Estimation of Water Discharge using Image Processing

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Abstract - *Measurement of velocity is a very difficult task in the surface water studies. Many attempts to measure the turbulences with the help of contact sensors but could not yield accurate results, as we know that the sensors alter the flow pattern. The aim of our project is to implement a non-contact velocity measurement system with help of image processing. The process is initiated by taking images of a strategically chosen environment or the proposed technique can be applied on the satellite images. The images from the database will further be processed using computer vision tools like open-cv and python. The velocities are then calculated over the entire image by dividing the displacements by the time interval successive frame.*

Key Words: **image processing, open-cv, gabor filter, k means segmentation, raschii, etc.**

1. INTRODUCTION

Measuring the velocity of the water has always been the difficult and crucial task.[2] Central Water and Power Research Station (CWPRS), a premier research institute has been working in the area of water resources since 1916.[2] During the recent years physical model studies have been proven very efficient and successful as math models are limited with boundary conditions.[2] The success of previous models is mainly due to the advent and implementation of new measurement and processing techniques. One such requirement is to measure the velocity of the flow occurring in the physical model area.

The velocity measurement of the water flow of rivers or oceans using a contact-oriented system has its own drawbacks as the different weather conditions may damage the system or components of the system present at the site. This causes inaccuracy and instability in the system which is not at all beneficial. The devices or components present in the water to measure the velocity may also disturb the water flow which will also result in inaccurate results. To overcome all the disadvantages of the contact-oriented system a contactless system is developed using Image processing.

Image processing technique will help us get more accurate and precise results for calculating the velocity of the water. Image processing will make the system contactless which will not disturb the water flow and the system will not be damaged. We propose a system based on Image Processing to make a contactless system to calculate water velocity with more accuracy. In this technique digital information is recorded and to obtain the flow details it is reprocessed as needed with different spatial and temporal resolutions.

Non-contact speed measurement is widely used in measurement of velocity and flow etc., because it can avoid the phenomena such as mechanical wear in contact speed measurement, it can improve the measurement accuracy too. In traditional speed measurement, signal from two electrical detectors were used to have speed measurement, due to small amount of information the accuracy was very low and in the same time it cannot catch exact process of speed. The non-contact speed measurement is considered to be commercially viable technique in the velocity measurement system.

2. FLOW DIAGRAM

The following figure is the basic flow diagram of our proposed system. The database consists of images captured from the camera which is located at the site and by accessing the satellite images. The images are stored in database for future purpose also. The collected images will further be processed in computer vision tools like open-cv and python. Further by using k-means segmentation images will be segmented and processed. After the k-means segmentation we implement the gabor filter on the images. In the end we use the raschii method to calculate the velocity of the water. The images collected will be compared with the images with normal conditions. Pattern matching of those images will be done to forecast about the current condition. The velocity of the water in lateral manner will be calculated and accordingly estimation will be done of it. The estimated results will be given to the Base Station to alarm about the conditions.

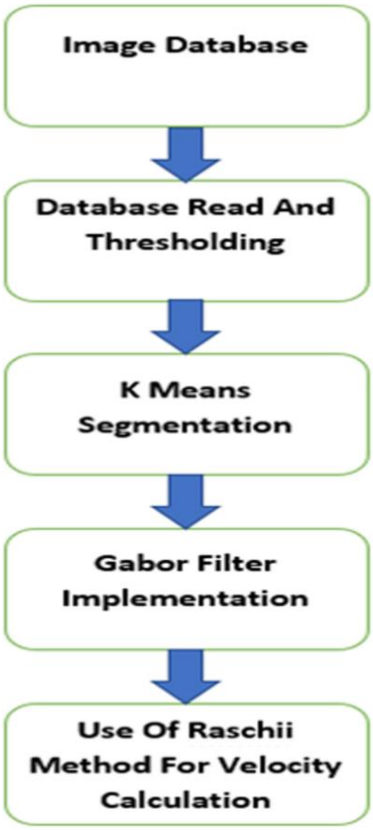

Fig -1: Flow Diagram

3. RESULTS

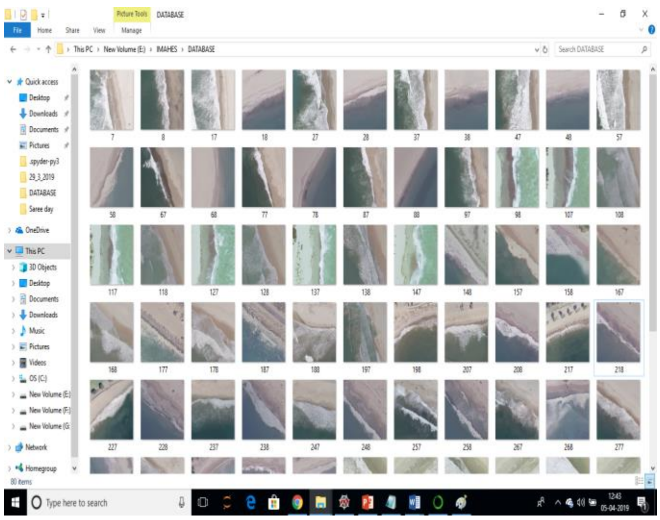

Fig -2: Image Database

Above figure shows the database of images of a certain water environment that we have considered. Then we will apply various segmentation techniques and filters to the database for the calculation. The calculation is basically a method in which we will compare different images of the water rise time to time of the same area and then compare it with the ideal flow of water in the same area. This method is explained below in detail.

Fig -3: Image from Database

An image will be selected from the database to show how the process takes place.

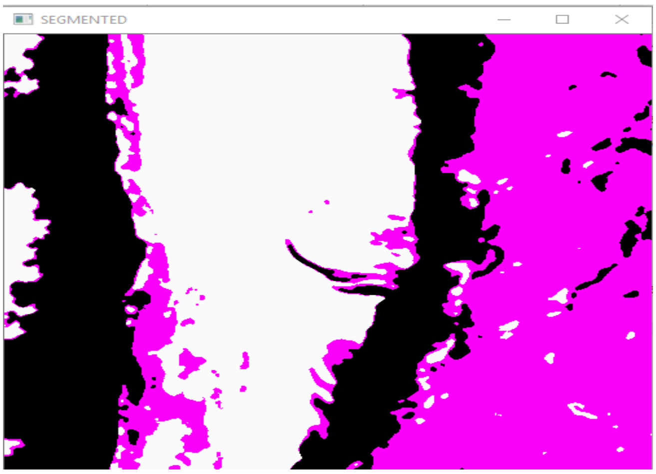

Fig -4: K means Segmented Image

Now we have applied the K Means segmentation the image which we took from the database. Basically, the k-means clustering is a method of vector quantization, originally from signal processing.

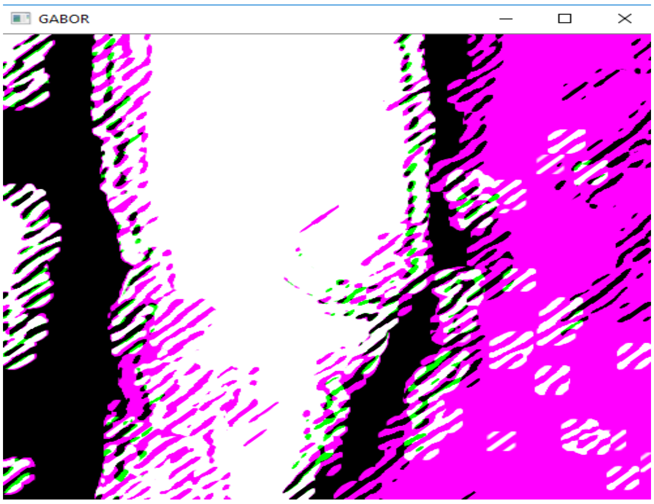

Fig -5: Gabor filtered image

After the k means segmentation is done then we will apply gabor filter on the segmented image, which will result us as shown in the above figure. Gabor filter is a linear filter used for texture analysis, which means that it basically analyze whether there are any specific frequency content in the image in specific directions in a localized region around the point or region of analysis.

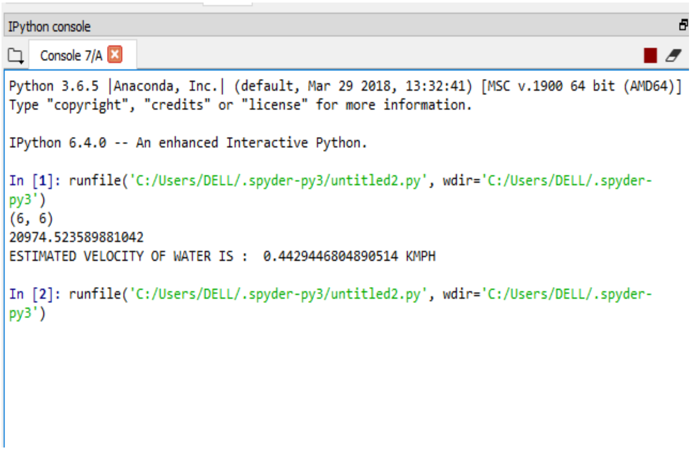

Fig -6: Snapshot of final window

After the implementation of the Gabor filter we will use the Raschii method for the final calculation of the velocity measurement of the water discharged. Most of the interaction with Raschii will be through the wave model object. To get such an object first get the class and then instantiate the class to get the wave model.

4. CONCLUSION

Image based technique is a reliable and accurate measurement approach. In a situation of extreme flood and during slow and shallow flows, this method is the only alternative as compared to any point based and profiling instruments that require considerable efforts to obtain data. Processing is done using pattern matching technique which generally uses cross-correlation and gives the displacement of tracer particles and thus the velocity is calculated.

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