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Portable Camera-Based Assistive System for Product Label Reading with voice output for Blind Persons

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Abstract:

This paper presents a camera-based label reader to help blind persons to read names of labels on the products. Camera acts as main vision in detecting the label image of the product or board then image is processed internally and separates label from image by using open CV library and finally identifies the product and identified product name is pronounced through voice.

Now it identifies received label image is converted to text by using tesseract library. Once the identified label name is converted to text and converted text is displayed on display unit connected to controller. Now converted text should be converted to voice to hear label name as voice through ear phones connected to audio jack port using flite library.

Keywords:

Assistive devices, blindness, distribution of edge pixels, hand-held objects, optical character recognition (OCR), stroke orientation, text reading, and text region localization.

I. INTRODUCTION:

Of the 314 million visually impaired people worldwide, 45 million are blind. Recent developments in computer vision, digital cameras and portable computers make it feasible to assist these individuals by developing camera based products that combine computer vision technology with other existing commercial products such optical character recognition (OCR) systems.Reading is obviously essential in today's society. Printed text is everywhere in the form of reports, receipts, bank statements, restaurant menus, classroom handouts, product packages, instructions on medicine bottles, etc.

The ability of people who are blind or have significant visual impairments to read printed labels and product packages will enhance independent living and foster economic and social self-sufficiency. Today, there are already a few systems that have some promise for portable use, but they cannot handle product labeling. For example, portable bar code readers designed to help blind people identify different products in an extensive product database can enable users who are blind to access information about these products through speech and Braille.

But a big limitation is that it is very hard for blind users to find the position of the bar code and to correctly point the bar code reader at the bar code. Some reading assistive systems such as pen scanner might be employed in these and similar situations. Although a number of reading assistants have been designed specifically for the visually impaired, to our knowledge, no existing reading assistant can read text from the kinds of challenging patterns and backgrounds found on many everyday commercial products.

To assist blind persons to read text from these kinds of hand-held objects, we have conceived of a camera based assistive text reading framework to track the object of interest within the camera view and extract print text information from the object. Our proposed algorithm can effectively handle complex background and multiple patterns, and extract text information from both hand-held objects and nearby signage.

II. SOFTWARE SPECIFICATIONS AND FRAMEWORK:

Software Specifications

Operating System : Linux
Qt for Embedded Linux
Platform : OpenCV (linux-library)

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Linux Operating System:

The Linux open source operating system, or Linux OS, is a freely distributable, cross-platform operating system based on Unix that can be installed on PCs, laptops, net books, mobile and tablet devices, video game consoles, servers, supercomputers and more.

Qt for Embedded Linux:

Qt for Embedded Linux is a C++ framework for GUI and application development for embedded devices. It runs on a variety of processors, usually with Embedded Linux. Qt for Embedded Linux provides the standard Qt API for embedded devices with a lightweight window system.

OPEN CVL:

Open CV is an open source computer vision library originally developed by Intel. It is free for commercial and research use under a BSD (Berkeley Software Distribution) license. The library is cross-platform, and runs on Linux, Windows and Mac OS X. It focuses mainly towards real-time image processing, as such, if it finds Intel's Integrated Performance Primitives on the system, it will use these commercial optimized routines to accelerate itself.

III. HARDWARE IMPLEMENTATION:

Raspberry pi:

Fig.1 Raspberry pi Development board

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

The Raspberry Pi is manufactured in two board configurations through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman. These companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage.

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux),C, Java and Perl.

Embedded Linux:

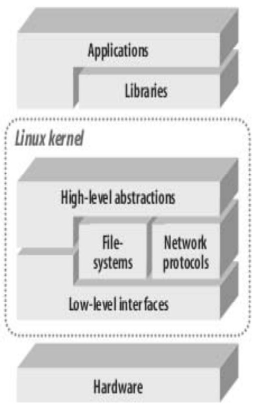

Fig.2 Typical architecture of an Embedded Linux System

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Immediately above the hardware sits the kernel, the core component of the operating system. Its purpose is to manage the hardware in a coherent manner while providing familiar high-level abstractions to user-level software.

It is expected that applications using the APIs provided by a kernel will be portable among the various architectures supported by this kernel with little or no changes.

The low-level interfaces are specific to the hardware configuration on which the kernel runs and provide for the direct control of hardware resources using a hardware-independent API.

Higher-level components provide the abstractions common to all UNIX systems, including processes, files, sockets, and signals. Since the low-level APIs provided by the kernel are common among different architectures, the code implementing the higher-level abstractions is almost constant, regardless of the underlying architecture.

Between these two levels of abstraction, the kernel sometimes needs what could be called interpretation components to understand and interact with structured data coming from or going to certain devices.

File system types and networking protocols are prime examples of sources of structured data the kernel needs to understand and interact with in order to provide access to data going to and coming from these sources.

TFT display unit :

TFT stands for Thin Film Transistor, and is a type of technology used to improve the image quality of an LCD. Each pixel on a TFT-LCD has its own transistor on the glass itself, which offers more control over the images and colors that it renders.

While TFT-LCDs can deliver sharp images, they also tend to offer relatively poor viewing angles, meaning they look best when viewed head-on. If you view a TFT-LCD from the side, it can be difficult to see.

IV. BLOCK DIAGRAM:

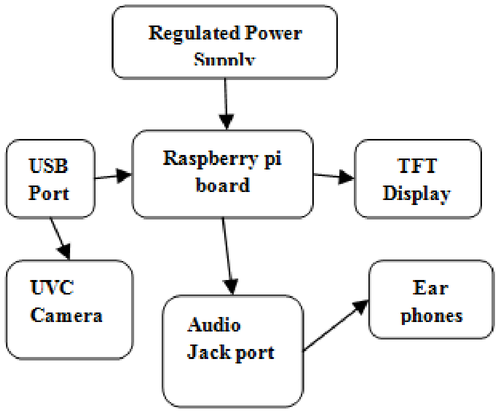

Fig.3 Portable Camera-Based Assistive Text and Product Label Reading from Hand-Held Objects for Blind Persons

When our application starts running it first check all the devices and resources which it needs are available or not. After that it checks the connection with the devices and gives control to the user. The GUI for the user has the following options.

An optional label is used for displaying the image taken from the camera. A status box is for representing the detected data from the image. The capture button is to detect the data from the image.

The detect button is to detect the human from the video streaming in front of the camera. The audio jack port is the output port here. The Raspberry board comes with integrated peripherals like USB, ADC and Serial etc.

On this board we are installing Linux operating system with necessary drivers for all peripheral devices.

V. WORKING PRINCIPLE:

When capture button is clicked this system captures the product image placed in front of the web camera which is connected to ARM microcontroller through USB .After selecting the process button the captured label image undergoes Optical Character Recognition(OCR) Technology.

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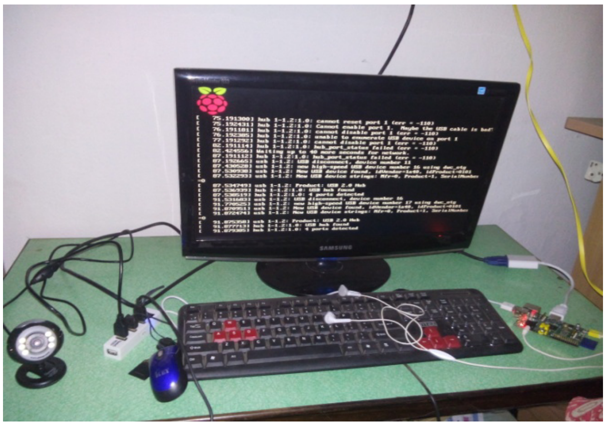
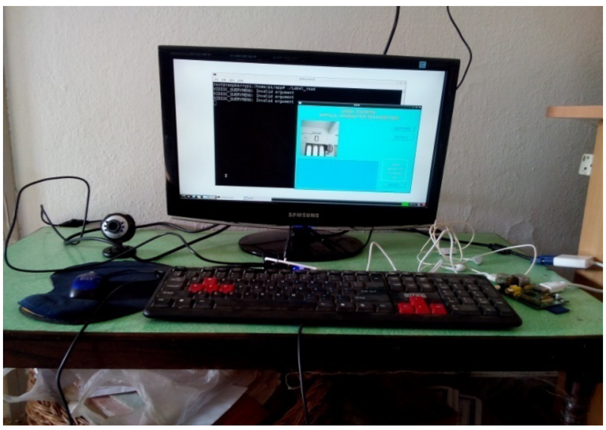
OCR technology allows the conversion of scanned images of printed text or symbols (such as a page from a book) into text or information that can be understood or edited using a computer program.

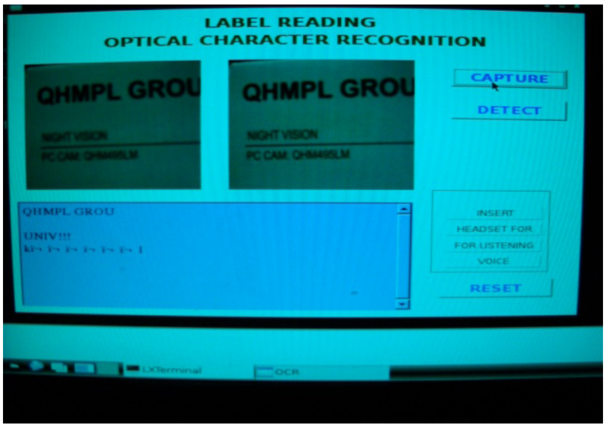
The most familiar example is the ability to scan a paper document into a computer where it can then be edited in popular word processors such as Microsoft Word. However, there are many other uses for OCR technology, including as a component of larger systems which require recognition capability,

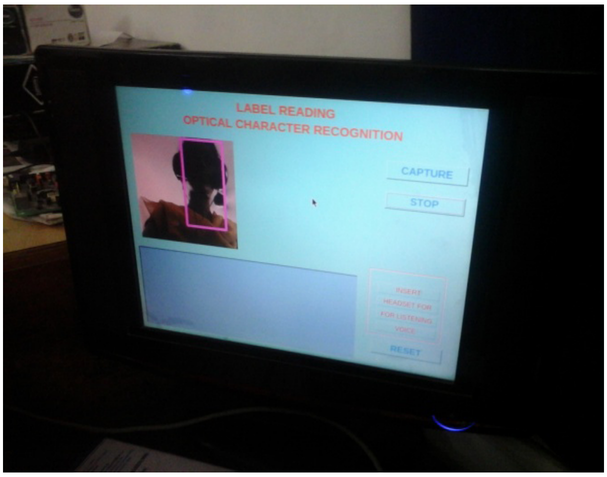
such as the number plate recognition systems, or as tools involved in creating resources for SALT development from print based texts. In our system for OCR technology we are using TESSERACT library. Using Flite library the data will be converted to audio.

VI.RESULTS:









VII. CONCLUSION:

This paper presented the label reading on the handheld objects and to identify the object in front of the camera either it is human or not. It has been developed by integrating features of all the hardware components and software used. In this paper, the camera acts as input for the paper. As the Raspberry Pi board is powered the camera starts streaming. The streaming data will be displayed on the screen using Qt GUI application. When the object for label reading is placed in front of the camera then the capture button is clicked to provide image to the board.

Using Tesseract library the image will be converted into data and the data detected from the image will be shown on the status bar. The obtained data will be pronounced through the ear phones using Flite library. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. In this by using highly advanced ARM11 board this paper has been implemented.

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