ISSN: 2321-7782 (Online)
Volume 3, Issue 2, February 2015
International Journal of Advance Research in Computer Science and Management Studies
Research Article / Survey Paper / Case Study
Available online at: www.ijarcsms.com

A Recent Study on Object Recognition for Visually Impaired Persons Using Smart Phone

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Abstract: ***Mobile platforms such as smart-phones and tablet computers have attained the technological capacity to perform tasks beyond their intended purposes. The steady increase of processing power has enticed researchers to attempt increasingly challenging tasks on mobile devices with appropriate modifications over their stationary counterparts. In this work we describe main features of software modules developed for Android smart phones that are dedicated for the blind users. The main module can recognize and match scanned objects to a database of objects, e.g. vegetable containers. The two other modules are capable of detecting major colours and locate direction of the maximum rightness regions in the captured scenes. In this paper, an application is proposed for visually impaired people to make their day to day life activities easy and simple.***

Keywords: Android; accessible environment; blindness; Human Computer Interface (HCI) image recognition; object recognition.

I. INTRODUCTION

Although many scientists are preoccupied to obtain results regarding the improvement of the comfort of visually impaired persons, the research in this field remains an open subject, as there are many aspects of it that are unresolved. The blind and the visually impaired face diverse kinds of life challenges that normally sighted people take for granted. As far as out-door activities are concerned the blind indicate difficulties in safe and independent mobility depriving them of normal professional and social life. Then the issues dealing with communication and access to information are pointed out. Here a significant help is offered by software applications for computers and touch-screen devices equipped with speech synthesizers that enable browsing the internet and access to text documents. Finally, the common problem experienced by the blind are the so called activities of daily living. So the main objective of this proposed system is to make blind people life simple and easy by using recent and advance technology. The paper consists of related work done in this field and technologies used to develop the system. Basically in this paper a system is proposed by studying the related work done and existing system. The proposed system is different and efficient as compare to other existing system.

II. PREVIOUSLY WORK DONE

In [1] this paper an overview of different types of assistive technologies is presented. Some of the most important aspects for the visually impaired are the solutions and assistance devices for the daily life. A simple categorization of this type of assistance devices is presented. Another important aspect for the visually impaired people is the indoor/outdoor navigation in dynamically changing environment. The technological advancement made possible the creation of different electronic equipments to help visually impaired/disabled persons in their navigation, such as different navigation systems, obstacle avoidance, object/obstacle localization, orientation assistance systems, in order to extend or change the basic support of guidance dogs and the white cane. In the paper a solution to integrate different assistive technologies is proposed; focusing on navigation and object detection, with the use of intelligent feedback by Human Computer Interfaces (HCI) with implication of Head-related transfer function HRTF functions. The paper is composed of three sections. In the first part a general description of the paper is presented. In the following section, entitled "Assistive technology", two main aspects are discussed: assistive technology for daily life and assistive technology for navigation and orientation of visually impaired. From the assistive systems for daily life, the following most important aspects/subjects are presented: personal care, timekeeping, alarms, food preparation and consumption, environmental control/household appliances, money, finance and shopping. Finally some conclusion is presented. The paper is a comprehensive overview of the literature and it does not contain implementation results.

In [2] an object recognition system has been developed that uses a new class of local image features. The features are invariant to image scaling, translation, and rotation, and partially invariant to illumination changes and affine or 3D projection. These features share similar properties with neurons in inferior temporal cortex that are used for object recognition in primate vision. Features are efficiently detected through a staged filtering approach that identifies stable points in scale space. Image keys are created that allow for local geometric deformations by representing blurred image gradients in multiple orientation planes and at multiple scales. The keys are used as input to a nearest-neighbor indexing method that identifies candidate object matches. Final verification of each match is achieved by finding a low-residual least-squares solution for the unknown model parameters. Experimental results show that robust object recognition can be achieved in cluttered partially-occluded images with a computation time of fewer than 2 seconds.

In [3] this paper presents a method for extracting distinctive invariant features from images that can be used to perform reliable matching between different views of an object or scene. The features are invariant to image scale and rotation, and are shown to provide robust matching across a substantial range of affine distortion, change in 3D viewpoint, addition of noise, and change in illumination. The features are highly distinctive, in the sense that a single feature can be correctly matched with high probability against a large database of features from many images. This paper also describes an approach to using these features for object recognition. The recognition proceeds by matching individual features to a database of features from known objects using a fast nearest-neighbor algorithm, followed by a Hough transform to identify clusters belonging to a single object, and finally performing verification through least-squares solution for consistent pose parameters. This approach to recognition can robustly identify objects among clutter and occlusion while achieving near real-time performance.

III. Proposed System Architecture and Algorithm

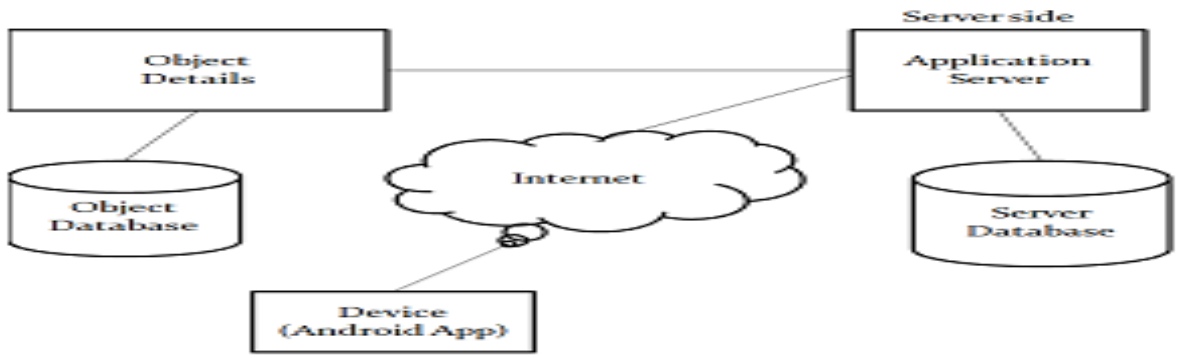

Fig3.1System Architecture

3.1 Color detection module:

This algorithm works on images taken with an automatic flash with the smallest resolution possible (320*480) pixels. RGB color images are converted into HIS (Hue Saturation Intensity). This color space enables to represents the color in single parameter i.e. H component where as S component is the saturation parameter of the recognized color.

3.2 Object recognition module:

It would allow recognizing objects from images recorded by the camera of mobile device. This algorithm should be insensitive to image registration parameter i.e. scale rotation and lightning condition.

3.3 Text to Voice Conversion Module:

We convert the text into a verbal formats the actual and important conversion take place in this module i.e. verbal message. The Images are stored in the form of text then it converted into appropriate verbal form.

3.4 Algorithm:

Firstly, an RGB image is captured by a mobile phone camera. Then, the image is converted into greyscale (in our approach colour information is not used for the object recognition procedure). Further, a key point detection procedure is performed. Originally, Difference of Gaussian (DoG) based algorithm was used, which builds a special image structure called the Gaussian pyramid. To improve performance of the application the Features from Accelerated Segment Test (FAST) algorithm was implemented. It is one of the fastest corner detection algorithms. Finally, a descriptor is calculated for each of the detected key point. The key-point descriptors are calculated on the basis of local image gradient magnitudes and orientations. Key points' descriptor is based on gradient magnitudes computed for 16 or 4 pixels adjacent to a key point. These values are used to form the so called edge orientation histogram.

SIFT: (Scale-Invariant Feature Transform)

1. Find Scale-Space Extreme
2. Key point Localization Filtering: Improve key points and throw out bad Ones
3. Orientation Assignment: Remove effects of rotation and scale
4. Create descriptor: Using histograms of orientations.

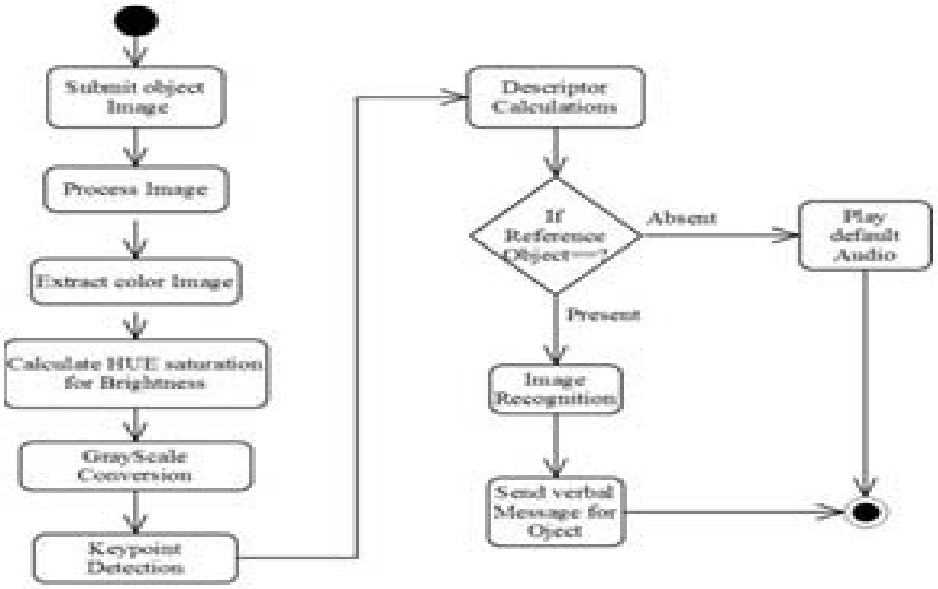

Fig 3.2 Activity Diagram

IV. RESULT ANALYSIS

The main objective is the presentation of a system for detection and avoidance of obstacles that assists visually impaired/disabled persons in their movement. Application will help the blind people to perform their daily activities easily. The application recognizes the objects from images recorded by the camera of a mobile device and give back the information to the blind users. Following system specifications are considered while implementing the system:

A] Hardware Interfaces

1. Processor: Pentium 4,

2. GHz and above 2. RAM: 1 GB

3. Disk: 40 GB

4. Smart phone having good quality camera and computational qualities.

B] Software Interfaces

1. Front end: Java

2. Back end: My SQL

3. IDE: Eclipse

4. Operating system: Windows XP/Vista/7

The Working of our system is explained in following steps:

Step1: First user will capture image from mobile.

Step2: Then user will click on submit button and submit image to server and wait for result.

Step3: Now server will Process image, Calculate the key points, recognize the object.

Step4: After this server will send these details to database to check that it is available in DB or not.

Step5: Now, sever will get the detail about object, generate the verbal message.

Step6: And server will this verbal message to user.

Step7: And finally user will listen the message and get to know about obstacles.

Following graph show how the efficiency of system increase by increasing camera quality as well as hardware specifications:

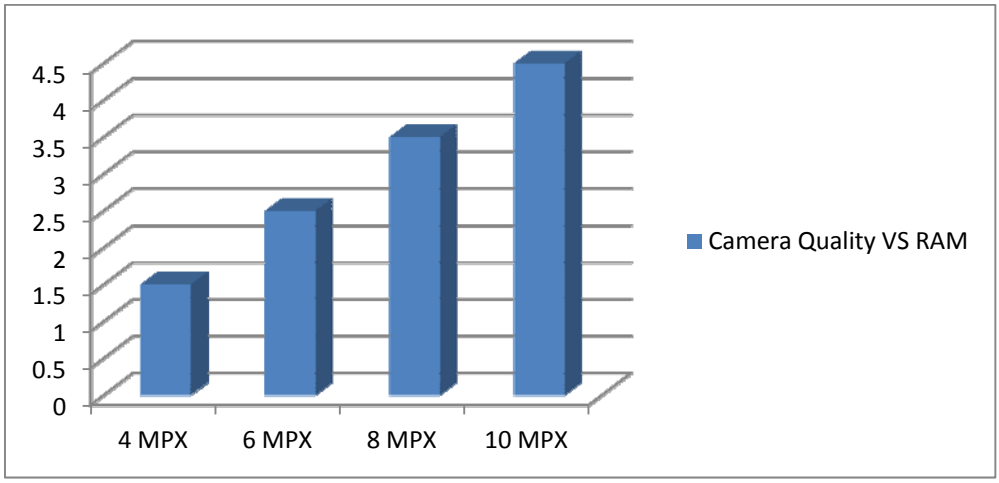

Fig 4.1 Graph

In above graph Y-axis shows the size of RAM in GB and X-axis shows the camera quality in megapixel. From this graph it is analyzed that the quality and efficiency of this application will increase if we improve its hardware specifications which will give better results.

V. CONCLUSION

An efficient and powerful application for image recognition is developed for blind users. If such type of application comes in to the market it will create a new keen point in electronic world. Also by using such application the day to day life problem of blind user can be resolved easily. The developed application can be tested on the Smartphone equipped with a digital camera. Ex. HTC Desire HD, HTC Explorer and Sony Xperia S. The performance of the application depends on the quality of the built-in camera and image acquisition lighting conditions.

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