

# A GIS Based Pruning Management System of Tea Garden Using Database Management System (GISBPMS)

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## ABSTRACT

This paper presents a pruning management system of tea garden using database management system. The segment wise pruning data can be inserted into the database. Retrieving stored data from the database through a GIS based decision support system provides the information about pruning for a segment of the garden. The segments of the garden under a particular pruning type can be visualized with a particular color over the digitized map. One colored segment can be selected from the visualized garden map by the mouse click operation. The selection of a segment provides the future pruning decisions about that segment along with the current and previous pruning information. The selected segment will be blinked and zoomed view of that segment will be generated along with the entire pruning related information of that segment.

The implemented GIS features provide the easy user interface. The implementation techniques of the GIS features are also present in this paper with results.

## Categories and Subject Descriptors

D.1.7 [Programming Techniques]: Visual Programming

## General Terms

Design, Management

## Keywords

Raster map, Digitization, GIS, Decision support system, Pruning, Blinking

## 1 INTRODUCTION

Tea is the most popular drink in the world. Tea industry contributes substantially towards the national and state economy by way of enriching the foreign exchange reservoir. In all aspects of tea production, consumption and export, India has emerged to be the world leader, mainly because it accounts for 31% of global production. It is perhaps the only industry where India has retained its leadership over the last 150 years. Pruning is one of

the most important operations, next to plucking, which directly determines the productivity of tea bushes. As the age of wood from the date of pruning increases, the size and weight of growing shoots on plucking surface decreases. Therefore to maintain the vegetative growth, pruning is an essential activity. There are some variations of pruning these are:

1. Light Prune
2. Un Prune 1
3. Un Prune 2
4. Deep Skiff

These pruning types are maintained by the Pugury Tea Estate Mirik, Darjeeling Dist., West Bengal which are performed in a cyclic order. Different tea gardens use different name.

In this era of computerization, the tea management procedure should be automated. All tea industries are trying to implement software, which helps them to store records and retrieving necessary data to provide decision easily. In this paper, a GIS based decision support pruning management technique has been proposed and implemented.

Section 2 of this paper deals with the scheme of the implementation techniques. The implemented results are given in section 3. Conclusions are drawn in section 4 and references are given in section 5.

## 2 SCHEME

Complete layout of the technique has been described in this section. The total structure of the scheme is the collection of 5 sub tasks. These are:

1. Creation of pruning database
2. Digitization
3. Updation of pruning database
4. Graphical Interpretation of Pruning Information
5. Searching information
6. Generation of next pruning decision

These sub tasks are discussed in the sections 2.1 to 2.6 respectively.

### 2.1 Creation of pruning database

To store the pruning information the pruning database has to be created. The suggestive attributes for the pruning database table are:

- Segment name
- Current pruning type
- Current pruning date
- Previous pruning type

- Previous pruning date

In the completely created and data inserted table one record of the table contains the information of a segment i.e. for each segment one record has to store in this database table.

## 2.2 Digitization

Digitization is a process by which all or required objects of a map can be segmented and converted as polygons lines or points. Polygons, lines and points are the basic components of a completely digitized map. The digitized maps are called the vector maps. In a raster map or scanned map all objects are constructed by pixels. By obtaining the necessary pixel's coordinates of an object the raster to vector conversion is done. This conversion process is called digitization and all the coordinates of the boundary points are stored in the database as table. Since vector map is a collection of polygons lines and points, and all objects have the boundary attributes attached with it, any type of GIS related activity can be performed on vectorized map. The necessary coordinates of boundary points of each required segments can be obtained by the mouse click operation and stored in the oracle database under table. Figure 1 shows the schematic flow of Digitization process.

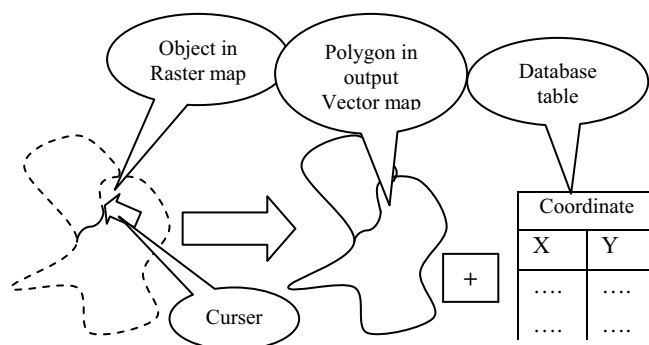


Figure 1: Digitization process

## 2.3 Updation of pruning database

To take decision about the pruning operations, the current and previous pruning information are required. In each updation into the table only the record corresponds to the segment name has to be changed. At the time of updation the current pruning type and date are to be replaced in place of previous pruning type and date attribute in the record of the selected segment. The input pruning date and type have to be placed at the current pruning date and type attribute for the record where the input segment matches with the segment name. The updation technique is represented in figure 2. To update pruning database the attributes of current pruning type and current pruning date is written under previous pruning date and pruning type and then current date and pruning type is inserted against the segment name where it matches with the segment name attribute of the record of the database.

## 2.4

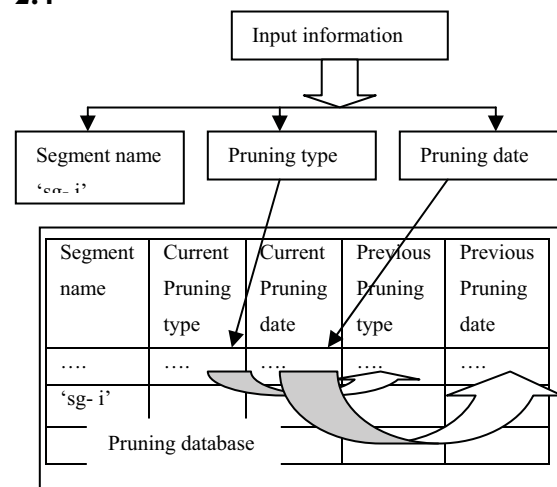


Figure 2: Updation operation in database table

## 2.5 Graphical Interpretation of Pruning Information

The management of the tea industry needs to know various statistics of pruning. Visualization may be segment wise or it may be based on pruning type. For this reason the pruning type wise and segment wise graphical visualization is necessary. If some one selects a particular pruning type from the pruning type menu then the segments of the map under the selected pruning type is colored with a particular color by using graphics technique. To perform this operation a separate layer is created on the scanned map. Then after fetching the boundary coordinates from the database tables which are created at the digitization phase, polygons are constructed and it filled with a color on this layer. The filling color depends upon the pruning type i.e. different color has been used to represent different pruning type.

## 2.6 Searching information

The colored segments do not provide all information about the segments. So segment selection and information visualization about the selected segment is presented as a separate module. The segment can be selected by the mouse click operation. If mouse click is performed on the map then the program searches all polygons to find whether any constructed polygon contains that clicked point or not. If any constructed polygon contains the point, the information about that segment/polygon is visualized. To provide information properly the following features are generated.

1. Blinking of segment
2. Zooming
3. Text information visualization

All of these features are discussed from section 2.5.1 to 2.5.3.

### 2.6.1 BLINKING OF SEGMENT

When the information about the selected segment will appear on the screen, the segment blinks to make representation prominent. The user can easily and perfectly understand that the visualized information is for the blinking segment. Blinking has been

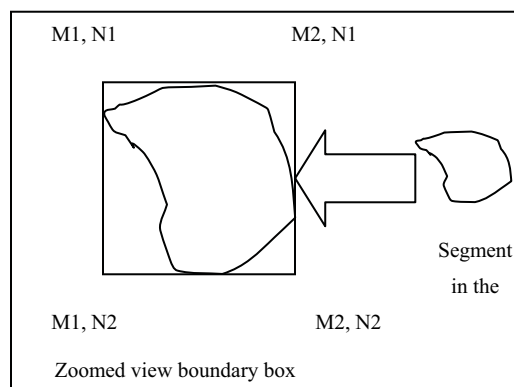
implemented using thread. When any polygon is selected then the thread is called which fill the polygon with two different colors with a fixed time interval. If mouse is clicked outside the blinking polygon then the thread for that polygon will stop its operation.

### 2.6.2 ZOOMING

Along with the information, if the zoomed view of the selected segment is generated, the representation will be more acceptable in respect of GIS. To visualize the zoomed view of the segment a panel has been created. In this panel a blank image of specific background color is inserted into the panel. On this image the zoomed view along with the text information of the selected segment is generated using graphics feature. On the blank image a boundary box has been specified where the zoomed view is generated. Figure 3 provide the structure of the boundary box along with the zoomed view. The zoomed view of the segment can be obtained by converting all the constructed boundary coordinates of the selected polygon to the zoom view boundary coordinates. The boundary point's coordinates transformation equations are:

- $M = M1 + (mx - minx) * ((M2 - M1) / Dx)$
- $N = N1 + (my - miny) * ((N2 - N1) / Dy)$

Where, M is the converted X coordinate in the zoom view for the polygon's X coordinate  $m_x$ . N is the converted Y coordinate in the zoom view for the polygon's Y coordinate  $m_y$ .  $(M1, N1)$ ,  $(M2, N1)$ ,  $(M2, N2)$  and  $(M1, N2)$  are the four corner coordinates of the zoom view box shown in figure 3



**Figure 3: Zoomed view of the segment in zoom view boundary box.**

$D_x$  is the difference between the minimum and maximum X coordinates of the boundary points of the polygon in the map.  $D_y$  is the difference between the minimum and maximum Y coordinates of the boundary points of the polygon in the map.

### 2.6.3 TEXT INFORMATION VISUALIZATION

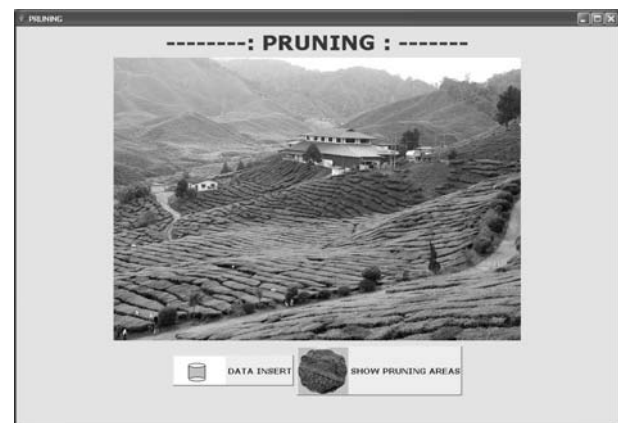
Along with the zoomed view the text information about the selected segment/polygon is visualized in the proper place of the screen. By the drawing string method of graphics the segment name can be fabricated at the middle of the zoomed view of the segment. Around the zoomed view all the pruning information can be drawn on the blank image by the string drawing mechanism.

## 2.7 Generation of next pruning decision

In the tea garden the management maintains a pruning cycle. In the Pugury tea state they maintain LP-UP1-UP2-DS pruning cycle i.e. after LP they perform UP1 type pruning on the tea garden and like this way LP again comes after DS type pruning. Between two successive prunings type some interval will exists. By comparing the interval with the system date the next pruning decision should provide on the screen. Along with the next pruning type the next pruning date, lagging or leading duration can be visualize in a text area.

## 3 RESULTS

The technique is implemented by using the garden map of Puguri Tea Estate, Mirik of Darjeeling district and by taking the pruning data of that tea estate. The implemented results of the proposed technique are presented in this section. The total technique is implemented using java swing and oracle9i database management system. Figure 4 shows the initial page of the implementation. Two buttons 'Data Insert' and 'Show Pruning Areas' are exists in this page. If updation of the pruning database is required for new pruning data insertion the 'Data Insert' button is to be pressed. Figure five shows the page which will occur if we press 'Data Insert' button. This is the Password page. There must be some protection to access the data insertion operation to avoid wrong insertion which may effect decision. Only authorized persons can update the pruning updation table. With proper user name and password if 'GO' button is pressed, the pruning insertion page will be opened



**Figure 4: Initial page**

This page is shown in figure 6. From this page the user may select the segment name, pruning date and pruning type. After the selection, if 'GO' button is pressed then the record corresponds to the selected segment in the pruning database table will be updated by the mechanism discussed in the section 2.3. But the user must have to select all the fields correctly. The other button in the initial page is 'Show Pruning Area' button. If this button is pressed, the page of pruning type selection will be opened. From this page the required pruning type can be selected. By selecting the pruning type if 'GO' button is pressed then the decision support pruning information page will be opened. This is shown in figure 8. The zoomed view of the selected segment along with the segment name is visualized in the middle of the upper left

sided panel. The blue color texts around the boundary of this panel visualize the current and previous pruning information. The upper right panel contains the digitized garden map. The green colored polygons on the map are the segments under the LP type pruning. The pink colored polygon represents the selected polygon/segment which is blinking by the two colors black and pink. In this implementation green color is used to represents the LP type pruning areas. Blue, yellow and red colors are used to represents UP1, UP2 and DS type pruning areas respectively. The left sided panel contains a blank image on which all the information along with the zoomed view is drawn. The mechanism of this page is described in sections 2.4 and 2.5 A text area exists in the decision support pruning information page which provides the next pruning decisions about the selected segment. If the next pruning is delayed then the text in this box appears in red color but the text appears in blue color if the next pruning date is the leading date. If mouse is clicked out side of any colored segment then no information will be appeared in text box and "Please clicked in a colored Segment" message will be appeared on the blank image.

Figure 5: Password page

Figure 6: Pruning Insertion page

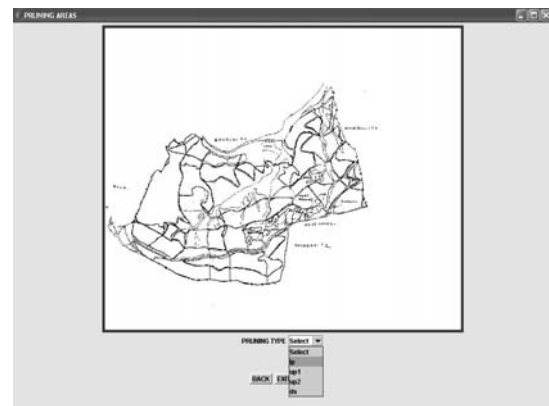


Figure 7: Pruning type selection page

Figure 8: Decision support pruning information page

## 4 CONCLUSIONS

A GIS based decision support techniques for pruning management in tea garden has been presented here in a cost-effective manner. Through this system, the management can make decision easily through visualization of the GIS based representation of the segments under the selected pruning type along with the text base information. This tools and techniques may enhance the efficiency of pruning management operations. The technique proposed has the flexibility to customize the tools for any tea garden with insertion of scanned map of the garden. If the management needs the total pruning information for the last few years then another database and interfacing page has to be added.

## 5 ACKNOWLEDGEMENT

The authors express a deep sense of gratitude to the Department of Computer Science and Engineering, University of Kalyani, Dist. Nadia, India for providing necessary infrastructure support for the work. The work is carried out under the Research and Development Schemes of Technical Education Quality Improvement Program, the World Bank Assisted Project of Government of India being implemented under the SPFU at Kalyani Government Engineering College, West Bengal. The authors also express their gratitude to the Dept. of Computer Science & Engineering, Kalyani Govt. Engineering College, Kalyani, Nadia, India where the current processing is being done.

The authors also express gratitude to the management of the Puguri Tea Estate, Mirik, Darjeeling district, India for the providence of all necessary information.

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