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CURRENCY RECOGNIZED ULTRASONIC BLIND WALKING STICK

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Abstract

Today technology improving daily different aspect in order to provide flexible and safe movement for people. The blind people used the blind walking stick to find out if any obstacle are present in front of them.For any type of movement blind people uses theirown senses such as hearing sound and touch. So to overcome this problem we are developing ultrasonic blind walking stick for blind people. Another one more system is added is currency recognition system for visually impaired people using image processing Money related transaction is an important part of our day to day life. With the consideration of visually disabled people or blind people, it is somewhat difficult task to identify the paper currency as it has same feel without any brail marking on it. Even though denomination based on size may or may not be identified but it is almost difficult to identify whether the note is original or fake. It is the question on edge to develop such a system that will make sure for visually disabled or blind people that the currency they have is original or not.

Index Terms: *ultrasonic sensor, intelligent stick, microcontroller, currency recognition system etc.*

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1Introduction.

According to world health organization around the 30 billion people are bind on the earth and around the 30 million people are blind India. This blind stick is integrated with the ultrasonic sensor,pit sensor, moisture sensor and light sensor.Our proposed first uses ultrasonic sensor to detect the obstacle aheadusing ultrasonic waves.Sensor senses the obstacle and passes this data to the microcontroller and then microcontroller process this data .if the obstacle is close the microcontroller send the signal to the buzzer and buzzer produced the sound and alert the blind person.

Another one more feature is added in this system is currency recognition system for visually impaired people using image processing.

Money related transaction is an important part of our day to day life. With the consideration of visually disabled people or blind people, it is somewhat difficult task to identify the paper currency as it has same feel without any brail marking on it. Even though denomination based on size may or may not be identified but it is almost difficult to identify whether the note is original or fake. It is the question on edge to develop such a system that will make sure for visually disabled or blind people that the currency they have is original or not. The currency recognition algorithm discussed in this paper using image processing is based on an ORB (Oriented fast and Rotated Brief). It is faster and also rotation invariant. The proposed algorithm shows 90% true recognition rate.

1.1 OBJECTIVE.

The main objective of this paper is to help the blind people to walking within the area or out of the area without using external help. This stick is very helpful for blind people to recognize the currency with the help of image processing technology we can usedin this stick.

1.2 LITERATURE SURVEY.

Zahid Ahmed, et.al. proposed a software system for currency detection developed for Bangladeshi currency. The fake currency can be detected with the extraction of existing features of banknotes. These features vary in accordance with the currency of corresponding country. Here features considered are micro-printing, optically variable ink (OVI), water-marking, security thread and ultraviolet lines, etc. Sample currency note has to go through optical character recognition. The success rate of this software can be measured in terms of accuracy that has 100% recognition result for UV visible lines, OVI and iridescent ink, security threads recognition, etc.

Faiz M. Hasanuzzaman, etal proposed banknote recognition system by using SURF (Speeded up Robust Features) in order to achieve high recognition accuracy. It can also handle different challenging conditions those are present in real-world environments. Initially monetary features of every image are extracted with the help of SURF. These features are then matched with the precomputed SURF features of image in each banknote category. The numbers of matched features are compared with automatic thresholds of each reference region. Thus category of banknote can be determined.

Farid Lamont, etal proposed a method of artificial vision to recognize Mexican banknotes. Images captured are supposed to be taken under no illumination changes i.e. the input images of notes are illumination invariant. Here features like colour and texture of the banknotes are extracted. On the basis of RGB space to extract colour and the Local Binary Patterns to extract texture, respectively these features of banknotes are classified. Similar method proposed here can be applied to recognize banknotes of other countries which constitute different colours to distinguish denominations.

2. METHODOLOGY

In this system the ultrasonic sensor are used to sense the obstacle. The sensor are set a threshold limit if any obstacle is found within that range it gives beep speech through speaker. The microcontroller read the distance of the obstacle using the sensor and also send the command to the buzzer. The vibrator is connected in parallel with the buzzer for vibration sensation. The light sensor is used to inform the users if its is day or night or any particular place dark or bright,the moistures sensor is used to detect the water pit or any puddles if present.All the signal is send to the microcontroller which in turned send signal to the buzzer thereby alerting the user.

And another most important system we can used in this stick, is currency recognition system. An overview of the proposed currency recognition system can be given as follows:

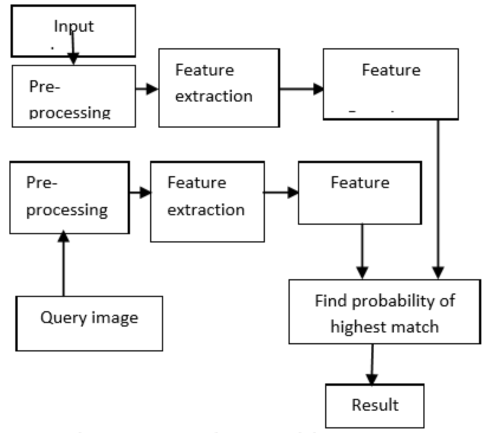

Fig.1.Proposed recognition system

In preprocessing, different images of banknotes are taken. These banknote images constitute images of different denominations.To make feature extraction easier, image resizing can be done. Image enhancement technique helps to increase the contrast among bright as well as dark points. This makes the image clear and so it will be further helps feature extraction. It produces feature points which are nothing but feature descriptors. Feature descriptors of both sample input image and query image are calculated and are compared to find probability of highest match points to generate final result.

A) Extraction of feature points Detection of fast corner Feature points extraction via ORB depends on detection of fast corner. If there are certain number of pixels, in a circular ring about the corner candidate pixel say p with its intensity as Ip, then a pixel can be considered as the fast corner if candidate pixel is brighter than Ip+t or it may be darker than Ip-t where t indicates threshold value. Gray images consist of larger difference among the intensity values. The corners detected via fast are considered as feature points. It is simple to implement and also requires very low cost for computation. It is rotation invariant. Orientation by intensity centroid ORB has a little scale invariance but it is rotation invariant that's why it can be employed for intensity centroid. Intensity of the corner pixel can be considered from the center. Here corner's intensity is assumed as an offset. When a patch is taken into consideration it has its center as one of the feature point as considered in case of fast corner detection. The moments of such a patch can be given as follows:

$$m x,y = p x p,q \in \mathcal{S}$$
$$q y \mathcal{F}\ p,q \qquad (1)$$

the intensity centroid can be : $\mathcal{C} = \ m\ 1, 0\ m\ 0, 0\ ,\ m\ 0\ ,1\ m\ 0, 0$

(2) A vector is constructed from the centroid to the feature point. The orientation of the features can be:

$\emptyset = arctan m0,1/m1,0$ (3)

B) Rotation Invariance of ORB The rotation invariance of a descriptor ORB is a bit string description of an image. This image is nothing but a patch which is constructed from a set of tests of binary intensity. Consider an image patch x of one feature point. A binary test $\mathcal{T}$ is:

$\mathcal{T}x;p,q = \{ 0 , \quad xp \geq x(q) \; 1 , \quad xp<x \; (q)$ (4)

where xp is the intensity of x at a test point p = (u , v)T . For $\mathcal{N}$ test point pairs selected, one can define the feature point descriptor with no rotation invariance as a vector of $\mathcal{N}$ binary tests: $\mathcal{FN}x = 2i{-}1\mathcal{T}x;pi ,qi \; 1 \leq i{\leq}\mathcal{N}$ (5)

Above equation represents a descriptor with no rotation invariance. That's why it is efficient to steer it according to the feature orientation in (3). Feature set of $\mathcal{N}$ binary tests at location pi ,qi the $2xn$ matrix can be:

$\mathcal{Q} =$
$p1,p2, \ldots\ldots pnq1,q2, \ldots\ldots qn$ (6)

Feature point orientation $\emptyset$ in (3) and the corresponding rotation matrix $R\emptyset$, ORB construct a steered version $\mathcal{Q}\emptyset$of $\mathcal{Q}$:$\mathcal{Q}\emptyset = R\emptyset\mathcal{Q}$, then the rotation invariant feature points descriptor of ORB can be:

$\mathcal{GN}x,\emptyset = \mathcal{FN}x \,|(pi,qi) \in\mathcal{Q}\emptyset$ (7)

The correlation in above equation (7) is larger, it decreases the matching accuracy. In order to reduce correlation between binary tests, a learning method is developed with the help of ORB.

It helps to choose a better set of binary tests by testing all possible binary tests with high variance and with no correlation.

C) Feature matching with hamming distance Similarity among the descriptors can be computed using the Hamming distance. It is a number which indicates the difference between two binary strings. It is used for information analysis.

To make matching possible, the binary strings should be of equal length. Comparing the strings bit per bit generates the result. If the bit compared is same, record 0 else record 1. Finally add these bits to obtain Hamming distance.

Table I– Representation of correctly and incorrectly recognized notes

Denomination	Samples	Correct	Incorrect	Missed
5	Front	4	6	--
	Back	10	--	--
10	Front	8	2	--
	Back	10	--	--
20	Front	8	2	--
	Back	10	--	--
50	Front	8	2	--
	Back	10	--	--
100	Front	10	--	--
	Back	10	--	--
500	Front	10	--	--
	Back	10	--	--
1000	Front	10	--	--
	Back	8	2	--

Fig-1: Represent of correctly and incorrectly recognition notes

3. CONCLUSION

All the study which had been review show that, there are no. of technique for making a currency recognized ultrasonic blind walking stick for blind people. The advantage of this system lies in the fact that it can prove to be a very low cost solution millions of blind person worldwide.

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