Forest Map-Think Green, Live Green

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Abstract

Forest degradation is the primary reason for global warming and this threatens the entire ecosystem. This is a significant concern as far as climate change and it's grave aftermaths matter. To check this unprecedented deforestation, the Government of India and many governmental/ non-governmental organizations have taken various initiatives. These organizations are planting trees to reduce the impact of global warming. They disclose the number of trees planted in each drive. The current system is inadequate in a way to keep a check on the work done by organizations in this field. Thus our system will create transparency by making it easy for the citizens to be aware of the forest restoration activities taking place. This will be done through the Geographical Information System(GIS), which will generate a detailed report of the changes in vegetation analysis over a period of time in a given geographical area that will be lucid, easy to understand on a user interface.

1. INTRODUCTION

Forests are not only a gaggle of plants and trees but it's a consolidated ecosystem and a home to many diverse species. They support biodiversity and forests foster medicinal conservation[5]. It also plays a vital role in the water and carbon cycles that make life attainable. When forests are deteriorating or lost, this destruction leads to a series of changes that disturb life both globally and locally. Deforestation refers to the cutting down of forests to open up room for such things as farms, roads and cities.[6] The scarcity of trees poses a significant threat to any nation's climate, and since we are aware that the climate does not respect any national borders, this makes it a global challenge. The threats blatant themselves in the form of deforestation and forest deterioration. We're losing 18.7 million acres of forests every year, equal to 27 football fields every sixty seconds[1]. India has lost over 1.6 million hectares of tree cover from 2001 to 2018, which is four times the territorial size of Goa, as per the new study released by the World Resources Institute (WRI).[3] At present, India's forest and tree cover is about 21.54% of the country's total geographical area which is less than the ideal forest cover which is 33%.[4] Environmentally based, the Western Ghats is one of the most important regions of the country and suffered a loss of more than 20,000 hectares of its forest cover over the time span of 17 years, which was reported by Global Forest Watch[2]. India has been quite successful in increasing the forest cover by implementing various schemes individually or in collaboration with various Non-Governmental Organisations (NGO's). Still, it is failing to monitor the progress of the affected areas. The lack of a monitoring system derails the whole afforestation process as mere plantation is not the end but looking after it's progress to ensure that the afforested area is preserved and it ends up adding to the forest cover has to be the final goal.

Therefore we aim is to develop a system which will :

1. Allow citizens to check the improvement in vegetation cover over some time in a given area.
2. Release a detailed result of vegetation in a given geographical area for a particular time span.

2. LITERATURE SURVEY

In paper[8], this study's prime reason is to make out the expanse of change that occurred in the forest area for the past two decades. The author has made wide use of advanced remote sensing as well as of GIS techniques to detect the difference in the forested area over the specified time range. Out of the supervised and categorizing on the basis of objects, the author opted for supervising approach for the forest vegetation classification.

In paper [9], the classification of forest cover into different types of vegetation is done. To achieve this the author has considered to classify arbitrary forests using remote sensing and geographical information. These methods used have proved to improve classification accuracy. This algorithm does not overfit, and it does work on its own without any supervisor. This algorithm also notices data points which lie out. This in turn helps when some of the samples may be wrongly named. Also this method is insensitive to noise and does not over train.

In paper [10], the author has used various techniques to monitor the forest cover change taking place. Monitoring of variation in forested areas for longer spans is done using high intention information that gives an in depth sight of forest exhaustion. Also the sight which may be blocked because of clouds is achieved using radar. There are various technologies and programs developed which can be used for this purpose. For tracking the variation in vegetation area, worldwide and zonal scale information was made available from various satellites. Because of the available in-depth information, prompt tracking and authentic verification of terrain even at regional level can be achieved.

In paper [11], the author presents a system for vegetation tracking which is timely and user interactive. The author believes that there is a constant improvement in the satellites used to obtain high-res information, various cell-phone and data connection technologies that offer user services. These advances will offer new openings in the field of near timely vegetation tracking systems. The author here demonstrates how feasible is the scheming and execution of interactive vegetation tracking systems. There are several approaches for examining the quality of execution of the system, one of which is used to assess and the end outcome is made ready for issuing.

3. PROPOSED SYSTEM

There are many factors that result in deforestation such as agricultural expansion, logging, infrastructure expansion, and increasing population. The proposed system will be based on historical as well as real-time data. In the comparison model, the user obtains maps of the current and previous years for the region for which the comparison is to be done. The more the data, the better will be the accuracy of the system to give the comparison. If the system gives an accurate comparison, it will become easier for the investors to donate to the Non-Governmental Organizations(NGOs) as they will be having proof for the plantations they are claiming.

The proposed model is most likely to be the better alternative to show the variations of the land cover of a particular region for a user's time span. This system will act as a proof for the NGOs. The system will take the time span in years from the user as an input and will generate the detailed report as an output. The user will use this report to check if there is an increase in the land cover or if there has been any decrease in the land cover or if it is the same. Thus a comparison model will help the user understand better about the plantation activities and it could help in the betterment of nature.

The organizations release the data related to the drive like budget, no of trees planted, area covered, etc. There is no way to check if the number of trees i.e. the vegetation in these areas has been affected by any means. This is the biggest drawback of the system so far. This drawback needs to be overcome by some sort of application to track the growth in vegetation cover after a tree plantation drive takes place in an area or a geographical region. This is the reason for developing an application that can track the growth of vegetation in the region. Having a device that individually tracks each of the trees planted seems to be an expensive and impractical affair. So, the need of the hour is the system that would track the required resources remotely and make it cost-effective, a system that will use existing resources.

In light of this, we plan to use the GIS system along with advanced image processing techniques like color based contour detection and mathematics to find if there has been any change in the area.

From Fig. 1. A GIS is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface.[7] A GIS system is defined as a system that is used to obtain maps, analyze the maps and provides the analysis in a readable format to the user.In our proposed system, the user will enter the area for which the comparison is to be done. The system will collect a raster image for that area and convert it into a PNG image for easy computation. This PNG image is stored at the server for further processing. The color-based contour detection technique is used on this image to detect the vegetation area. The different tasks performed by our GIS system are:-

- Downloading of maps.
- Storing maps on the server.
- Processing the maps i.e. we are performing contour detection on the maps.

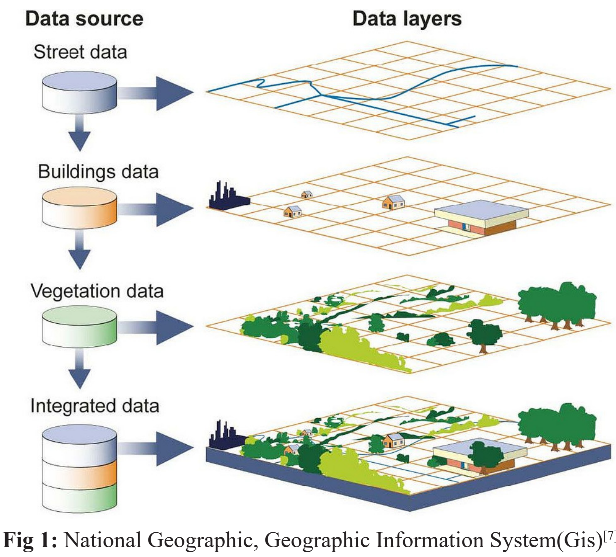

Fig 1: National Geographic, Geographic Information System(Gis)[7]

- Displaying the processed results in the form of Pie charts and Bar graphs.
- Thus, our proposed system's tasks above make our whole system called a GIS system.

4. METHODOLOGY

4.1. Block Diagram

In the developed system, for obtaining maps a set of steps are to be followed. The user will enter the name of the region for which the comparison is to be done in the system after which he will enter the zoom area needed for the comparison process. Followed by this, the user will mention the start year and the end year i.e the timeframe for which the comparison is needed. The system will take all the above-mentioned as inputs for further processing.

The system will ask for the user's email id on which the analyzed report would be sent. The system will process all the provided user inputs, and two separate URLs for start year as well as for end year will be generated, which will be further used to get the maps using the static maps library.

This will, in turn, use the request library to download the map which will be a raster image which will be in .TIFF(Tagged Image File Format) format for the particular year, which the system will convert it into .PNG(Portable Network Graphics) format for ease of usage and store it at the pre-specified location in the system.

Followed by this is the vegetation detection module where the maps downloaded in the previous module will be used in this module.

Fig 2 depicts a Block diagram, which illustrates the flow of our project.

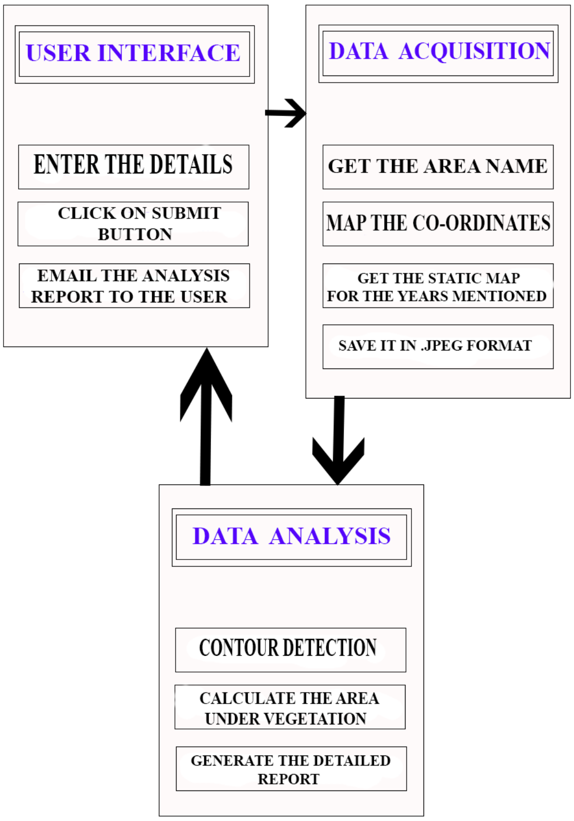

Fig. 2: Block diagram

5. MODULAR DIAGRAM

The working of the individual modules in Fig. 3 is explained as follows:

5.1.1. Module for obtaining Maps

1. The user will enter the Name of the region for which the comparison is to be done.
2. The user will then enter the Years for comparison to obtain the data.
3. The system will take the user inputs.
4. The system will ask the user for a valid Email id.
5. The system will process user inputs and call generate a URL.
6. This URL will be used to get the maps using the static maps library.
7. This will, in turn, use the request library to download the map for the particular year and store it at the pre-specified location.

5.1.2. Module for Vegetation detection

1. The maps downloaded in the previous module will be used in this module.
2. The process of color based contour detection in image processing will be used for this purpose.
3. This will return the area on the map which has vegetation.
4. Then the area of the entire map will be calculated.
5. The system will calculate the ratio of green vegetation area to the map's entire area.
6. A detailed report will be generated and will be mailed to the user.
7. This will be repeated for both the years entered by the user.

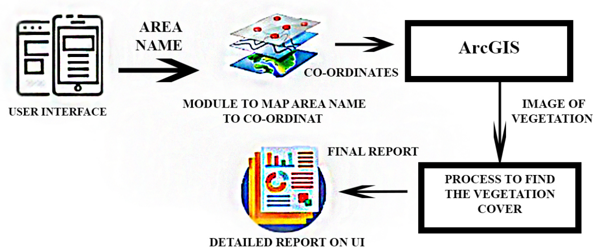

Fig. 3: Modular diagram

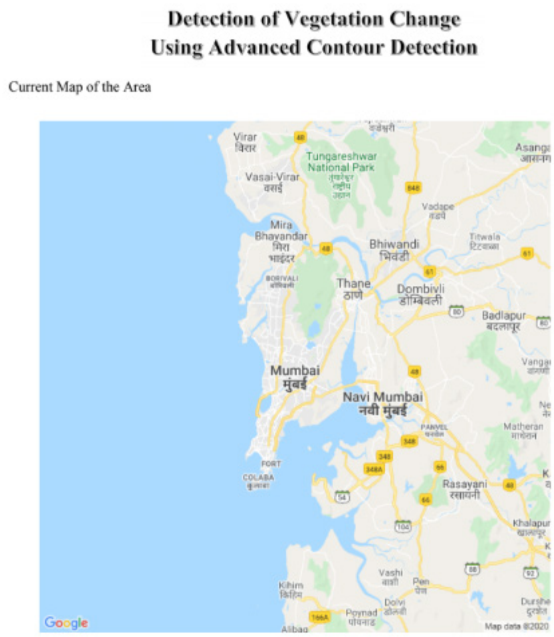

Fig 4: Selection of area for detecting the Vegetation

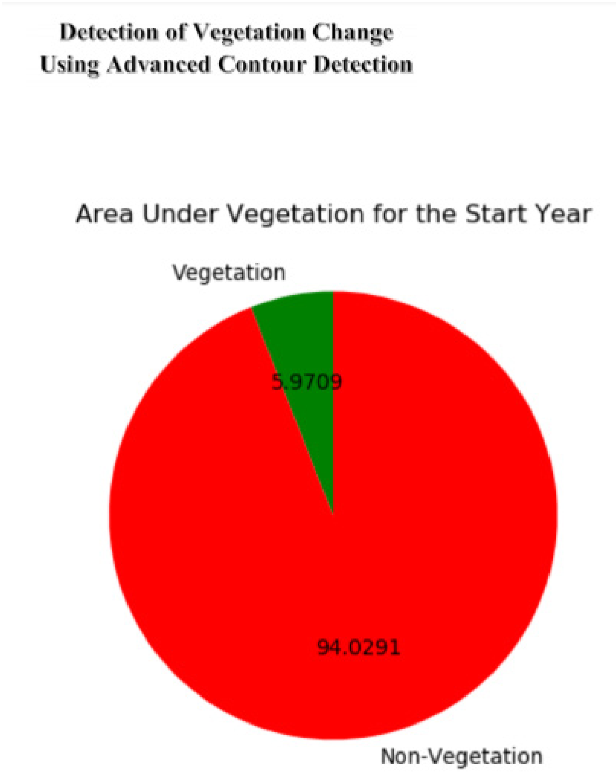

Fig 5: Area Under Vegetation for First selected year

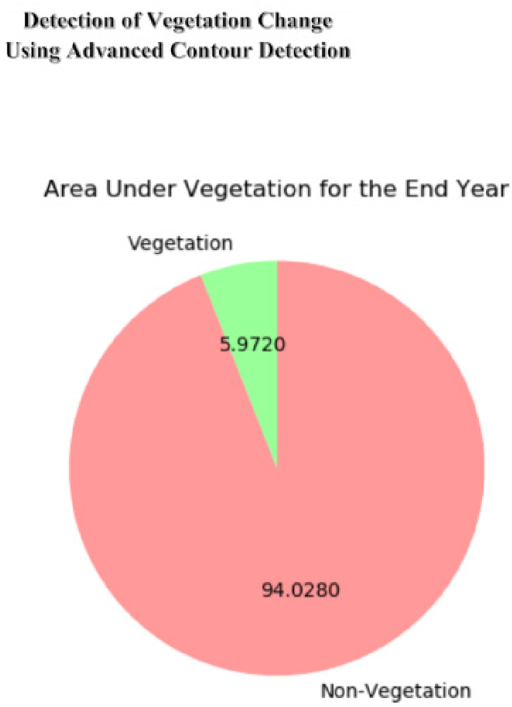

Fig 6: Area under vegetation for Second selected year

5.1.3. Final Output

1. The Outputs for both the modules need to be displayed for the user on the user interface.
2. The output of the first module, i.e. maps for both the years will be displayed to the user.
3. That will be followed by the detailed report being mailed to the user. This report will also be displayed on the user interface.

6. RESULTS

The data from the maps are processed to calculate the area of vegetation for the number of years provided by the user. We are summing up the area of the conture; this process will be carried out individually. This process will continue for the start year as well as the end year. Then the sum of the area is found & it will be different for all maps but the total area covered by the map is going to be the same, since our map will always be the same size 640 x 640 image. So the total area is always going to be the same. The ratio of area is then used in our pie chart & bar graph. We are programmatically creating a pdf file.

Data presented in the pdf file are:-

1. Map of the region (using the end year map) (Fig. 4)
2. Pie chart (in % under vegetation and non-vegetation and the result is up to 4 decimal points [45.3456%]) for the start year (Fig. 5).
3. Pie chart (in % under vegetation and non-vegetation) results in up to 4 decimal points [45.7290%])for the end year (Fig. 6).
4. Bar graph(shows the difference between the area under vegetation in start year and end year) (Fig. 7).

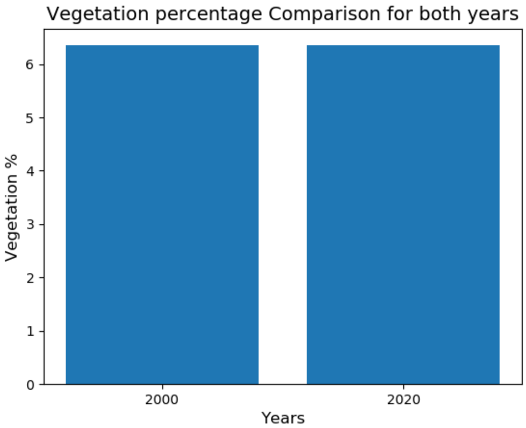

Fig 7: Comparison of Area under vegetation for the selected two years by the user

After this Data is shown, a mail of the same will be sent to the user that he entered at the beginning. We are using a mailing library, for which we have created a Gmail email id, this Email id and password is mentioned in our python code for the sender. So the receiver just needs to enter his email id and a mail will be sent to him. This mail consists of a pdf file which will have the Figs. 4-7 depending upon the selected region.

5. CONCLUSION

Our system will be developed using GIS through which users will be able to check the plantations of a particular region and compare the statistics with previous values of the vegetation cover. The rate at which the deterioration of forests takes place has adversely affected the ecosystem and has caused an increase to be planted in that region in global warming. Thus increasing the forest cover is the only way to conserve nature. Even after afforestation, the results have been below par, because of the lack of availability of tools to monitor the plantations.

In the future, we can combine our system with regression capabilities to confidently predict future outcomes and present it to the stakeholders. Since it is essential to preserve the survival of plants, the system will be able to give information about the plants which will be suitable for plantation in a specific region.

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