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Object Recognition in Mobile Phone Application for Visually Impaired Users

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Abstract:*Blind people face a number of challenges when interacting with their environments because so much information is encoded visually .There are many problems when blind people need to access visualizations such as images, objects ,information in the form of text etc. Many tool and technologies seek to help blind people solve these problems by enabling them to query for information such as color or text shown on object. Blind use Braille technique to read. Also there are many applications like screen reader which help them to read. But there is a need of special training to use these techniques and also they are not so much portable. 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. food or medicine containers. The two other modules are capable of detecting major colors and locate direction of the maximum brightness regions in the captured scenes. We conclude the paper with a short summary of the tests of the software aiding activities of daily living of a blind user*.

Keywords:*accessible environment, blindness,image recognition*

I. Introduction:

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. Activities in this area and the corresponding aids can be subdivided into the following main components:

- personal care, i.e. labeling systems, health care monitoring and the use of medicines,
- timekeeping, alarm and alerting, e.g. tools for controlling household appliances, smoke and monoxide detectors,
- food preparation and consumption; utensils of special construction and talking (or sonified) kitchenware (e.g. liquid level indicators),
- indoor environmental control and use of appliances, i.e. accessible systems providing feedback information about in a format suitable for a blind user,
- money and finance; high- and low-tech solutions making shopping and money operations possible for the blind.

In this work we focus our attention on the group of daily living tasks related to personal care systems, in particular, systems that enable the visually impaired to identify objects, e.g. food packs, medicine containers and other items. Currently available solutions can be grouped into the two major groups:
1. low-techlabeling systems in which labels are attached to objects, e.g. with tactile signs or text messages in,
2. high-tech systems, that employ 1-D and 2-D barcodes, talking labels or radio-frequency identification devices (RFID) .

Both systems, however, require attaching special tags or visual signs to the objects. Consequently, they can be costly, since such systems need to be regularly maintained to keep them up to date. In this communication we report a solution aimed at aiding the visually impaired in color detection, light direction detection and recognition of objects. The system is based on a dedicated image recognition application running on an Android system smart phone. Image recognition results are communicated to the blind user by means of pre-recorded verbal messages.

II. Mathematical Model

2.1Mapping:

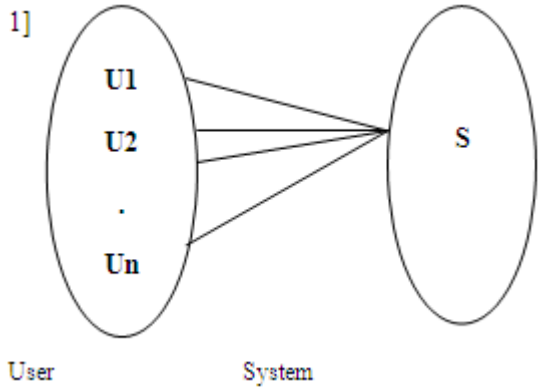

Fig1.one system will be used by many blind users.

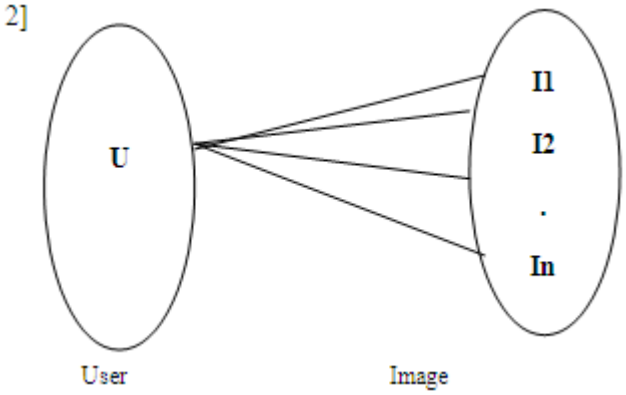

Fig2.one user will submit many object images to the system.

2.2Set Theory

Our system can be represented as a set
System S = {I,O,C}
Where,
I=set of inputs
O=set of outputs
C = set of constraints
Input
Input I= {Object Image}
Object Image = {Object Image1, Object Image2,…, Object Imagen }
Output
Output O = {Recorded verbal message}
Constraint
C1 = "The system should have an huge set of object images with its respective verbal message stored in database".

III. Modules Used:

In the developed software tool for Android smart phones we propose the three following image processing modules:
3.1. Color detection module
3.2. Object recognition module
3.3. Light source detector.
An advantage of the algorithm we proposed for object recognition model is its scale and orientation invariance.

3.1. The Color Detection Module:

The color detection algorithm works on images taken with an automatic flash with the smallest resolution possible (320x480 pixels). The RGB color images are converted into the HSI (Hue Saturation

Intensity) color images. This color space enables to represent the color in a single parameter, i.e. the H component, whereas the S component is the saturation parameter of the recognized color. We tested two different approaches. In the first approach, in the HSI color space, the average value of the color (the H component) is determined for the photo taken. The average color is compared with a predefined reference

table of colors and the color of the photographed object is determined. If the image is too dark or too bright (this decision is made based upon the saturation and intensity components) a special warning message is generated. In the second approach a special color histogram is computed. Each image pixel is represented in the HSI space and allocated to a predefined color histogram bin. If there is a significant disproportion between the first and the second most frequent image color the most frequent one is communicated to the user only. If the occurrence frequency of more than one color is similar, the application informs the user about mixture of colors, e.g. by voicing the message "yellow-red color".

3.2. The Light Detector Module:

The idea of light detector module was proposed by one of the blind users. The application operates in real time and is based on the content of the camera's preview image. In the first step, the average brightness of the centre part of the image is calculated. Next, an audio signal with a frequency dependent on the average brightness is generated. The brighter the image the higher is the frequency of the generated sound. The application proved suitable in robust localization of light sources, for example streetlights or a lamp in the room.

3.3. Image Recognition Algorithm:

The goal was to design an application which would allow to recognize objects from images recorded by the camera of a mobile device. The object recognition algorithm should be insensitive to image registration parameters, i.e. scale, rotation and lighting conditions. Moreover, the recognized object should be robustly detected and localized in the image context (e.g. among other similar objects). The SIFT (Scale-Invariant Feature Transform) proposed in was applied in the developed application. The SIFT is considered as a very power computer vision algorithm for detecting and describing local image features. SIFT allows to compute feature descriptors strongly independent on the image registration conditions. These descriptors are further used to recognize objects in the proposed application.

Object recognition with the help of SIFT

IV. System Architecture:

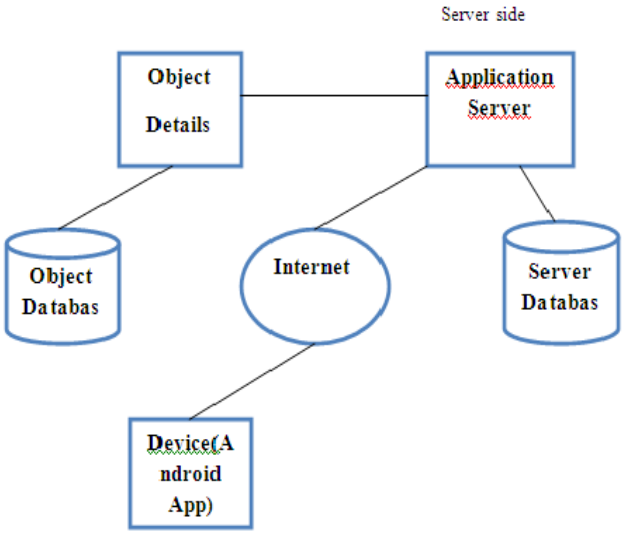

Figure 1-System Architecture

V. Conclusion

Image processing is a very vast area and it is among rapidly growing technologies today, with its application in various aspects of a research. The text present on an image gives the important information about an image. In this project we extract that text from the image and convert it into speech. The project is developed mainly for the blind people.

The converted voice will help them to identify the object whose image is captured by them directly as input to software and can listen it. In this way, we can help to blind people in some sort of their activities such as identifying the objects, reading text etc. In addition to this, it will also help to people having reading disabilities in reading text. We can use this software on android mobile as well as on the computer system having web-cam

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