International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 05, May-2015

Design and Development of Color and Texture Detection System for the Visually Impaired People

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***Abstract*— Choosing complex patterned clothes remains a challenging task for visually impaired people. In this paper, a camera based prototype system is proposed. The system is capable of recognizing the clothing pattern and color. The system consists of ARM micro controller with camera. The picture of cloth is fed as input to pattern analyzer. The pattern analyzer detects the color of the cloth, texture and design pattern. Speakers aid the visually impaired by playing the pre-recorded message. The proposed system is found to efficient and simple to use for the visually impaired people.**

Keywords*— *Clothing pattern recognition, texture analysis, color.

I. INTRODUCTION

Statistics from the World Health Organization (WHO) shows that, there are more than 161 million visually impaired people around the world, and 37 million of them are blind. Choosing clothes with suitable colors and patterns becomes a challenging task for blind or visually impaired people. They manage this task with the help of their family members, by using plastic Braille labels, by different types of stitching pattern tags on the clothes, by wearing clothes with a uniform color or without any patterns. Automatic recognition of clothing patterns and colors may improve their life quality. Clothing pattern and color designs have a large intra-class variation. Existing texture analysis methods focus on textures with large changes in viewpoint, orientation, and scaling, but with less intra-class pattern and intensity variations.

An Electronic Travel Aid is another form of assistive technology that provides direction for the blind and visually impaired pedestrian. Assistive devices designed to aid visually impaired people deal with two different issues: at first they need to capture contextual information (distance of an obstacle, position of the sensors, environment around the user), followed by their need to communicate to the user with those observed information. Sensors are provided for obstacle detection. The real time signal reflected from the obstacles is collected by the sensor and then processesed. Appropriate decision is taken by the microcontroller, based on the processed data. Accordingly a relevant message is invoked from the memory.

Several clothing pattern recognition systems exist in literature. X.Yang *et al*. [1] proposed an assistive clothing pattern recognition system. The system recognizes colors in 4 different patterns. The system employed Radon signature to capture global directionality features and was found to be 92.55% efficient. F.Hasanuzzaman *et al*. [2] proposed a Camera-based computer vision technology that recognizes banknotes for assisting visually impaired people. The banknote recognition provided for high true recognition rate and low false recognition rate. The system was robust and handled a variety of currency designs and bills in various conditions. The system was efficient and recognized banknotes quickly and helped blind users to aim the target for image capture. The process largely alleviates false recognition and can guide the user to correctly aim at the bill to be recognized. The banknote recognition system is also tested by blind users.

Moore S.E. and Ramachandran.B.[3] proposed a wireless pedestrian navigation system. This system gives contextual information to the visually impaired and computes optimized routes based on user preference, temporal constraints, and dynamic obstacles. The system constantly guides the blind user to navigate based on static and dynamic data. Environmental conditions and landmark information queried from a spatial database along their route are provided on the fly through detailed explanatory voice cues. The system also provides capability for the user to add intelligence, as perceived by, the blind user, to the central server hosting the spatial database. Vigneshwari C *et al*. [4] proposed an electronic navigation system for visually impaired people. This system uses a sensor for obstacle detection. Other traditional methods are also proposed by [5],[6] and [7].

It is observed that traditional texture analysis methods cannot achieve the same level of accuracy during clothing pattern recognition. Developing assistive systems to improve life quality and safety for the individuals with special needs, including indoor navigation and way finding, display reading, banknote recognition, rehabilitation requires a lot of effort. In this paper, we propose a system to assist blind people. This system provides the user with information about whether or not the clothing patterns and colors match.

The paper is organized as follows. Section 1 gives a birds eye view into the available literature. Section 2 describes the Proposed System. Section 3 presents the results and discussions. Section 4 concludes the paper.

II. PROPOSED SYSTEM

The proposed camera-based system is developed to help the visually impaired people in recognizing clothing patterns and colors. The system has three major components:
(1) Sensors including a camera for capturing clothing images, a microphone for speech command input, and speakers (or Bluetooth, earphone) for audio output;
(2) Data capture and Analysis module to perform command control, clothing pattern recognition, and color identification using a ARM board; and
(3) Audio outputs to provide for recognition results of clothing patterns and colors, and system status.

Overview and architecture design of the camera-based clothing pattern recognition system for blind and visually impaired person is depicted in Fig.1.

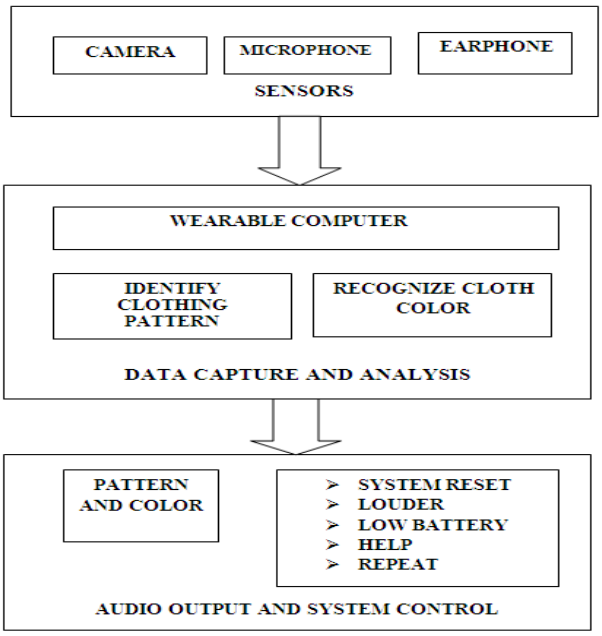

Fig. 1. Overview Architecture

A. System and Interface design

The system interfaces are depicted in Fig.2. A blind user can fix the system configuration by many high priority speech commands such as system restart, turn-off system, stop function (i.e., abort current task), speaker volume and speed control commands (e.g., louder, quieter, slower, and faster), and help. The high priority commands can be employed at any fraction of time. The recognition results in audio outputs. The audio outputs include recognized, not recognized, and start a new function. The Operating System provides for a variety of configuration options made available according to user preference, such as speech rate, volume and sound, and voice gender

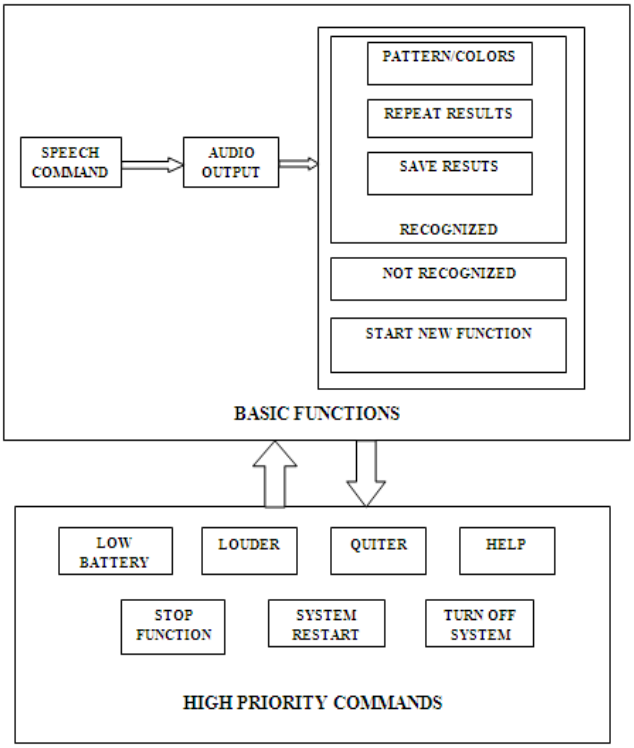

Fig.2. System and Interface design.

B. Clothing Pattern Recognition

The recognition of clothing color is implemented by quantizing clothing color in the HIS (hue, saturation, and intensity) space.

C. Clothing Color Identification

Clothing color identification in the proposed system is based on the normalized color histogram in the HIS color space. The color identification of the clothing image is done by comparing the relationships between hue, saturation, and intensity and also by quantizing the pixels in the image to the red, green, blue, black and white. The detection of cloth color white and black is based on the saturation value of S and intensity value I. The hue H is visualized as 360^{o} in the color wheel. In the proposed system the color red is quantized in the range of 345^{o}-360^{o} and 0^{o}-9^{o}, green as 76^{o}-160^{o}, and blue

as 201°-280°. The weight of each color is percentage of pixels belonging to this color. If a clothing image contains multiple colors, the dominant colors whose pixel is larger than 5% of the whole image will be output.

D. PROCESS FLOW

- The visually impaired person has to provide this choice(color,pattern) as input through the microphone.
- The camera is used to capture the image of the cloth.
- The captured image is converted into the gray scale image
- By using gray scale values the system identifies the color and pattern of the cloth.
- A voice signal is sent through speakers or earphones.

III. RESULTS AND DISCUSSIONS

The proposed system is designed and developed to meet the basic requirements of visually impaired people. The proposed system can handle clothes with complex patterns and also identify 3 colors(red, blue, and green). The clothing patterns recognized are plain, striped, pattern less, and irregular. For clothes with multiple colors, the first several dominant colors are spoken to users.

Fig.3. GLCD Display

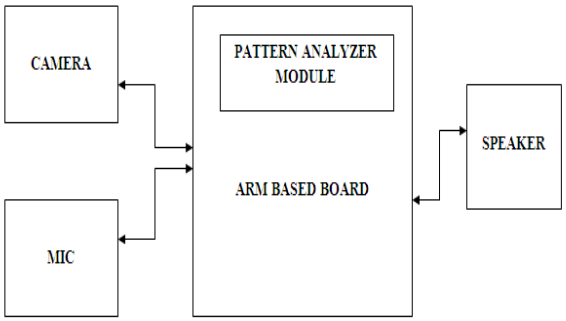

Fig 4. Proposed Module

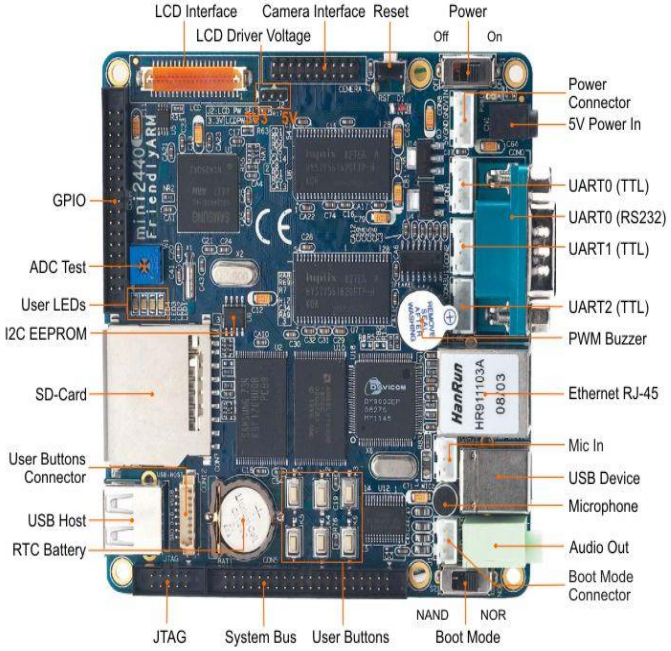

Fig 3: ARM9 Processor

The camera based system uses the Video4linux version 2 interface for capturing image. The various interfaces used is shown in Fig.3. and Fig.4 respectively.Video4Linux2 is used to interface Linux and video devices, including tuners and some We,bcams. The V4L2 API controls the imaging device and to open the device, query its capabilities, set capture parameters and negotiate the output format and method. The output mechanism and output format play a prominent role.

IV. CONCUSION

Choosing clothes with different colors is a challenging task for visually impaired people. The proposed system developed, assists visually impaired people in the recognition of colors and pattern. This system recognized clothing features and colors in particular to help blind or visually impaired people in their daily life to lead an independent and quality life

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