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Eyebot – A Smart Assistive System

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ABSTRACT: Visually challenged people find many difficulties in day to day life in detecting currency, water and fire in front of them while walking in the streets, which affects them a lot. In this paper, we have come upon with a proposed solution of using a smart assistive system to assist them and sense the world around them using vision substitution and vision enhancement techniques. We propose to use image processing technique to detect the Indian currency dominations, fire and water in pits and puddles in front of the visually challenged people on the way by using Support Vector Machine (SVM) algorithm. The system also gives simple navigation to alert them and navigate them with simple instructions. All the mentioned features are integrated in a portable wear with speech warning messages that are enabled when any of the above mentioned is detected. It enables empowering the visually-challenged to move twice their normal speed because they feel more secured and confident. The system is of low cost, fast response, low power consumption and light weight. The system also prevents the visually challenged people from getting cheated by giving fake or wrong denominations of currency notes.

KEYWORDS: Puddle detection, Micro lettering, Intaglio printing, Contour detection, Image processing.

I. INTRODUCTION

A survey conducted by World Health Organization has once reported that there are 28.5 crore visually-impaired people worldwide out of which 3.9 crore peoples are entirely blind. Over the past years, blindness due to diseases as been reduced. However, the number of visually challenged people is estimated to be doubled by the year 2020. Hence, the need for assistive devices for navigation and assistance has exponentially increased. In our system, the simplest and the most affordable navigations features as well as obstacles and risks detection modules are to be incorporated in a portable wear which is easy to wear and carry at the same time. The proposed system comprises of a module to detect the denominations of currency notes thereby reducing the chances of visually challenged people getting cheated. The system reduces the complexity of visually challenged people since they look as equal as every other individual in this world.

II. LITERATURE SURVEY

The various earlier developed systems are studied and the inference are as follows

Pratik N K et.al [1] explains about the object detection methods. The blind stick would have sensors integrated in it which senses the objects, when any objects or obstacles come in range of an ultrasonic sensor then the person is alerted using a vibrator. The overall system also has a GPS module to know the current location with the help of a microphone and a speaker. The system has a feature by which the visually challenged can contact to a person whose details is stored in case of any emergency. The System also has a water and infrared sensor.

Himanshusharma et.al [3] has developed a system in which the pits and puddles are detected and avoided by the ultrasonic sensor to sense if there is a hole or staircase. A moisture sensor is placed at the bottom of stick to measure

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the degree of water and soil moisture. A knee above obstacle detection and avoidance system is implemented by using an additional ultrasonic sensor. Finally, a wireless remote consisting of RF modules (transmitter and receiver) is implemented which enables a person to detect the location of the lost stick.

Sanjana.B et.al [5] proposes to build a self-assisted text to speech module so as to make them read and understand the text in an easier way. It is applicable to both the visually impaired and day to day normal citizens. A mounted camera is inbuilt to capture the text image from the printed text and the captured image is analysed using optical character recognition. A predefined dataset is loaded into the offline database so that it helps match the observed text with the captured image. Once it is matched the text is processed for implementing speech output.

NikhilRajan P et.al C [7] proposes a system that supports Object recognition and output comes in the form of Voice output. In Smart Walking Stick, we detect the things with the assistance of a camera. The stick measures the space between objects and Smart Walking stand by Ultrasonic sensor. When the objects or obstacles are available range of the ultrasonic sensor, the speaker tells the name of obstacle in front of the stick. Images will be captured using a built in camera and the camera is integrated to the Raspberry Pi microprocessor. If any obstacle comes in front of visually challenged people, he is alerted by giving a sound output through headphones connected to his ears.

III. KEY FEATURES OF THE SYSTEM

This system encloses the presence of pits and puddles on the way by detecting water and helps the visually challenged people by means of simple navigations, alert messages and alarms. Our system also enables identifying the denominations of currency notes using the security features present in the Indian currency notes. The presence of fire in the surrounding environment is also done by the system.

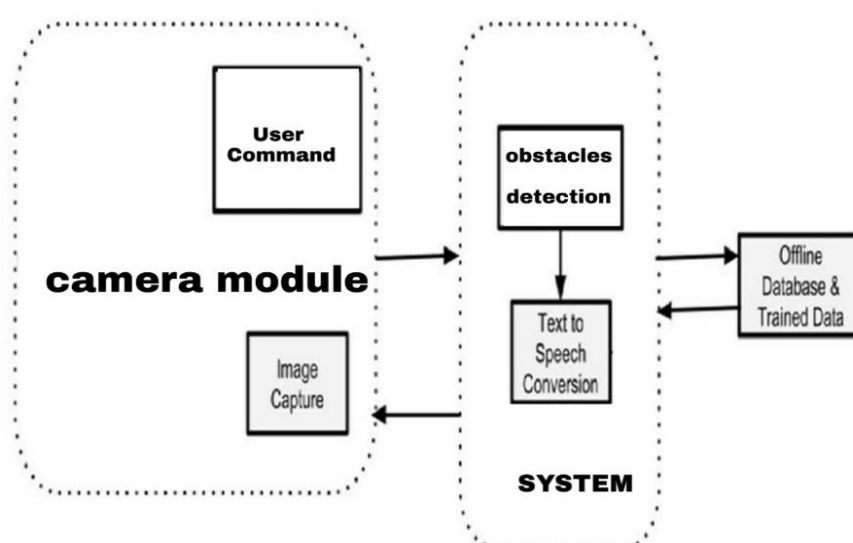


Fig.3.1 Architecture Diagram

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Vol. 9, Issue 2, February 2020

IV. PROPOSED METHOD

The recognition of obstacles using image processing is a multilevel process which has the following layers namely Image Acquisition, Image Pre-processing, Edge Detection, Feature Extraction, Image segmentation and Authentication.

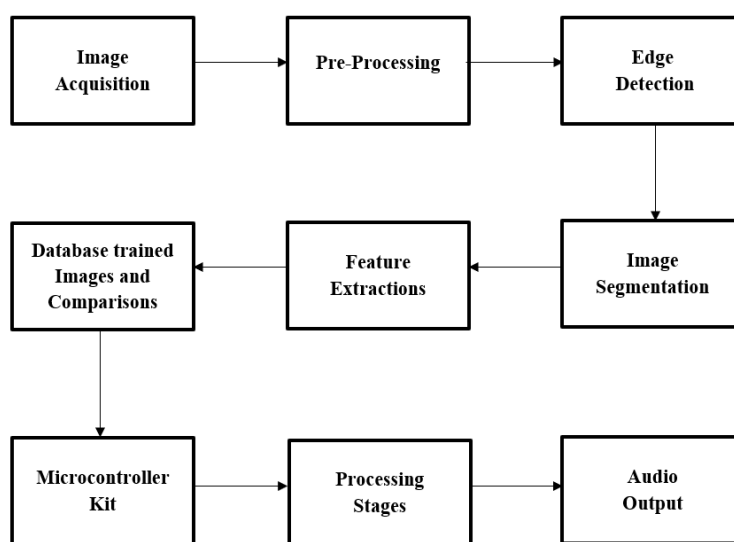


Fig.4.1 Architecture Diagram of Image Processing

Commonly Used Methods to Detect denominations and Fake Currency

The various methods used to detect the denominations of currencies are namely See through Register, Water marking, Security Thread, Latent image, Intaglio Printing, Micro lettering, Identification Mark and Optically Variable Ink.

Commonly Used Methods to Detect water

The proposed system for detection of water comprises of comprises of two fundamental parts: shading demonstrating and movement identification. The calculation is done and is utilized in parallel with traditional fire and water location frameworks to lessen bogus cautions. It can likewise be conveyed as a stand-alone framework to identify fire by utilizing video outlines procured through a video securing gadget.

Commonly Used Methods to Detect Fire

An epic fire shading model are created in CIE L*a*b* shading space to distinguish fire pixels and water pixels from others. The different intensities of the flame light are captured using the 26megapixel camera. The intensity is captured and the presence of fire is detected.

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Vol. 9, Issue 2, February 2020

V. SECURITY FEATURES IN INDIAN CURRENCY

SI NO	VALUE (₹)	SECURITY FEATURES
1	2000	<p>Front face</p> <ul style="list-style-type: none"> ➤ Holding the note in a latent position one can see two thousand printed in 4 places with different coloured ink and typesetting ➤ Picture of Mahatma Gandhi on the front side ➤ A see-through register on the left side with the numeral 2000 ➤ Security thread passing straight up with the lettering's RBI, Bharat, and 2000 ➤ Watermarks of Mahatma Gandhi's image and the numeral 2000 on the right side <p>Reverse face</p> <ul style="list-style-type: none"> ➤ The Rs.2000 note bears an image of Mangalyaan on the reverse side, which represents India's venture into the Mars orbit. ➤ Year of printing ➤ Language panel
2	500	<p>Front face</p> <ul style="list-style-type: none"> ➤ Intaglio print of Mahatma Gandhi's image ➤ 5 bleed lines on both the sides ➤ See through register in the bottom left ➤ Security thread that changes colour from blue to green when held in different positions ➤ Promise clause signed by the RBI governor along with the RBI emblem <p>Rear face</p> <ul style="list-style-type: none"> ➤ The rear side of the note has an image of the Red Fort along with Indian flag ➤ Year of printing ➤ Language panel ➤ Swachh Bharat logo and slogan
3	200 100 50 20 10	<p>Front face</p> <ul style="list-style-type: none"> ➤ See through register with denominational numeral 200 ➤ Latent image with denominational numeral 200 ➤ Portrait of Mahatma Gandhi at the centre ➤ Guarantee Clause, Governor's signature with Promise Clause and RBI emblem towards right of Mahatma Gandhi portrait and electrotype (200) watermarks <p>Rear face</p> <ul style="list-style-type: none"> ➤ Year of printing of the note on the left ➤ Swachh Bharat logo with slogan ➤ Language panel ➤ Motif of Sanchi Stupa

VI. IMPLEMENTATION RESULTS

The Figure No. 6.1 shows the Offline Database of the system in which all the images of the known obstacles and denominations of currencies are stored. Images can be uploaded, deleted and renamed in the database.

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Figure 6.5 shows the pre-processing part of the Hough transformation part of our algorithm which performs grey scale to recognize the UV lines better. Figure 6.6 shows the edge detection part. In this system application of edge detection is done to get clear idea about UV lines, because these UV lines can be present anywhere. The clear and cut edge detection is made and output is processed with optimality



Figure 6.6: Edge Detection

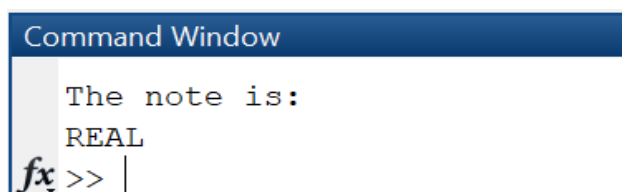


Figure 6.7: Output (real)

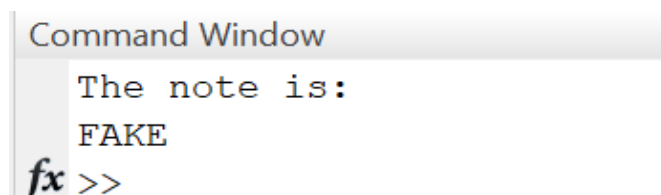


Figure 6.8: Output (fake)

VII. PERFORMANCE ANALYSIS

Figure 7.1 shows the accuracy of our proposed algorithm and it is evident that almost in every case, correct detection has been performed.

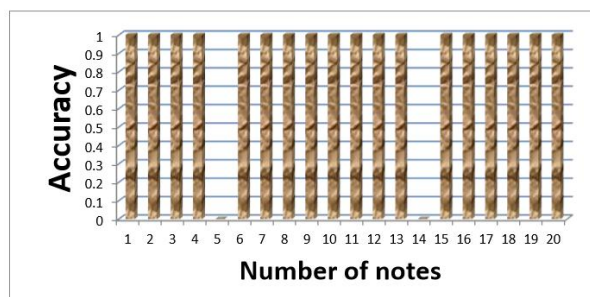


Figure 7.1: The Accuracy of proposed algorithm

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Vol. 9, Issue 2, February 2020

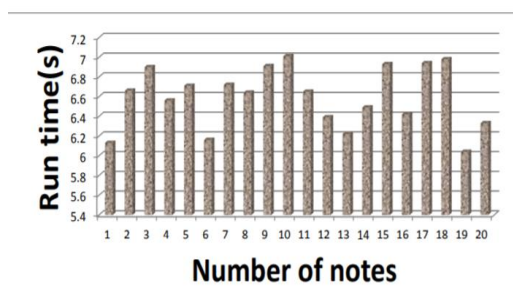


Figure 7.2: run time of proposed algorithm graphically

Figure 7.2 shows the run time of our proposed algorithm which shows the average time needed for the code to run. After the implementation it was found that the highest time needed did not exceeded 7seconds and the lowest time needed was only 6seconds.

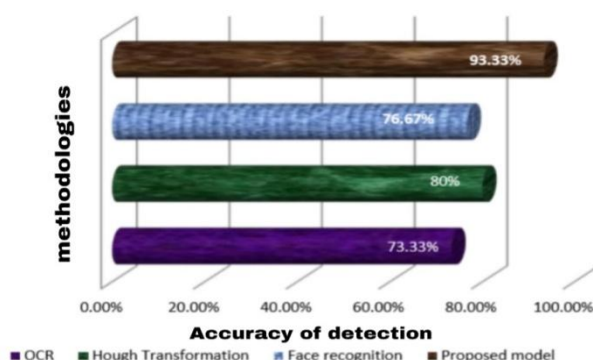


Figure 7.3: percentage comparison of all the techniques

Figure 7.3 shows overall comparison between the accuracy of our proposed algorithm and the individual algorithms. We are mentioning that implementation of tests with the expected results for both the proposed models and previous models are finished and measured. After verifying the each and every module individually results are noted. After the individual implementation, each one was combined and checked and we noticed that our model is having the highest accuracy.

First method of implementation has the accuracy of 73.33%. However, relying on only one technique may be risky as new technologies are emerging constantly and new techniques of micro printing on fake notes may come around in future.

Hough transformation took the shortest time to run. Hence, the system showed better performance when OCR and face recognition were applied together. Overall, the algorithms were combined. It was found that they showed better accuracy. On the other hand, more than one technique was decided to be used to ensure correct recognition of obstacles and denominations.

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Lastly, we combined the face recognition, OCR and Hough transformation algorithm and this gave better accuracy than all the other ones. However, this algorithm took the longest to run due to the accumulation of all the algorithms at one go. Nevertheless, it gave us the highest accuracy of 93.33% which was to maintain motive of work.

VIII. CONCLUSION

An innovative and cost-efficient model for Fire, water and currency recognition using image processing has been discussed to augment the life of visually challenged by producing more accurate results in detecting the known obstacles and currencies in their day to day life. Wide number of image processing methodologies and algorithms have been studied to design and build a highly efficient system. The cost and size of the system is reduced by one tenth when compared to the existing system. In this system, accuracy is more important than a millionth of a second. The proposed digital image processing system for the detection of currency and known obstacles is more efficient on the basis of cost, weight and less time consuming than the other existing system.

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