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Design and Implementation of Smart Glass with Voice Detection Capability to Help Visually Impaired People

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Abstract

The present innovation has wearable device answers for ease the issues of handicapped people. Student-GLASS is a wearable smart camera device built with a powerful microcontroller that has the ability to see what we, normal people, are seeing, understands the user voice requests and supplies the relevant information using auditory feedback through an earphone. The device aims to improve the quality of life for the blind and visually impaired people and makes them understand their surroundings in a clear way as close as to a normal person at an affordable cost. The device consists of an OV7670 camera sensor based vision module, which can capture up to VGA resolution pictures. The device depends on the services of a smart phone for its voice recognition capabilities. A special voice recognition app must be installed on the smart phone which will communicate with the device using a Bluetooth connection. The device supports memory card up to 4GB, to store the necessary audio and image files. It is capable of generating high quality MP3 audio using VS1011e, a DSP based audio codec chip. The user can interact with the device using a four input capacitive touch buttons built into it. This is helpful when the user doesn't have a smart phone or if its data connectivity is lost.

Keywords: Wearable, Smart Camera Device, Recognize Objects, Recognize Obstacles and Bluetooth

1. Introduction

In recent years, the scaling down of actuators and hardware, combined with quick mechanical advances in the fields of versatile and omnipresent processing, has prompted development in the production of wearable devices which can be implanted in the user's apparel or set specifically on the user's body [1]. These arrangements are especially appealing for individuals experiencing visual hindrances since they furnish them with without hands access to advanced data expanding their awareness of and encouraging their cooperation with their condition [2]. However, outwardly weakened individuals experience issues in understanding their condition as normally as others. A few thoughts and outlines have just been done, being proposed and actualized to tackle the issues confronted by individuals with low vision capacity.

Be that as it may, as innovation advances, there is dependably a plan to think of better and enhanced arrangements. As of late camera sensor is as a rule generally utilized as a part of all the most recent and most noteworthy devices [3]. The advanced mobile phone transformation has cut down the vast majority of the semiconductor part cost altogether and the camera sensor is not a special case. By joining an advanced camera sensor with most recent era vision processors and complex picture preparing programming, an answer nearest to a genuine human eye is presently conceivable.

2. Working Principle

Figure 1 shows that the wearable device is built to fulfill the needs of a visually impaired person and thus capable of doing the following. It can

- Recognize obstacles
- Identify traffic signal lights
- Find vehicle and people movement while crossing roads
- Identify currency notes (10, 50, 100, 500 rupee notes)
- Recognize objects
- Recognize alphabets
- Recognize numerals
- Act as night time security camera
- Play your favorite music

Figure. 1 Low Vision Glass

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A current modification of visual weakness definitions in the global measurable arrangement of sicknesses, completed in 2006, has uncovered that visual keenness and execution are classified by one of the accompanying four levels, to be specific typical vision, direct, extreme, and visual deficiency [4]. Notwithstanding such phrasings, visual impedance by and large and visual deficiency specifically, as whatever other pathology, have its unfriendly effects as respects to both physical and good perspectives. Despite the momentous restorative endeavors being devoted to adapt to vision inability, the huge imminent jump to full sight recuperation has not yet been met [5]. In any case, strong arrangements could be methods towards an incomplete recuperation. Several common vision based algorithms like Image comparison and color extraction are used to extract meaningful information from the captured camera pictures.

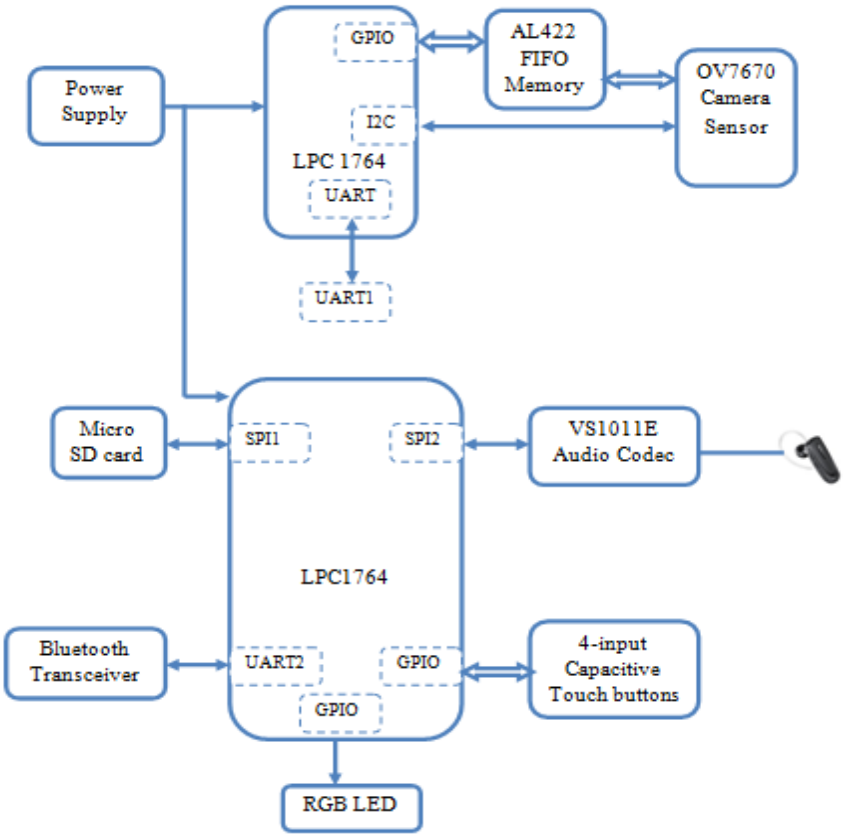

Figure. 2 Block diagram of low vision glass

Figure 2 shows that the low vision glass implementation. The device is constructed around two LPC1764 microcontrollers capable of running at 100MHz each. One dedicated for the camera sensor and image processing and the other to manage the device operations. LPC1764 is a powerful, low power ARM Cortex-M3 based microcontroller from NxP. The device is battery powered and hence low power operation is vital for its long time functionality.

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3. Results and Discussion

Figure 3 described that the design and implementation of visually impaired people glass. But now this paper designed only the prototype. This paper improves the quality of people visual result. In this paper used clear speaker [6]. This speaker only takes care of visually impaired people.

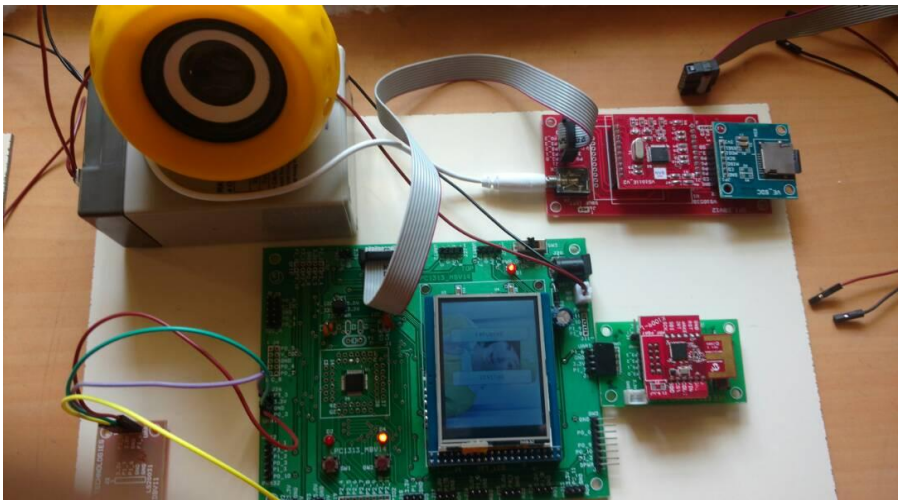

Figure. 3 Hardware Implementation

Project Demonstration Procedure:

1) Switch ON the LPC1764 board and speaker keep volume in high position then open flash magic software in output window it displayed Bluetooth initialise complete ,memory card initialization complete, audio coder initialization complete, rapid cam initialization complete, after 2 sec it displayed rapid cam ok incase it skip any line means there is some problem in that particular hardware [7-8].
2) After complete the line RAPID CAM OK It plays some introduction audio message are already stored in that memory card.
3) Then connect the Smartphone with the kit through Bluetooth first search the device and pair using password as “0000” or “1234” it gives some indication message in phone after pairing the Bluetooth.
4) Thus device capable of doing the following. It can
    i. Recognize obstacles
    ii. Identify traffic signal lights
    iii. Find vehicle and people movement while crossing roads
    iv. Identify currency notes (10, 50, 100, 500 rupee notes)
    v. Recognize objects
    vi. Recognize alphabets
    vii. Recognize numerals

Issn No:0975-0932

viii. Act as night time security camera
ix. Play your favourite music

5) First give password as OK GLASS then it reply YES after that you give the other command it is same for all commands
6) Now give voice command as OBSTACLE RECOGNITION then it reply as OBSTACLE RECOGNITION MODE on it takes one background snap after 2 sec show any ball in front of camera it recognise the difference and reply like obstacle felt if you move closer it plays like OBSTACLE VERY CLOSE then press any one of the capacitive touch button it come back the normal mode then it plays like OBSTACLE RECOGNITION MODE OFF.
7) Once again give password as OK GLASS and it replay then move for another demo after complete the demo just press any one of the capacitive touch button it come back to main menu
8) In traffic signal mode show red colour ball it plays like RED SIGNAL STOP second show yellow ball it plays like YELLOW SIGNAL PLEASE WAIT finally show green colour ball it plays like GREEN SIGNAL GO after complete the demo press any button
9) To find people and vehicle movement give command as movement it reply people movement recognition mode on it takes background snap after 2 sec create any movement it plays people movement detected once again it takes background image without any disturb means it plays like no people movement detected.
10) Now give voice command as object it tell object recognition mode on after some time it plays record ready press switch SW1 in lpc1764 board it takes empty background snap and stored in memory card ,take any two object keep first object in front of camera press SW1 take and store the image next keep second object press SW1.
11) After that show any object in that recorded image it reply like object1 or object2 , press capacitive touch button it come back to main menu
12) Same procedure follow for alphabet and number totally three images save and then compare first back ground is compulsory for all demo second image in number mode keep number 1 finally keep number 2 in alphabet mode keep A second keep B as third image it is compulsory because stored voice like that only.
13) Now give voice command as security camera it replay security camera mode on within one second it takes background image after that any interrupt is detected means it play like who is that and generate alarm sound to alert the blind people and surrounding.

Finally give voice command as MUSIC PLAYER [9] it replay MUSIC PLAYER ON then you give this commands like

i. Old Song ,
ii. New Song,
iii. Devotional Song,
iv. Hindi Song,
v. Telugu Song

This songs already stored in memory card depending upon your command it will play the music if you want to stop the music press SW2 in LPC1764 board then press capacitive touch button to come back the main menu.

Issn No:0975-0932

4. Conclusion

The concept of wearable device is very useful for visually impaired people. In this device easily voice response to blind people. Implementation of the project is based on visually impaired people. Although the Paper described that the vision based implementation, it is still a prototype that could only be tested and not in the real hands of the end consumer [10]. Computer vision is a vast research area and this device is only in its nascent stages. There are significant works to be done to make this device to become a true end product that could be carried by a visually impaired under real world conditions. This device has the potential to aid blind people in interacting with their environment.

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