

CREATION OF WEB BASED MANDAL LEVEL INFORMATION SYSTEM USING REMOTE SENSING & GIS AND VISUAL BASIC PROGRAMME - A MODEL STUDY

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ABSTRACT

The present study is aimed to prepare the, micro level planning for sustainable development of singarayakonda mandal of prakasam district in this digital thematic maps has prepared namely, land use/ land cover , hydro geomorphology, slope, physiography, soil, geology, drainage etc. using satellite imageries on ARC/INFO GIS platform. This constitutes the spatial database and to create information system for mandal development. The mandal taken for the study is singarayakonda of prakasam district.

The present study resulted in information system for mandal level planning with a scope to develop the mandal further by providing the information necessary about the mandal. This system is user friendly and many decisions can be made by the user according to his choice. The Decision Support System developed here can further serve as a replica to other mandals.

Keywords: Remote sensing, Geographical Information System, Sustainable development, Decision Support System.

1. INTRODUCTION

This Information system has been developed in order to generate maps, which would provide relevant information for developmental activities and also act as source information authentication about the villages in the Mandal. The present study emphasizes the power of Remote sensing and GIS technology in developing a mandal level information system of Singarayakonda mandal of Prakasam district of Andhra Pradesh, which will help to better understand and evaluate spatial data by creating graphic displays and retrieve information stored in the database. This information system will be helpful for planners, academicians, geographers and government officers. The present DSS developed with singarayakonda mandal as the study area is for sure helpful in micro level planning and is sustainable development of the mandal. For this Remote Sensing and GIS techniques have been used with the assistance of VB.NET, a user friendly package having point and click graphical user interface (GUI).

2. DESCRIPTION OF STUDY AREA

The Mandal Singarayakonda is located at 79⁰.59'.48'' to 80⁰.05'.05'' Longitudes and 15⁰.12'.53'' to 15⁰.17'.50'' Latitudes. It has an average elevation of 15 metres and is covered in the Survey of India toposheet numbers 57M15 SE, 57M16 NE, 66A03 SW and 66A04 NW. It is one of the 56 Mandals of prakasam district, in Andhra Pradesh.

Location Map Showing Singarayakonda Mandal Area:

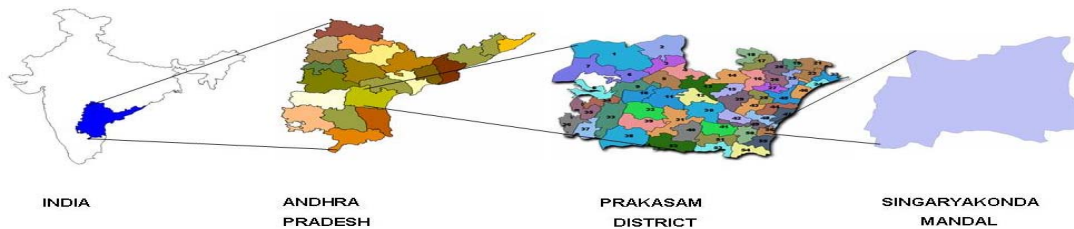


Fig.1 Location Map of the study area.

2.1 Study Objectives

- To prepare digital thematic maps namely Base Map, Transport Network Map, Geomorphology Map, Land Use/Land Cover, Physiographic Map, Drainage Map etc. using satellite imageries on ARC/INFO GIS platform. This constitutes the spatial database.
- To prepare Information system using VB.Net as front end and SQL Server as back end database for user friendly environment.

3. METHODOLOGY

3.1 Step by step processing of methodology

1. Collection of source data like satellite data, SOI toposheets. The satellite data of LISS III is geometrically corrected and enhanced. Finally after map composition satellite imagery is printed in FCC in 1:50,000 scale.
2. Preparation of themes like Base map, Transport and Settlement map, Village map, Contour map, Drainage map, Land use/ Land cover map and Geomorphology map are prepared by using Visual Interpretation Techniques.
3. Field visits are carried out to check the delineated units of the maps prepared maps and also secondary data related to irrigation, agriculture, land use and ground water are collected. Field observations are incorporated in to the related thematic layers.
4. All the maps prepared are converted into soft copy by digitization. All maps are integrated with village map and analyzed to get village wise statistical findings.
5. Report was prepared with report generation, graphics preparation, layout preparation, and Editing / composition and Annexure preparation using Arc Info
6. Villages are categorized by based on the village wise statistical findings.
7. Preparation of Arc/View project files with hotlink to all thematic maps.
8. presenting the spatial and aspatial data obtained from the above process, in an information system, through VB.NET.

3.2 Creating a Program in Visual Basic .Net

VB.Net is a VISUAL and events driven programming language. These are the main divergence from the old BASIC, programming is done in a text only environment and the program is executed sequentially. In VB.Net, programming is done in a graphical environment .Because users may click on a certain object randomly, so each object has to be programmed independently to be able to response to those actions (events). Therefore, a VB.Net program is made up of many subprograms, each has its own program codes, and each can be executed independently and at the same time each can be linked together in one way or another.

Creating event-driven programs in visual basic requires a different approach than that used in procedural languages. If you are experienced with procedural programming, the approach may seem unusual at first. Both types of programming require logic and order, but visual basic requires a different type of logic and order. For example, to create an interface in visual basic, you draw the objects and controls on a blank form. Compared to the programming effort required to produce graphical objects in most procedural languages, the actual coding needed to provide functionality in visual basic is minimal.

3.3 Information System

The maps so far obtained in the present study through GIS and the collateral, socio-economic and demographic data obtained through the field work are related in an user-friendly manner in the form of an information system with the help of VB (Visual Basic) software. These information system utilities are:

1. It gives the detailed information about the mandal with respect to different parameters like socio profile, agricultural practices, ground water, soil, rock structure, population, etc., displayed in the form of both maps and data.
2. Helps to know the selecting of statistical data.
3. Updating with the data from time to time is also possible.
4. Can be used by any user without having any prior knowledge about the software (user friendly).
5. Create database and design tables for the storage of data in a proper manner.
6. Design the forms with appropriate controls as per the final user requirement.
7. Generate individual reports for each category.

3.4 Processing of VB Program: (Sample code)

3.4.1 Code for Sign in Verification

```
Private Sub SIGN_IN_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
```

```
    CON = New SqlConnection("Data Source=LOCALHOST;Initial Catalog=decision1;Integrated Security=True;Pooling=False")
```

```
    CON.Open()
```

```
End Sub
```

```
End Class
```

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click
```

```
    Dim q As String
```

```
    q = "select * from signin where username='" & UNAME.Text & "' and password='" & PWD.Text & "'"
```

```
    CMD = New SqlCommand(q, CON)
```

```
    DR = CMD.ExecuteReader()
```

```
    If (DR.Read) Then
```

```
        Dim c As New Form1
```

```
        c.Show()
```

```
    Else
```

```
        MessageBox.Show("login failed")
```

```
    End If
```

```
End Sub
```

3.4.2 Code for Signup Verification:

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click
```

```
    Dim q As String
```

```
    q = "insert into SIGNIN VALUES(@EUN,@EPW,@RTP)"
```

```
    CMD = New SqlCommand(q, CON)
```

```
    Dim P1 As New SqlParameter("@EUN", EUN1.Text)
```

```
    Dim P2 As New SqlParameter("@EPW", EP1.Text)
```

```
    Dim P3 As New SqlParameter("@RTP", RP1.Text)
```

```
    CMD.Parameters.Add(P1)
```

```
    CMD.Parameters.Add(P2)
```

```
    CMD.Parameters.Add(P3)
```

```
    CMD.ExecuteNonQuery()
```

```
    If (EP1.Text = RP1.Text) Then
```

```
        MessageBox.Show("LOGIN CREATED")
```

```
        Dim c As New SIGN_IN
```

```
        c.Show()
```

```
    Else
```

```
        MessageBox.Show("ENTER YOUR PASSWORD CORRECTLY")
```

```
        EP1.Clear()
```

```
        RP1.Clear()
```

```
        EP1.Focus()
```

```
    End If
```

3.4.3 Code for Load Button:

Private Sub DLOAD_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles DLOAD.Click

```

If (selectvillage.SelectedIndex = -1) Then
    Dim s As String
    s = "select id from villageid"
    ' WHERE villageid ='" & selectvillage.SelectedItem.ToString() & ""
    CMD = New SqlCommand(s, CON)
    CMD.ExecuteNonQuery()
    DR = CMD.ExecuteReader
    While (DR.Read())
        VID.Items.Add(DR(0).ToString())
    End While
    DR.Close()
    DDEL.Enabled = True
Else
    Dim s As String
    s = "select id,villagename from villageid WHERE villagename ='" &
selectvillage.SelectedItem.ToString() & ""
    CMD = New SqlCommand(s, CON)
    CMD.ExecuteNonQuery()
    DR = CMD.ExecuteReader
    If (DR.Read()) Then
        VID.Text = DR(0).ToString()
        VN.Text = DR(1)
    End If
    DR.Close()
    s = "select * from demographic where id=" + VID.Text
    CMD = New SqlCommand(s, CON)
    DR = CMD.ExecuteReader
    If (DR.HasRows) Then
        If (DR.Read()) Then
            NHH.Text = DR(1)
            PM.Text = DR(2)
            PF.Text = DR(3)
            PT.Text = DR(4)
            PSC.Text = DR(5)
            PST.Text = DR(6)
        End If
    End If
    DR.Close()
    DDEL.Enabled = True
    DUP.Enabled = True
    End If

```

3.4.4 Code for update Button:

Private Sub EUP_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles EUP.Click

```

If (selectvillage.SelectedIndex = -1) Then
    Dim s As String
    s = "select id from villageid"
    ' WHERE villageid ='" & selectvillage.SelectedItem.ToString() & ""
    CMD = New SqlCommand(s, CON)
    CMD.ExecuteNonQuery()
    DR = CMD.ExecuteReader
    While (DR.Read())
        VID.Items.Add(DR(0).ToString())
    End While
    DR.Close()
    DDEL.Enabled = True
Else
    Dim s As String

```

```

s = "select id,villagename from villageid WHERE villagename =" &
selectvillage.SelectedItem.ToString() & ""
CMD = New SqlCommand(s, CON)
CMD.ExecuteNonQuery()
DR = CMD.ExecuteReader
If (DR.Read()) Then
    VID.Text = DR(0).ToString()
    VN.Text = DR(1)
End If
DR.Close()
s = "select * from EDUCATION where id=" + VID3.Text
CMD = New SqlCommand(s, CON)
DR = CMD.ExecuteReader
If (DR.HasRows) Then
    If (DR.Read()) Then
        nps1.Text = DR(1)
        nss1.Text = DR(2)
        nses1.Text = DR(3)
        nc1.Text = DR(4)
        nis1.Text = DR(5)
        nals1.Text = DR(6)
    End If
End If
DR.Close()
EDEL.Enabled = True
EUP.Enabled = True
End If

```

3.4.5 Code for Delete Button:

Private Sub edudel_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles EDEL.Click

```

Dim Q As String
Q = "DELETE FROM EDUCATION WHERE ID=" & VID3.Text
CMD = New SqlCommand(Q, CON)
Dim RES1 As Integer = CMD.ExecuteNonQuery()
If (RES1 > 0) Then
    MessageBox.Show("RECORD DELETED")
    vn3.Clear()
    nps1.Clear()
    nss1.Clear()
    nses1.Clear()
    nc1.Clear()
    nis1.Clear()
    nals1.Clear()
Else
    MessageBox.Show("RECORD NOT FOUND")
    vn3.Clear()
End If

```

3.4.6 Code for Image

Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click

```

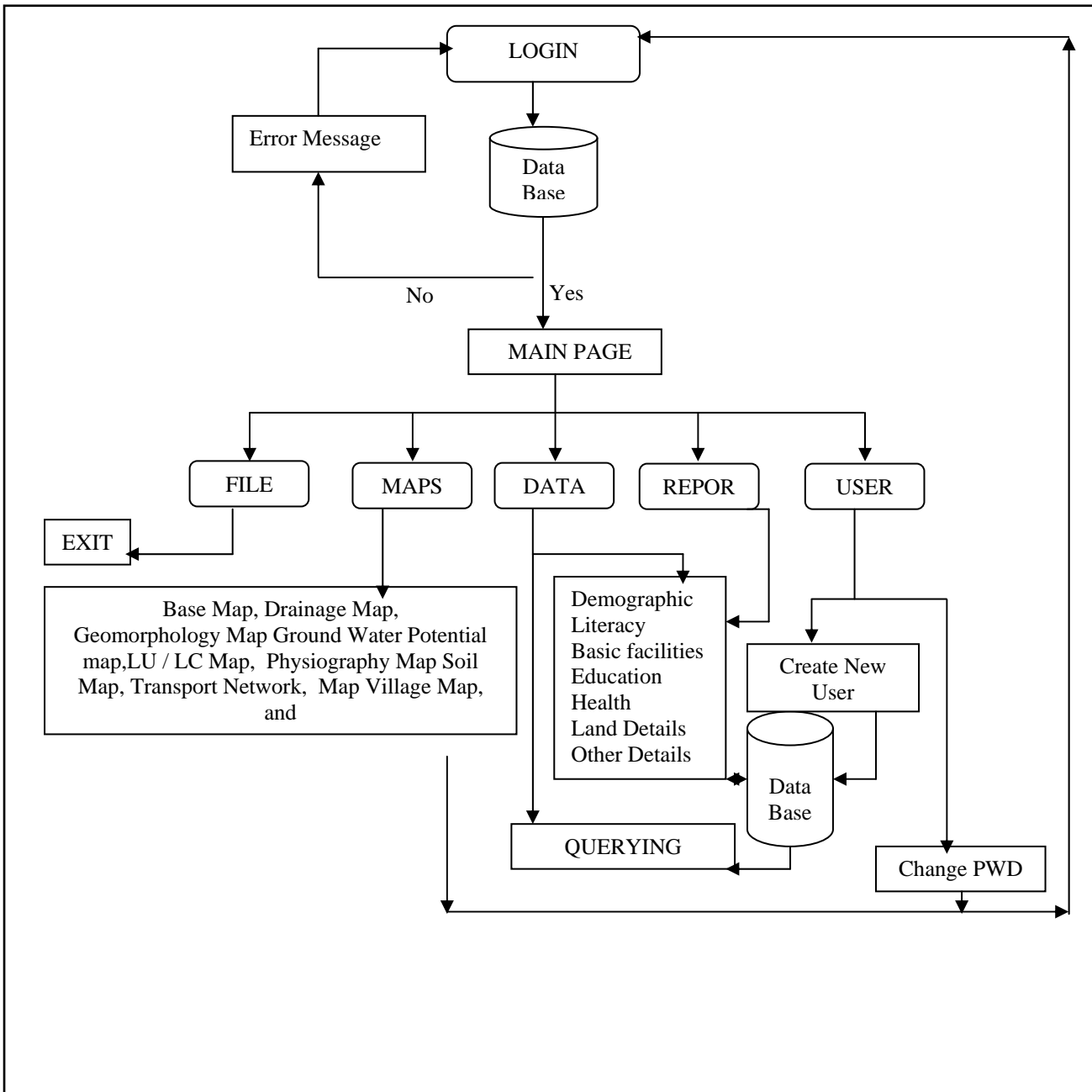
Dim q As String
q = "insert into image values(@map,@img)"
cmd = New SqlCommand(q, con)
Dim p1 As New SqlParameter("@map", map.Text)
Dim b() As Byte
fs = New FileStream(img.Text, FileMode.Open)
br = New BinaryReader(fs)
b = br.ReadBytes(fs.Length)
Dim p2 As New SqlParameter("@img", b)

```

```

cmd.Parameters.Add(p1)
cmd.Parameters.Add(p2)
res = cmd.ExecuteNonQuery
If (res > 0) Then
    MessageBox.Show("inserted")
End If
map.Clear()
img.Clear()
map.Focus()
End Sub
Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles
Button2.Click
    Dim q As String
    q = "select * from image where mapname='" & map.Text & "'"
    cmd = New SqlCommand(q, con)
    dr = cmd.ExecuteReader()
    If (dr.Read()) Then
        fs = New FileStream("d:\temp.gif", FileMode.Create)
        bw = New BinaryWriter(fs)
        Dim b() As Byte
        b = dr(1)
        bw.Write(b)
        bw.Close()
        fs.Close()
        dr.Close()
        Dim f2 As New Form2
        f2.str = "Transport"
        f2.str = "base map"
        f2.str = "PHYSIOGRAPHY MAP"
        f2.str = "DRAINAGE MAP"
        f2.str = "LANDUSE/LANDCOVER"
        f2.str = "village map"
        f2.str = "mandal MAP"
        f2.str = "geomorphology map"
        f2.Show()
    End If

```



Flow chart 1: Methodology

4. RESULTS AND DISCUSSION:

4.1 Village Map

A map that shows the geographical locations of all villages in the Mandal is called Village Map. The locations of all villages are drawn from SOI toposheet and transferred on a transparency sheet. This transparency is then overlaid on land use / land cover map to find out features at a known site. This map is also used as a guide map for ground truthing.

This map is prepared by digitization of the maps of Central Survey Office. Revenue boundaries of all the villages are plotted in this map. The entire data of the village available is attached to this map as database using GIS. This database is very useful to know the present scenario of a village. In the study area there are 8 revenue villages, out of these Singarayakonda, which is the Mandal head quarter.

S.NO	VILLAGE NAME	VILLAGE AREA IN Ha.	VILLAGE AREA IN Sq.Kms.
1	KALIKIVAYA	981	9.81
2	KANUMALLA	996	9.96
3	SANAMPUDI	1274	12.74
4	SINGARAYAKONDA	1548	15.48
5	SOMARAJUPALLI	2194	21.94
6	MULAGUNTAPADU	338	3.38
7	PAKALA	2252	22.52
8	BINGINIPALLE	1269	12.69

Table 1: showing the village wise area.

4.2 Base map

A geographically accurate Base Map can be generated either by undertaking a detailed topographical survey or by using satellite images along with other sources of information. The salient features and pros and cons of both the methods are briefly described.

4.3 Transport Network Map

Transportation plays a significant role in the overall development of a nation's economy. In the development of any village transportation plays significant role.

In the study area all the settlements are connected either by Metalled road or Un-Metalled road. Where as, National Highway connects Singarayakonda and Mulaguntapadu. Railway network passes through Singarayakonda, Mulaguntapadu and Somarajupalli.

4.4 Physiography Map

The Physiography map shows the landform patterns that make up the Singarayakonda village and its surrounding. The Physiography is prepared using the contours derived from Survey of India toposheets. According to the guidelines of CPCB, two physiographic categories are demarcated in the map as under: Low-Gentle slope areas including plains. The major part of the project area is occupied by the plains which indicates nearly level, gently sloping and very gently sloping terrain.

4.5 Land Use / Land Cover Map

Land Use / Land Cover map is prepared by visual interpretation of high-resolution satellite data with the help of Survey of India Topographic maps on 1:50,000 scale. Two seasons' data is used for the delineation of different units. The units are confirmed by the ground truth/field visits.

The minimum level of interpretation accuracy using remotely sensed data should be at least 85%. The LU/LC map of Singarayakonda Mandal is shown in plate no:5 Level-II classification of National (Natural) Resources Information System (NRIS) has been followed for the delineation of units.

S.NO	DESCRIPTION	AREA IN Ha.
1	BUILT-UP AREA	580.194
2	DOUBLE CROP	5501.491
3	SINGLE CROP	1906.711
4	AQUACULTURE	698.740
5	PLANTATIONS	881.587
6	SANDY AREA(COASTAL)	63.691
7	LAND WITHOUT SCRUB	0.0318
8	WATER BODY(DRY)	845.602
9	WATER BODY(WET)	739.986

Table 2: showing the LU/LC area in Hectors

4.6 Drainage

Drainage map is prepared by using Survey of India Topographic maps on 1:50,000. All the streams and tanks existing in the study area are marked in this map. These streams further classified based on stream ordering. Up to fourth order streams exist in bottom of the study area. Most of the streams flow North to South in top of the study area North to East, reservoirs and lakes do not exist in the study area. Only minor rivers and tanks are exists. The drainage system existing is dendritic.

4.7 Geomorphology

The earth’s surface can be classified into different geomorphic units/land forms based on their physiographic expression, origin, material content and climatic conditions, etc. Technical guidelines of National Remote Sensing Agency are taken into consideration in the classification of geomorphic units. In the study area, the following eight geomorphic units are delineated from the satellite imagery.

CPD	Coastal plain with weathering
CPM	Coastal plain with moderate weathering
PD	Pediment
PPM	Pedi plain with moderate weathering
PPS	Pedi plain Shallow weathering

Table 3: Geomorphological units

4.8 Soil

The specific objectives of soil mapping are identification, characterization and classification of the soils of the area. The soil types identified in the study area are (1) loamy-skelital, mixed, rhodicpaleustalfs (55%). (2) fine loamy, mixed, fluventicustropepts (10%) (3) fine, montmorillonitic, typichaplusterts (35%).

4.9 Socio Economic Conditions

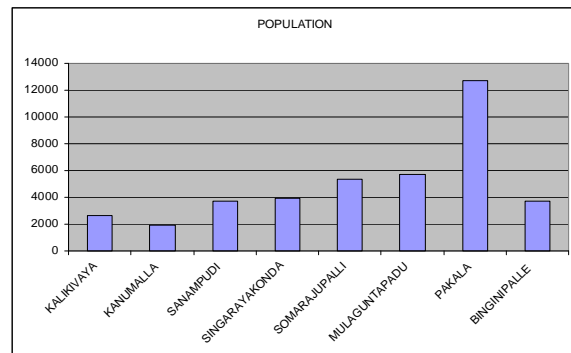
4.9.1 Population

The population of singaranyakonda Mandal is 39,704 (as per 2001 census). The population of singaranyakonda is 3937 persons (as per 2001 census) The village wise population details given in table:

Table 4: village wise population of the study area

Table 5: Details of educational facilities in singaranyakonda Mandal:

S.NO	VILLAGE NAME	POPULATION
1	KALIKIVAYA	2615
2	KANUMALLA	1944
3	SANAMPUDI	3708
4	SINGARAYAKONDA	3937
5	SOMARAJUPALLI	5381
6	MULAGUNTAPADU	5726
7	PAKALA	12681
8	BINGINIPALLE	3712



4 Education facilities

In the rural areas, up to high school education facilities are available in singaranyakonda, mulaguntapadu, pakala, binginipalle, villages and only primary and middle education is available in the rest of the villages.

s.no	Village name	population Total	population		primary school	Middle schools	secondary school
			Male	Female			
1	Kalikivaya	2615	1288	1327	1	0	0
2	Kanumalla	1944	967	977	5	0	0
3	Sanampudi	3708	1818	1890	3	1	0
4	Singarayakonda	1937	1938	1999	18	6	3
5	Somarajupalli	5381	2677	2704	5	0	0
6	Mulaguntapadu	5726	2894	2832	2	1	1
7	Pakala	12681	6487	6194	10	2	2
8	Binginipalle	3712	1848	1864	7	1	1

In the rural areas, up to high school education facilities are available in singarayakonda, mulaguntapadu, pakala, binginipalle, villages and only primary and middle education is available in the rest of the villages.

5. Conclusions

This study helps to get the digital data of the total singarayakonda road network, according to their importance. If we analyze any road we can get the total information in the form of tabular attribute data, length of the roads, details along the roads. We can get the distance between any two settlements, infra structure facilities to the villages, and as a future extension, with the details available we can get the shortest route among the network.

Not only the road network details, we can obtain the full details of the singarayakonda mandal as it is a Decision support system of mandal level micro planning. For example we can get the socio-economic data like demographic details(village wise), details of farmer categories, transportation, live stock and educational facilities.

The decision support system developed in VB.net is useful in updating, viewing report and hence for making decisions useful for the end user. With the help of this decision support system, any user who is not having any prior knowledge on this software can easily find out all the details of the village at one place. The future extension of this project is to share information to the public via internet.

Fig:2 Window Showing Login Page

Fig.4 Form Showing Create New User Account

Fig.6 Window Showing the Base Map

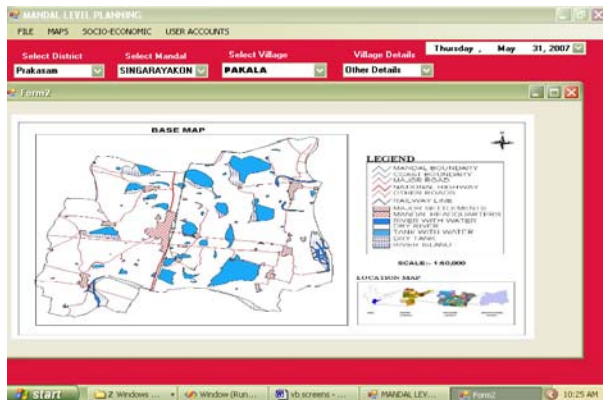


Fig.8 Window showing the LU/LC Map

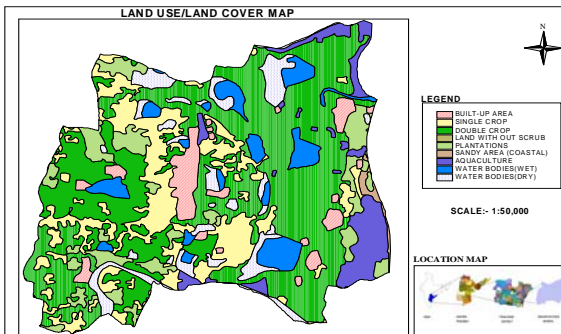
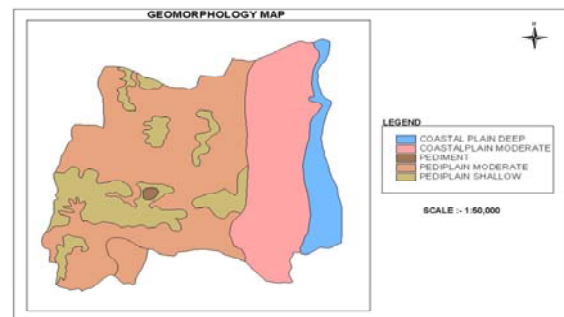


Fig : 3 : Window Showing Demographic Details

Fig.5 Window Showing Education Details

Fig.7 Window Showing Basic Category Details

Fig.9: Window showing the Geomorphology



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