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Portable Camera Based Assistive Text and Product Label Reading for Blind Persons

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ABSTRACT:

Assistive technologies are being developed for Visually impaired people in order to live confidently. This project work proposes a camera-based assistive text reading framework to help blind persons read text labels and product packaging from hand-held objects in their daily lives. The project work is framed into three stages . First, Image capturing – Using a mini camera ,the text which the user need to read get captured as an image and have to send to the image processing Platform. Secondly, Text recognition – Using text recognition algorithm, the text will get filtered from the image. Finally, Speech output - A filtered text will be passed into this system to get an audio output. This project work can be able to insist the blind people in their daily life. The entire application will run on Raspberry Pi.

INTRODUCTION:

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. And while optical aids, video magnifiers, and screen readers can help blind users and those with low vision to access documents, there are few devices that can provide good access to common hand-held objects such as product packages, and objects printed with text such as prescription medication bottles. 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.

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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 scanners might be employed in these and similar situations. Such systems integrate OCR software to offer the function of scanning and recognition of text and some have integrated voice output. However, these systems are generally designed for and perform best with document images with simple backgrounds, standard fonts, a small range of font sizes, and well-organized images rather than commercial product boxes with multiple decorative patterns.

PROPOSED HARDWAERE BLOCK DIAGRAM:

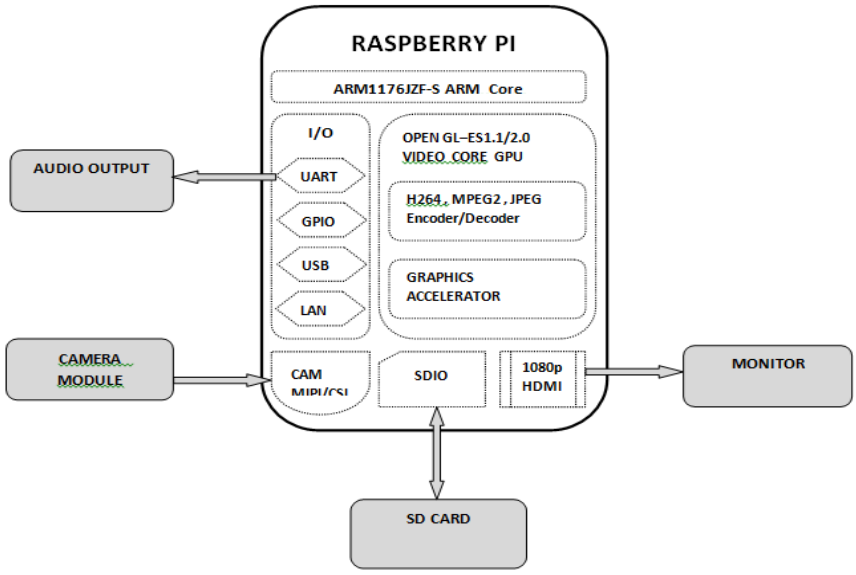


Fig1:Block Diagram of recognition system

BLOCK DIAGRAM DESCRIPTION:

Here, in this block diagram the whole system is controlled by Arm11 processor and this processor is implemented on Raspberry Pi Board. The system consists of Raspberry pi, Camera, SD card and personal computer. Those all components are connected by USB adaptors. Raspberry pi is the key element in processing module. First, Image capturing Using camera image to be taken. Secondly Text recognition Using text recognition algorithm text to be monitored. Finally Speech output the text content is changed into speech output.

3.1 INTRODUCTION:

A system is something that maintains its existence and functions as a whole through the interaction of its parts. E.g. Body, Mankind, Access Control, etc A system is a part of the world that a person or group of persons during some time interval and for some purpose choose to regard as a whole, consisting of interrelated components, each component imagined by properties that are selected as being relevant to the purpose. Embedded System is a combination of hardware and software used to achieve a single specific task. Embedded systems are computer systems that monitor, respond to, or control an external environment.

Image processing:

image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of Imagistics or parameters related to the image.[1] Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals where the third-dimension being time or the z-axis.

Image processing usually refers to digital image processing, but optical and analogy image processing also are possible. This article is about general techniques that apply to all of them. The *acquisition* of images (producing the input image in the first place) is referred to as imaging.[2]

Closely related to image processing are computer graphics and computer vision. In computer graphics, images are manually *made* from physical models of objects, environments, and lighting, instead of being acquired (via imaging devices such as cameras) from *natural* scenes, as in most

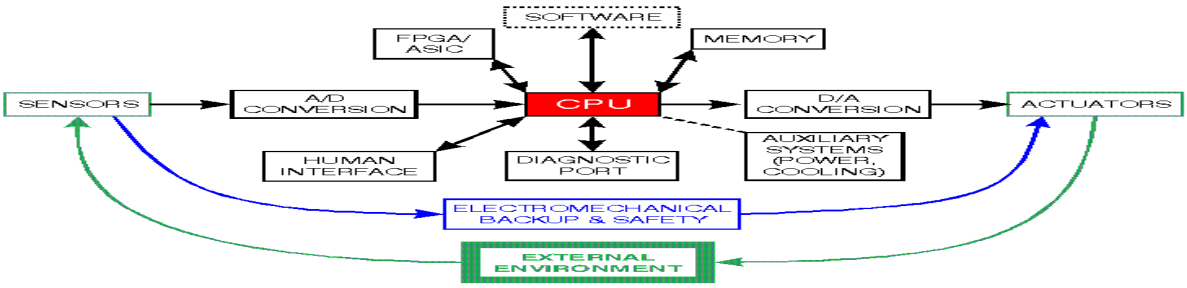
animated movies. Computer vision, on the other hand, is often considered *high-level* image processing out of which a machine/computer/software intends to decipher the physical contents of an image or a sequence of images (e.g., videos or 3D full-body magnetic resonance scans).

In modern sciences and technologies, images also gain much broader scopes due to the ever growing importance of scientific visualization (of often large-scale complex scientific/experimental data). Examples include microarray data in genetic research, or real-time multi-asset portfolio trading in finance.

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analogy image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be model in the form of multidimensional systems.

Object Recognition:

The recognition system is described. A typical image recognition system consists of pre-processing, segmentation, feature extraction, classification and recognition, and post processing stages. Image



recognition has been one of the most fascinating and challenging research areas in field of image processing and pattern recognition in the recent years. It contributes immensely to the advancement of an automation process and can improve the interface between man and machine in numerous applications. Several research works have been focusing on new techniques and methods that would reduce the processing time while providing higher recognition accuracy. In general, image recognition is classified into two types as off-line and on-line image recognition methods. In the off-line

recognition, the writing is usually captured optically by a scanner and the completed writing is available as an image. But, in the on-line system the two dimensional coordinates of successive points are represented as a function of time and the order of strokes made by the writer are also available. The on-line methods have been shown to be superior to their off-line counterparts in recognizing handwritten images due to the temporal information available with the former . However, in the off-line systems, the neural networks have been successfully used to yield comparably high recognition accuracy levels .Several applications including mail sorting, bank processing, document reading and postal address recognition require off-line image recognition systems. As a result, the off-line image recognition continues to be an active area for research towards exploring the newer techniques that would improve recognition accuracy. The first important step in any handwritten recognition system is pre-processing followed by segmentation and feature extraction. Pre-processing includes the steps that are required to shape the input image into a form suitable for segmentation. In the segmentation, the input image is segmented into individual images and then, each image is resized into m x n pixels towards the training network.

Image Acquisition:-

In Image acquisition, the recognition system acquires a scanned image as an input image. The image should have a specific format such as JPEG, BMT etc. This image is acquired through a scanner, digital camera or any other suitable digital input device.

Image used in image processing:-

Image recognition enhances the processing of scanned images by allowing you to automatically recognize and extract text content from different data fields. For example, when you scan a form and use document imaging software to process it, CR allows you to transfer information directly from the document to an electronic database.

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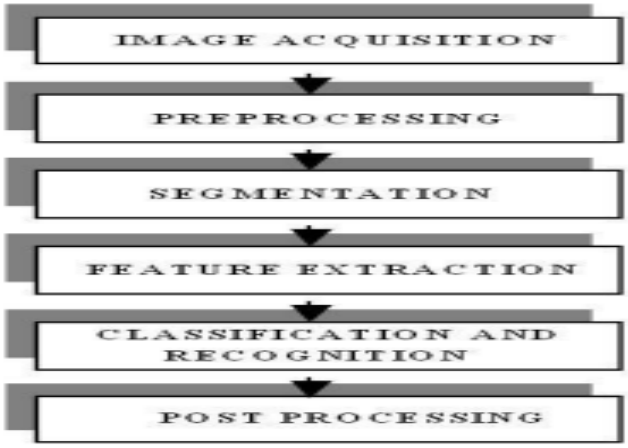

Figure . Schematic diagram of the recognition system

Image recognition:-

Since commercial IR engines achieve high recognition performance when processing black and white images at high resolution, almost all the methods in the literature that addressed the issue of image recognition in complex images and videos employed an IR system to finally recognize images. However, this IR software cannot be applied directly on regions previously extracted by a image localization procedure. Experience shows that IR performance in this context is quite unstable, as already mentioned in Section, and significantly depends on the segmentation quality, in the sense that errors made in the segmentation are directly forwarded to the IR.

To extend the recognition capability of the IR for image and video text, the main research efforts focus on text segmentation and enhancement.

Segmentation:-

In the segmentation stage, an image of sequence of images is decomposed into sub-images of individual image. In the proposed system, the processed input image is segmented into isolated images by assigning a number to each image using a labelling process. This labelling provides information about number of images in the image. Each individual image is uniformly resized into pixels for classification and recognition stage.

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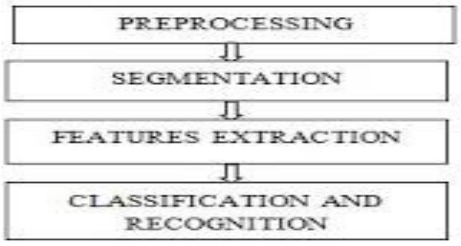


Fig. block diagram of segmentation

image segmentation methods are performed on the extracted image regions to remove the background surrounding text images. These methods usually assume that the greyscale distribution is bimodal and that images a priori correspond to either the white part or the black part. Great efforts are thus devoted to performing better linearization, combining global and local threes holding, M-estimation or simple smoothing. To eliminate the non-image regions in each binary image, a simple connected component analysis step is employed by setting constraints on size, height and width ratio and so on. However, these methods are unable to filter out background regions with similar greyscale values to the images.

Raspberry pi:

The Raspberry Pi is a series of credit card–sized single-board computers developed in England, United Kingdom by the Raspberry Pi Foundation with the intent to promote the teaching of basic computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations through licensed manufacturing agreements with Newark element14 (Premier Farrell), RS Components and Ego man. The hardware is the same across all manufacturers.

In February 2016, the Raspberry Pi Foundation announced that they had sold eight million devices, making it the best-selling UK personal computer, ahead of the Amstrad PCW.

All Raspberry Pi include the same Video Core IV graphics processing (GPU),[12] and either a single-core ARMv6-compatible CPU or a newerARMv7-compatible quad-core one (in Pi 2); and 1 GB of RAM (in Pi 2), 512 MB (in Pi 1 models B and B+), or 256 MB (in models A and A+, and in the older model B). They have a Secure Digital (SDHC) slot (models A and B) or a Micro SDHC one (models A+, B+, and Pi 2) for boot media and persistent storage.[14] In 2014, the Raspberry Pi

Foundation launched the Compute Module, for use as a part of embedded systems for the same compute power as the original Pi.[15] In early February 2015, the next-generation Raspberry Pi, Raspberry Pi 2, was released. That new computer board is initially available only in one configuration (model B) and has a quad-core ARM Cortex-A7 CPU and 1 GB of RAM with remaining specifications being similar to those of the prior generation model B+. The Raspberry Pi 2 retains the same US$35 price of the model B,[17] with the US$20 model A+ remaining on sale. In November 2015, the Foundation launched the Raspberry Pi Zero, a smaller product priced at US$5. Raspberry Pi 3 was released on 29 February 2016.

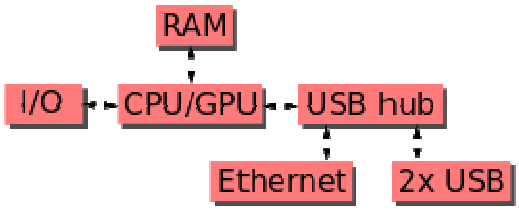
The Foundation provides Debi an and Arch Linux ARM distributions for download, and promotes Python as the main programming language, with support for BBC BASIC[21] (via the RISC OS image or the Brandy Basic clone for Linux), C,C++, Java, Perl, Ruby, Squeak Smalltalk and more also available.

On 29 February 2016, Raspberry Pi 3 is now on sale for US$35 (the same price as the existing Raspberry Pi 2). Pi 3 adds the following new features: A 1.2 GHz quad-core ARM Cortex-A53 CPU (~10× the performance of Raspberry Pi 1 and compared with Pi 2 which is ~6× performance of Raspberry Pi 1) based on ARM's latest ARMv8-A architecture (which is compatible with older, and at first not used to its full potential); has integrated 802.11n wireless LAN and Bluetooth 4.1. Complete compatibility with Raspberry Pi 1 and 2.

Raspberry Pi 3 has a new BCM2837 Sock retaining compatibility with the GPU, CPU and connectors of its predecessors BCM2835 (Pi 1) and BCM2836 (Pi 2), so all those projects and tutorials for Pi 1 and Pi 2 hardware should continue to work. The 900 MHz 32-bit quad-core ARM Cortex-A7 CPU complex has been replaced by a 1.2 GHz 64-bit quad-core ARM Cortex-A53. Combining a 33% increase in clock speed with various architectural enhancements, this provides a 50–60% increase in performance in 32-bit mode versus Raspberry Pi 2, or roughly a factor of ten over the original Pi 1.

Hardware:

The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.



This block diagram depicts models *A*, *B*, *A*+, and *B*+. Model *A* and *A*+ and *Zero* lack the Ethernet and USB hub components. The Ethernet adapter is connected to an additional USB port. In model *A* and *A*+ the USB port is connected directly to the Sock On model *B*+ and later models the USB/Ethernet chip contains a five-point USB hub, of which four ports are available, while model *B*ony provides two. On the model *Zero*, the USB port is also connected directly to the Sock, but it uses a micro USB (OTG) port.

Processor:

The system on a chip (Sock) used in the first generation Raspberry Pi is somewhat equivalent to the chip used in older smart phones (such as phone, 3G, 3GS). The Raspberry Pi is based on the Broadcom BCM2835 Sock, which includes an 700 MHzARM1176JZF-S processor, Video Core IV graphics processing unit (GPU), and RAM. It has a Level 1 cache of 16 KB and a Level 2 cache of 128 KB. The Level 2 cache is used primarily by the GPU. The Sock is stacked underneath the RAM chip, so only its edge is visible.

The Raspberry Pi 2 uses a Broadcom BCM2836 Sock with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor, with 256 KB shared L2 cache.

The Raspberry Pi 3 uses a Broadcom BCM2837 Sock with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.[19]

Accessories:

- Camera – On 14 May 2013, the foundation and the distributors RS Components & Premier Farrell/Element 14 launched the Raspberry Pi camera board with a firmware update to accommodate it. The camera board is shipped with a flexible flat cable that plugs into the CSI connector located between the Ethernet and HDMI ports. In Rasping, one enables the system to use the camera board by the installing or upgrading to the latest version of the operating

system (OS) and then running Raspi -c onfig and selecting the camera option. The cost of the camera module is €20 in Europe (9 September 2013). It can produce 1080p, 720p and 640x480p video. The dimensions are 25 mm x 20 mm x 9 mm.

- Garboard – A Raspberry Pi Foundation sanctioned device, designed for educational purposes, that expands the Raspberry Pi's GPIO pins to allow interface with and control of LEDs, switches, analogy signals, sensors and other devices. It also includes an optional Adriano compatible controller to interface with the Pi.[80]
- Infrared Camera – In October 2013, the foundation announced that they would begin producing a camera module without an infrared filter, called the Pi Nair.
- HAT (Hardware Attached on Top) expansion boards – Together with the model B+, inspired by the Adriano shield boards, the interface for HAT boards was devised by the Raspberry Pi Foundation. Each HAT board carries a small EEPROM (typically a CAT24C32WI-GT3) containing the relevant details of the board, so that the Raspberry Pi's OS is informed of the HAT, and the technical details of it, relevant to the OS using the HAT. Mechanical details of a HAT board, that use the four mounting holes in their rectangular formation.

Review:

Raspberry Pi model B rev. 1 was rated 4/5 by Puma, while Raspberry Pi model B rev. 2 was rated 4.1/5 by Board-DB.org.

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An early alpha-test board in operation using different layout from later beta and production boards

In 2006, early concepts of the Raspberry Pi were based on the Atmel ATmega644 microcontroller. Its schematics and PCB layout are publicly available. Foundation trustee Been Upton assembled a group of teachers, academics and computer enthusiasts to devise a computer to inspire children. The computer is inspired by Acorn's BBC Micro of 1981. Pi's model A, model B and model B+ are references to the original models of the British educational BBC Micro computer, developed by Acorn Computers. The first ARM prototype version of the computer was mounted in a package the same size as a USB memory stick. It had a USB port on one end and an HDMI port on the other.

The Foundation's goal was to offer two versions, priced at US$25 and US$35. They started accepting orders for the higher priced model B on 29 February 2012, the lower cost model A on 4 February 2013. and the even lower cost (US$20) A+ on 10 November 2014. On November 26, 2015, the cheapest Raspberry PI yet, the Raspberry PI Zero was launched at US$5 or £4.

Python:

Python is a widely used high-level, general-purpose, interpreted, dynamic programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale.

Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library.

Python interpreters are available for installation on many operating systems, allowing Python code execution on a wide variety of systems. Using third-party tools, such as Py2exe or Pyinstaller, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, allowing the distribution of Python-based software for use on those environments without requiring the installation of a Python interpreter.

Python, the reference implementation of Python, is free and open-source software and has a community-based development model, as do nearly all of its alternative implementations. Python is managed by the non-profit Python Software Foundation.

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Conclusion:

Here we describe the framework of the surveillance system and provides the algorithms and implementation results of the current work on multi-person tracking. It is done by doing background subtraction and extracting the foreground object, using the extracted foreground object the object containing motion alone is detected and tracked. This system works well in real-time situations. It can be used in large number of applications particularly in anti-crime systems. It can track multiple persons in the camera's field of view accurately and the performance is higher. In future this work will be handling the occlusion problem based on assigning unique ID for each object.

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