years datum and generating comparison graphs were the major tasks in the project. I participated in every work except creating comparison graphs.

### References

Humphrey, W. (1989) Managing the Software Process. Addison-Wesley, pp. 247-286.

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The Waterfall Model,

http://www.ctg.albany.edu/publications/reports/survey\_of\_sysdev?chapt er=5, Accessed on 2003/December

# Appendix-A

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### Education sub forms

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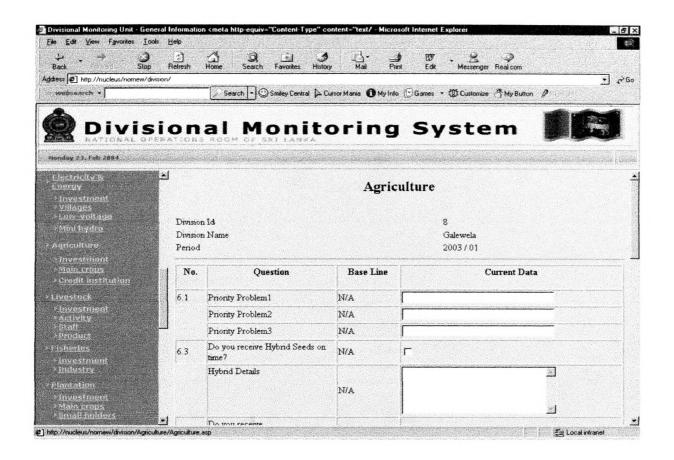
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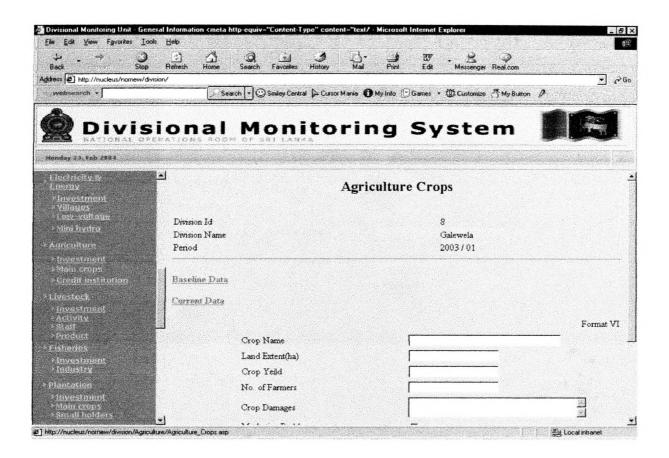
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### **Agriculture Main Form**



# Agriculture Sub forms

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# Appendix-B

# Expected Results

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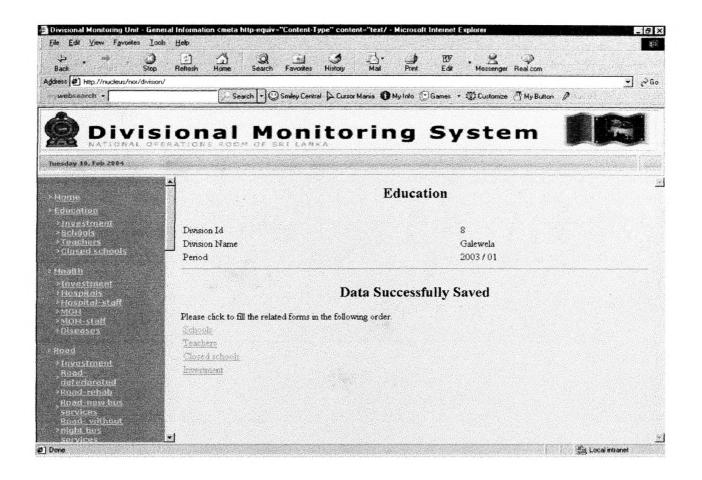
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#### 4) Data successfully saved



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