GIS Based Model for Analysing the Pattern Changes in Water Bodies Occurring in Coastal Kerala
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Abstract:
Water’ a word which can lead to many debates and arguments in this present world. We all know that many countries have started facing water crises and are depending on many external factors and support of other countries for their survival. Research has predicted that many developing countries like Japan, Chile, India will drink up their surrounding water and perish. As people say, “If ever there is a world war 3 then that would be for water”. Situation has definitely got worse during last 2-3 decades, every time we are forgetting that this planet belongs to the future generation and we have borrowed it from them. It is the responsibility of each and every human being to contribute in reviving the situation. This is where our new idea comes up which will help to determine the change in water level for a specific period of time and give a comparative study of the changes that have happened. We will be able to predict whether the condition has deteriorated or improved in the region. It is really necessary to map the changes of everything happening around us in order to revive the earth from its depriving situation. Tools like QGIS and MATLAB are used for this purpose. QGIS is used to classify the images while MATLAB is used for calculating the water level. We used coastal area of Kerala coordinates 76.25E9.5N-76.5E9.75N to monitor the change and the result obtained is plotted.

Keywords: Change detection, Observations, QGIS classification, Satellite Image Formation, Water area.

I. INTRODUCTION
Determination of water level will make it easier for decision making and helpful for doing a lot of research work with these quantitative measurements we tend to obtain with our project. This project will help to determine the change in water level of the water bodies by giving the precise measure quantitatively. Change detection in the water level of different water bodies is done using software called MATLAB, which uses processed satellite images from QGIS. QGIS is a tool which is used to process and classify the satellite images as land, water, sea, buildings, etc. in the required format which is accepted by the programming tool MATLAB. By applying the change detection algorithm in MATLAB the satellite images of different dates are processed and the software will give us the exact surface level water at the region at that time[1]. The satellite images are obtained from a free and open source website called Bhuvan, which is completely owned and maintained by ISRO itself. The research work which we have done with our new project helps for a comprehensive study in the field of water resource management to a very large extent [4].

II. MATERIALS AND METHODS
The tools used in this project include QGIS, MATLAB and BHUVAN portal. The total project is effectively divided into three modules. They are:
1) Obtaining Satellite Images of Location
2) Classification of the Images Using QGIS
3) Program Using MATLAB to Study the Comparison

A. Data and Location
The input images are obtained from Bhuvan portal. Images of the coordinate’s 76.25E9.5N-76.5E9.75N are taken for the purpose. Images are downloaded in LIS III format as a tile. Images with time gaps of 1, 2, 3, 4, 5 years are considered. Five sets of images are formed. They are:
1. Set I is formed by grouping 3 images (December 2011, February 2012, February 2013) with a time gap of approximately 1 year.
2. Set II is formed by grouping 2 images (December 2011, February 2013) with a time gap of approximately 2 years.
3. Set III is formed by grouping 2 images (January 2008, December 2011) with a time gap of approximately 3 years.
4. Set IV is formed by grouping 2 images (January 2008, February 2012) with a time gap of approximately 4 years.
5. Set V is formed by grouping 2 images (January 2008, February 2013) with a time gap of approximately 5 years

B. Methodology

Figure.1. Flowchart representing the whole process
**QGIS classification of the image:**
Images from Bhuvan are classified using QGIS software. A plugin inbuilt in QGIS called “semi-automatic plugin” was installed for the purpose of classification. Using the semi-automatic plugin, a band set is created and the band is processed. After this a training set is created and band processing is done. The training set is used to train the different band set images. Once training is completed, classified images are obtained. The images are classified into areas of water and others. The output of this yield classified images with water represented as white pixels and other areas as black pixels[7].

**MATLAB coding to find the surface area of water:**
MATLAB provides many inbuilt functions. Imread() function in MATLAB helps in reading the image file. Imshow() helps in showing the image file. The output of the previous section, that is, classified black and white images are read into MATLAB and are processed. In MATLAB, we convert the rgb image to gray scale image using the function rgb2gray(). A function called bwarea() helps in calculating the surface area of white pixels in the image. Bwarea () estimates the area of all of the on pixels in an image by summing the areas of each pixel in the image. In bwarea(), the area of an individual pixel is determined by viewing at its 2-by-2 neighbourhood[6].

There are six different patterns, each representing a different area:

- Patterns with zero on pixels (area = 0)
- Patterns with one on pixel (area = 1/4)
- Patterns with two adjacent on pixels (area = 1/2)
- Patterns with two diagonal on pixels (area = 3/4)
- Patterns with three on pixels (area = 7/8)
- Patterns with all four on pixels (area = 1)

**Code:**
The below code displays and calculates the surface water area of the grayscale classified image of January 2008.

```matlab
BW= imread('C:\Users\GAHANA\Desktop\Classifies images\jan2008ori.png');
Aw=rgb2gray(BW);
imshow(Aw);
bwarea(Aw);
```

The same code is used with a change in file name in the imread() is used to calculate the surface area of water of that image.

**III. RESULTS**
Images were classified into black and white with white pixels representing water and black pixels representing other areas. Classified images are shown in fig 1,2,3,4. The classification process was verified using another input image of different coordinates (69.5E22.5N-69.75E22.75N, 17oct2008) as in fig 5. The change in the surface area of the water of different images taken different at a time are obtained successfully.

**The surface area of water are obtained as**

- January 2008 - 6.6021e+04
- December 2011 - 6.0268e+04
- February 2012 -5.8870e+04
- February 2013-5.871e+04
IV. DISCUSSION AND CONCLUSION

Some of the Bhuvan images were unclear, concurrent and had some errors. All other valid available input images are considered for the coordinates 76.25E9.5N-76.5E9.75N. We did a detailed study in a region called Alappuzha, a district in Kerala state. Alappuzha is one of the districts in Kerala which is known for its great backwaters, long canals and lagoons. The satellite images of this place were obtained from the BHUVAN site and we manually classified them into water and others and then they were converted to grayscale. Those images were then processed in the MATLAB to find out the changes in the water level. The classification process done in QGIS is verified as shown in Fig 3.5. The resultant water area obtained is plotted with time. The graph clearly indicates the decrease in water level with the passage of time. As time goes on, the nature is getting affected and its water level is decreasing. As only surface area is considered and not the volume only minute changes are obtained. These were enough to understand the depriving situation faced. If the trend continues, soon water will dry out from the region which in turn affects all living organisms. The future is going to be completely research oriented where every project would depend on solid data’s and reports. Our project will help for every such research work in the field of hydrology and metrology [4]. It will help in future for measuring the water changes and also comparing water to land ratio and many more. This will give a detailed mapping through the past and present which enables us to set a target or landmark for the future. Since water is going to be scarce and really precious in the coming years, it is really essential to map them and would be very beneficial when we can measure it quantitatively. It is going to benefit many areas and these inputs from our project could be of very crucial help in the near future.

IV. DECLARATION OF CONFLICT OF INTEREST

The authors whose names are listed immediately below the main title at the beginning certify that they have NO affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

V. REFERENCES


