Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 1): pp. 5032-5049
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.01.538

Currency Detector For Visually Impaired Persons

[1]Ms. S. Mathupriya , [2]Ms. Sushmachowdary , [3]Ms. Akishga V P

[1]Assistant Professor , Sri Sai Ram Institute of Technology, Sai Leo Nagar, West Tambaram, Chennai

[2]Student, Sri Sai Ram Institute of Technology, Sai Leo Nagar, West Tambaram, Chennai

[3]Student, Sri Sai Ram Institute of Technology, Sai Leo Nagar, West Tambaram, Chennai

Abstract— our project opens up a world of possibilities for solving day to day problems for the visually impaired and sighted alike. The proposed system overcomes four major issues addressed by the prototype for visually impaired persons. Firstly, Identification of colors of the object present around the visually impaired people. Color variability is done through grayscale based vision algorithm that is difficult to work. So, in this paper we propose a colorvision algorithm that consists of two methods namely 1.) Anartificial color contrast as a pre-filter that aims at highlighting the target while suppressing its surroundings 2.) Statistically based fast bounded box (SFBB),that utilizes the component analysis technique to characterize the target features in color space which is obtained from a set of training data through which the color classification can be performed accurately and efficiently. Secondly, the currency along with the fake note detection is done by a component based recognition system which uses the speed up robust features (SURF) algorithm. The input image is converted to grey scale, the grey image is extracted and compared with an algorithm and then the voice output is produced through the earphone to visually impaired users. Thirdly, the optical character recognition algorithm is usedto convert the given text into voice output with the help of the e-speak engine. Finally, the detection of the obstacle in front of visually impaired users is also been achieved by using Ada-Boost model to differentiate between human andvehicles and given as voice output

Keywords— Statistically based fast bounded box(SFBB), Speed up robust features(SURF), Optical character recognition(OCR).

II. COLOUR DETECTION

Color information is useful in vision-based feature detection, particularly for color detection where color variability often renders grayscale based machine vision algorithms that are difficult or impossible to work with. So in this paper, we propose a color machine vision algorithm that consists of two methods.

1) Firstly, it creates an artificial color contrast as a pre-filter that aims at highlighting the target while suppressing its surroundings.

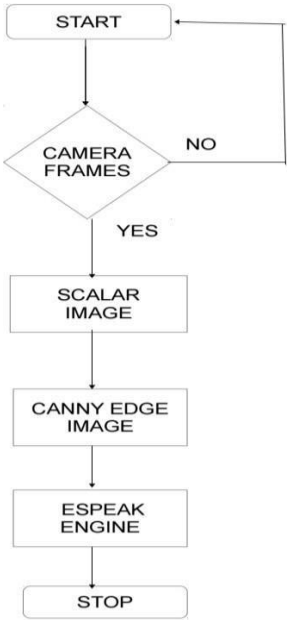
2) Secondly, referred to here as the statistically based fast bounded box, utilizes the principal method analysis technique to characterize target features in color space from a set of trained data so that the color classification can be performed accurately and efficiently.

3) Flow,chart

INTRODUCTION

Visually impaired persons find very difficult to identify the color of the object, currency and fake note detection, to read the text in the product labels, new papers, receipts, bank statements and to detect the obstacle in front of them. There are no proper systems to help the visually impaired persons. Some products are available separately in the market but here we introduce a switch based algorithm to implement all these four modules into a single product which is able to switch among these modules.

Fig 1: Flowchart for colour of the object detection.



III. CURRENCY AND FAKE NOTE DETECTION

Currency and fake note detection can be done by SURF (speeded up robust features algorithm) which is a robust algorithm used to identify the watermark and pixel intensities of the images. Feature detection is a image processing operation which is performed as the first operation to capture a image and examines every pixel to see if there is a feature present at that pixel. Many computer vision algorithms use feature detection as the initial step. So as a result, a very large number of feature detectors have been developed.

1) Distinguish interest point descriptors:

The currency note is kept in front of the camera and from the captured image SURF (Speeded up Robust Feature) detector is used to observe the water mark and pixel intensities. Each pixel in a

currency note has different color range. These specifications are noted in a circle. The input image is converted into a grey image and then into binary image.

2) Distinguish key points:

Once the specifications are identified, the corresponding key points are gathered. The input currency note specification and key points are gathered and stored separately. Then the predefined currency note specification and key points are gathered from the information set and it is also stored separately. Each key point has a decimal value and those decimal values are summed up and its threshold value is compared with the predefined threshold value. If the value is around 0.5 to 1.0, then the image is matched with corresponding object or else not. Optical character recognition which can handle images with complex background converts the image into text and gives the output to the e-speak engine. The audio output is produced and given out via the earphone.

3) Block diagram:

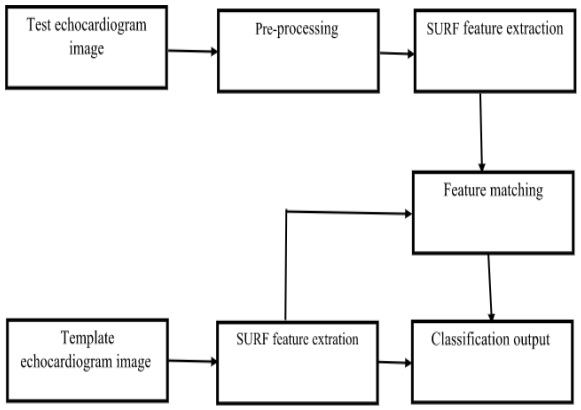


Fig 2: Block diagram for currency and fake note detection.

4) Flow chart

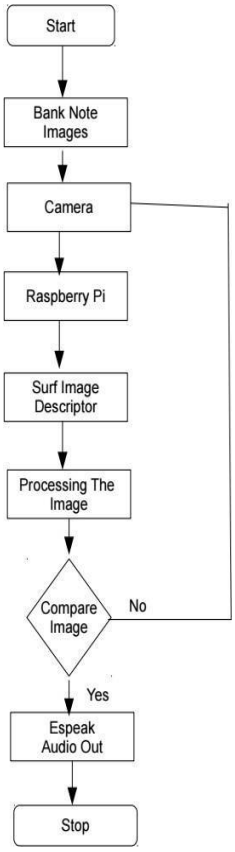


Fig 3: Flow chart for currency and fake note detection.

IV. TEXT READING

The live video is captured by using web camera and it can be done using OPENCV libraries. The image format from the web camera is in RGB24 format. The captured videos are projected in a window with a size of 320x240.Totallytenframesper secondcan be captured by using the web camera. To identify the text from the input image,firstthevideocapturedisconvertedintoframesandtheneachframeis convertedintograyimageandfinallyintobinaryimage. Thentextlocalization is applied on thebinaryimage to localize thetextfromthebackground.The outputisgivento theopticalcharacterrecognitionforthetextrecognitionand theaudiooutput.

1) Textlocalizationalgorithm:

Text localization algorithm takes the frames which are segregated from the videoastheinputandtheRegionofInterest(ROI) isfoundbytakingonlythe required text area from the image. The ROI region is confined within the rectangulararea containthetextwhichistobegetdetected, andthattextwhich isinsidetheROIisfirstconvertedto thegreyimageandthentobinaryimage. The Region of Interest is specified and the localized text gets compared with the predefined text in the training set by the Ada-boost Model. Ada-boost Model is in charge for identifying which alphabet is exactly located on the identifiedregion.

2) Haar-Cascade-Ada-boostModel: 1) Description

V. OBSTACLE DETECTION

Ada-boost Model is the effective machine learning training set for text detection. The training set consists of positive and negative samples where the positive samples comprise of the text images and the negative samples comprise of the images other than the textpresentin theinputimage.Theinputimage is given to Haar-Cascade to analyze the text which is inside the ROI and match the input text with the predefined text in the training text. Both the existing training set and the given input image are compared to identify variations. The one to which the range of similarity is high, is then confirmed to be the character and the corresponding audio is produced.

3) Audio Output Using E-Speak Engine:

Optical Character Recognition (OCR) is the mechanical or electronic conversion of images of typewritten or printed text into machine-encoded or computer-readable text. The output of the haar-cascade is stored in out.png file which dynamically overwrites the text with every frame. The processed output is sent to the e- speak engine which is based on Microsoft Speech Synthesizer Development kit and the audio output is generated and given out via the ear phone.

4) Flow chart

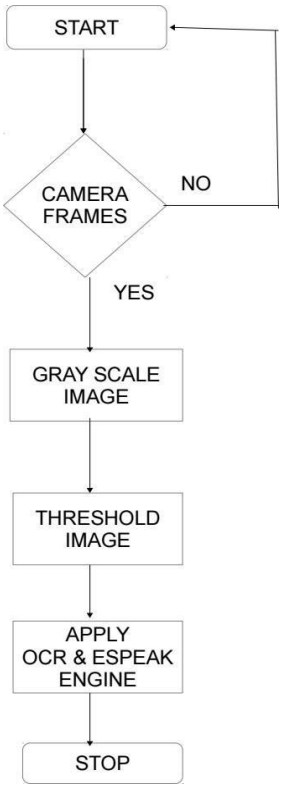


Fig 4: Flow chart for text reading.

To identify the type of the obstacle in the input image, the image gets compared with the samples in the training set. The positive image alone gets localized from the background by the ada- boost model. The

output is given to the optical character recognition for the text recognition and audio output is generated.

2) Cascade Ada-Boost Model

Ada-boost model is the effective machine learning training set for the text detection. The training set consists of positive and negative samples where the positive samples comprise of the human face or car images and the negative samples comprise of the images other than the object present in the input image. The input image is given to cascade Ada-boost Model to analyze the image and match the input image with the predefined image in the training set. Then the corresponding output is produces as audio. Apart from human or car, any object can be included in the training set so as to help the blind person. Our training set is restricted to human and vehicles.

VI. BLOCK DAIGRAM

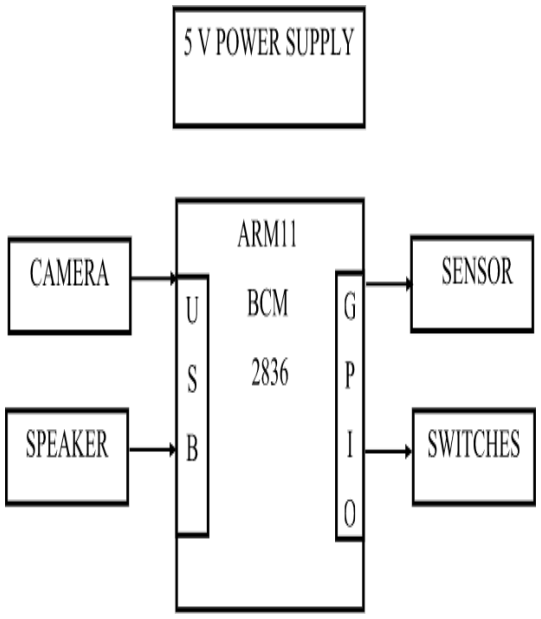


Fig 5: Block diagram for full prototype.

ARM11 processor is the interface to the camera and ultrasonic sensor. It captures the image and converts it to a text file using OCR engine. It differentiates the various currency notes while making payments. Ultrasonic sensor is used to navigate in indoor, because of the various obstacle detected in indoor.

VII. CIRCUIT DAIGRAM

Fig 6: Circuit diagram for full prototype module.

VIII. RASPERRY PI

Here we have used raspberry pi 2 for our proposed system and the particular specification is RASPBERRYPI-MODB-1GB and RPI-MODB-16GB-NOOBS.

1) RASPBERRYPI-MODB-1GB

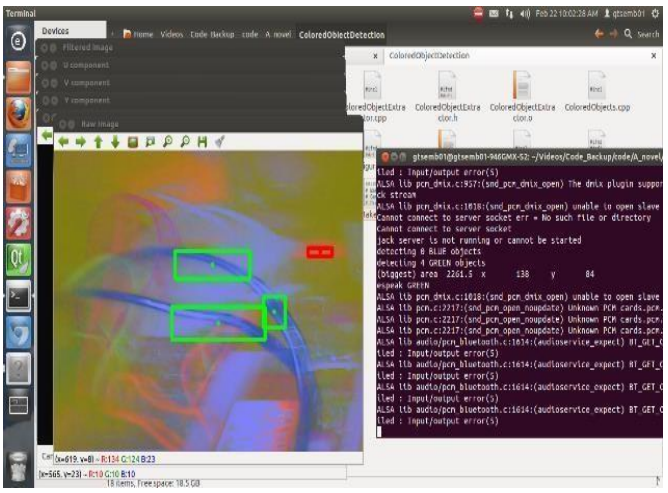
The Raspberry Pi 2 delivers 6 times the processing capacity of previous models. This second generation Raspberry Pi has an upgraded Broadcom BCM2836 processor, which is a powerful ARM cortex-A7 based quad-core processor that runs at 900MHz. the board also features an increase in memory capacity to 1Gbyte.

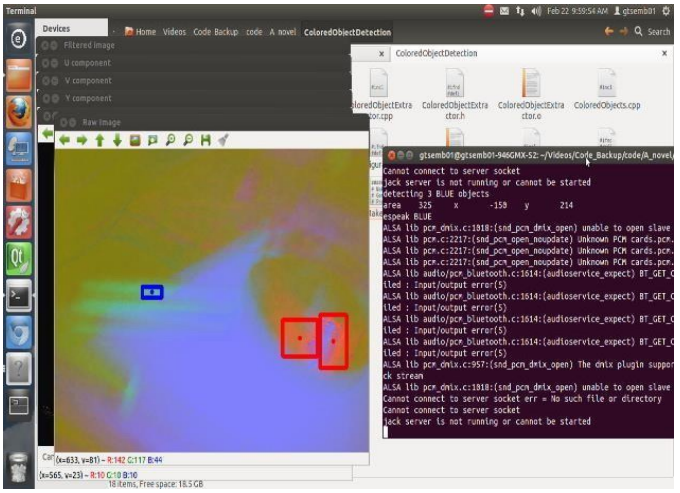
2) SPECIFICATIONS

- Chip Broadcom BCM2836
- Core architecture Quad-core ARM Cortex-A7
- CPU 900 MHz
- GPU Dual core (Video Core IV)
- Memory 1GB LPDDR2
- Operating system Linux
- Dimensions 85*56*17mm
- Power Micro USB socket 5v. 2a

3) RPI-MOB-16GB-NOOBS

2) Colour of the object detection module



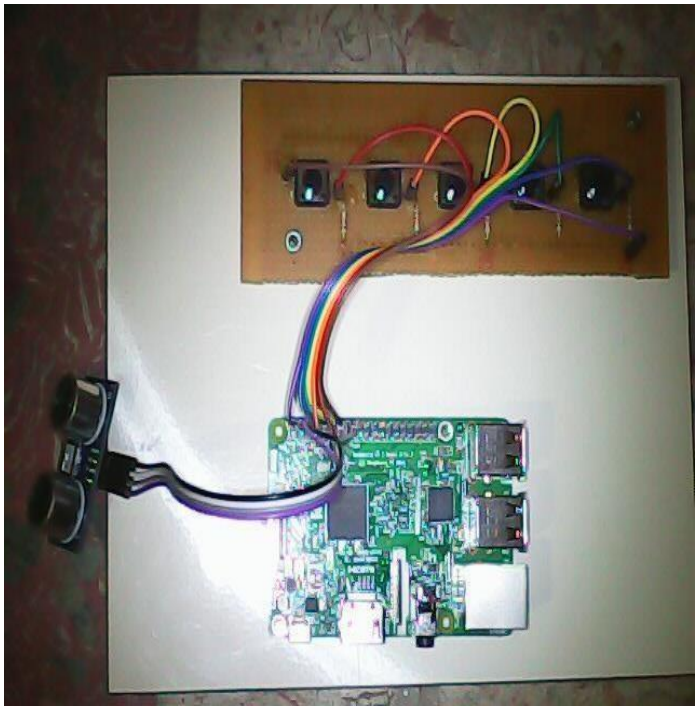


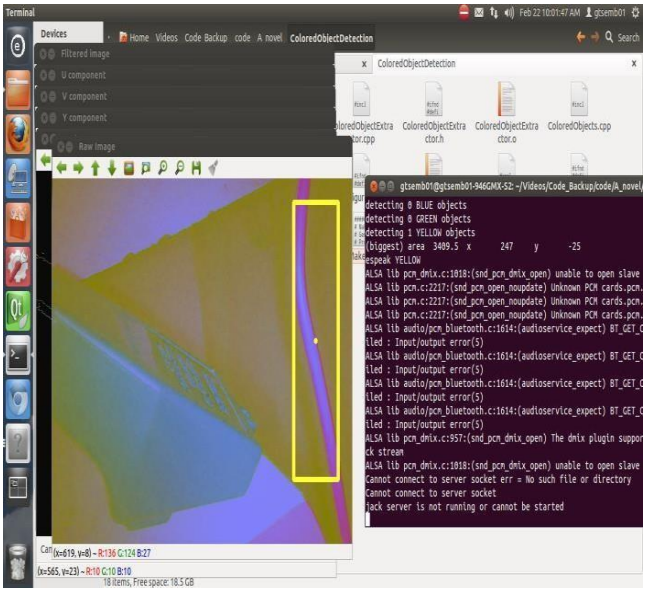
4) CONNECTORS

- Video output HDMI (rev 1.3 & 1.4)
- Audio output 3.5mm jack, HDMI
- USB 4 * USB 2.0 connector
- Memory card slot micro SDIO

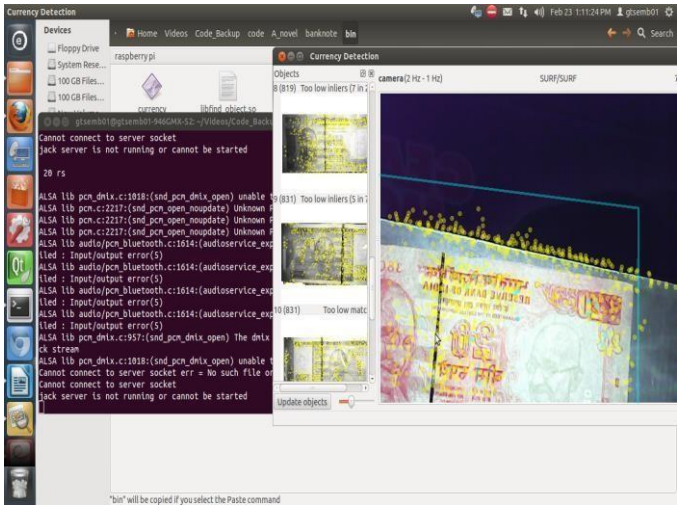
IX. PROJECT RESULTS

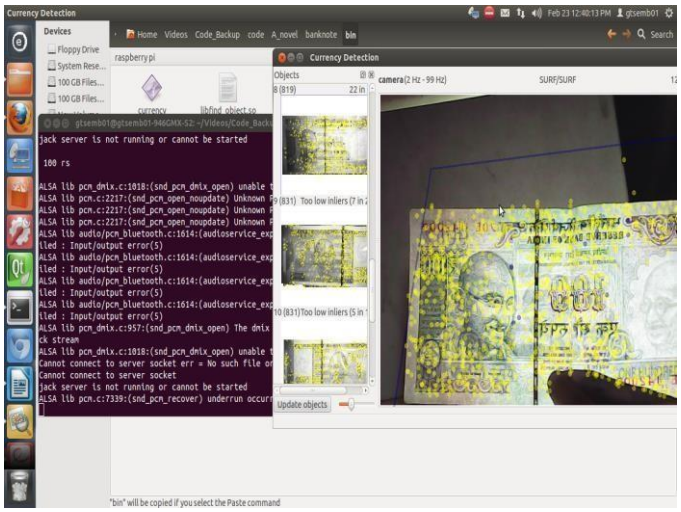
1) Final kit setup

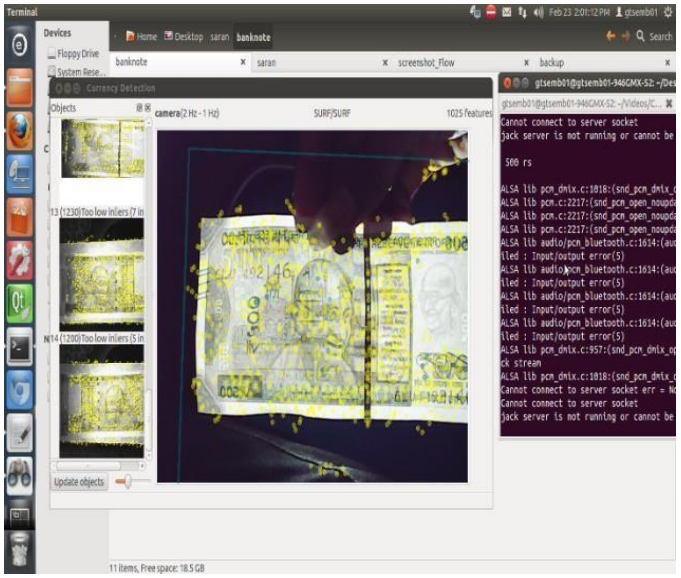




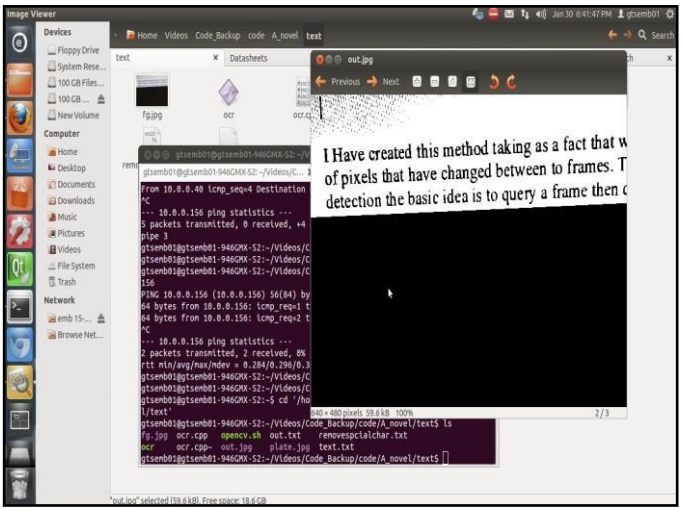
3) Currency and fake note detection module

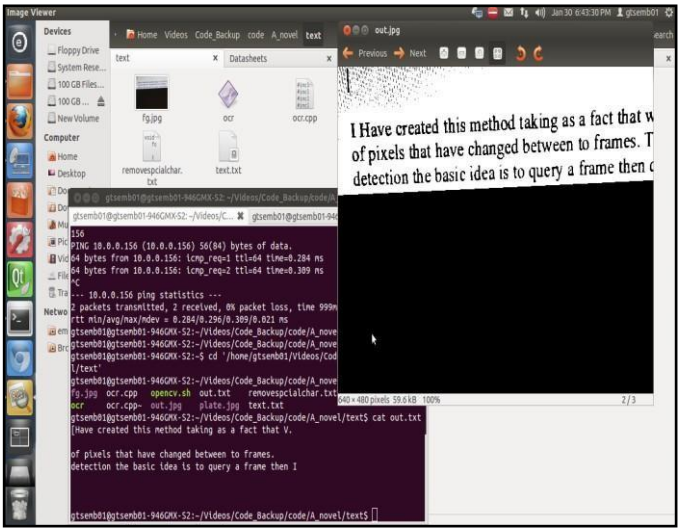


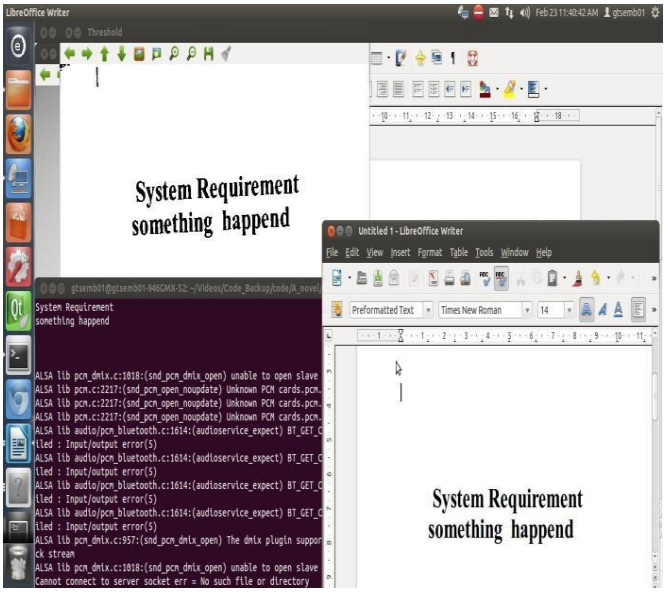




4) Text reading module







5) Surf output

6) Ultrasonic sensor

HC-SR04 Ultrasonic Distance Sensor is a popular and low cost solution for non-contact distance measurement function. It is able to measure distances from 2cm to 400cm with an accuracy of about 3mm. This module includes ultrasonic transmitter, ultrasonic receiver and its control circuit.

Fig 7: Ultrasonic sensor Description

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1" to 13 feet. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module.

HC-SR04 module has 4 pins:

- **VCC** – 5V, +ive of the power supply
- **TRIG** – Trigger Pin
- **ECHO** – Echo Pin
- **GND** – -ive of the power supply

Electric Parameter

- Working Voltage DC 5 V
- Working Current 15mA
- Working Frequency 40Hz
- Measuring Angle 15 degree
- Trigger Input Signal 10uS TTL pulse
- Echo Output Signal Input TTL lever signal and the range in proportion
- Dimension 45*20*15mm

7) Switches

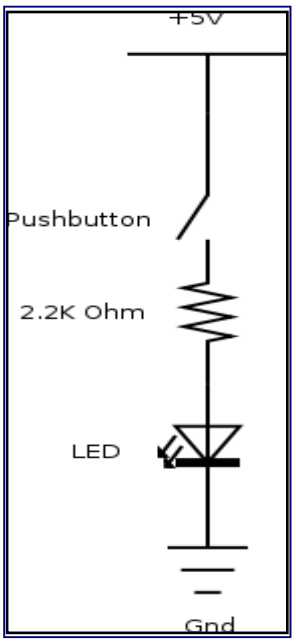
A pushbutton is a simple switch mechanism which permits user generated changes in the state of a circuit. Below you can see the pushbutton available in the Arduino Base Workshop KIT.

Fig 8: switches

Pushbutton usually comes with four legs. Anyway, as you can see from the picture below, legs are always connected in groups of two. When the pushbutton is pressed all the 4 legs are connected.

A simple circuit using a pushbutton and the Arduino board

We can try how pushbuttons work by creating a simple circuit based on the Arduino board. Here is the circuit schematics:



Resistors are considered to be the most used and the most important component of all the electronic circuits. Take a look at the working, types and also use of resistors in the field of electronics. We know that the basic idea of any electronic circuit is the flow of electricity. This also is further categorized into two – conductors and insulators. Conductors allow the flow of electrons, while insulators do not. But the amount of electricity that we want to pass through them depends on the resistors. If a high voltage is passed through a conductor such as a metal, the whole voltage passes through it. If resistors are introduced, the amount of voltage and current can be controlled. Thus "resistance can be defined as the ease with which something will let electricity flow through it". A conductor has lower resistance than an insulator. The amount used by the resistor to control the electrical circuit is termed as the resistance. The definition of resistance is based upon the Ohm's law given by the German physicist Georg Simon Ohm.

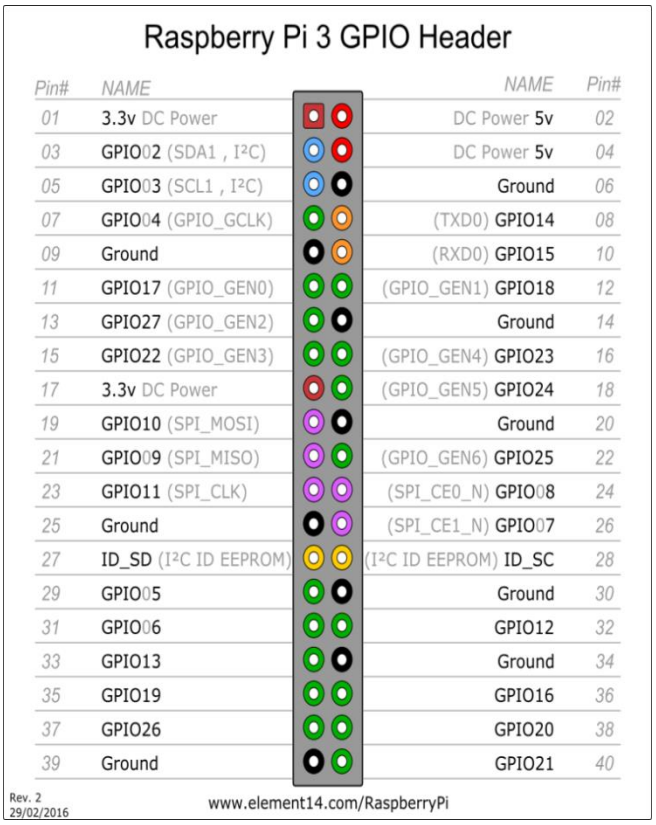
8) Pin diagram for Raspberry Pi 3 GPIO Header

BCM2837 contains the following peripherals which may safely be accessed by the ARM:

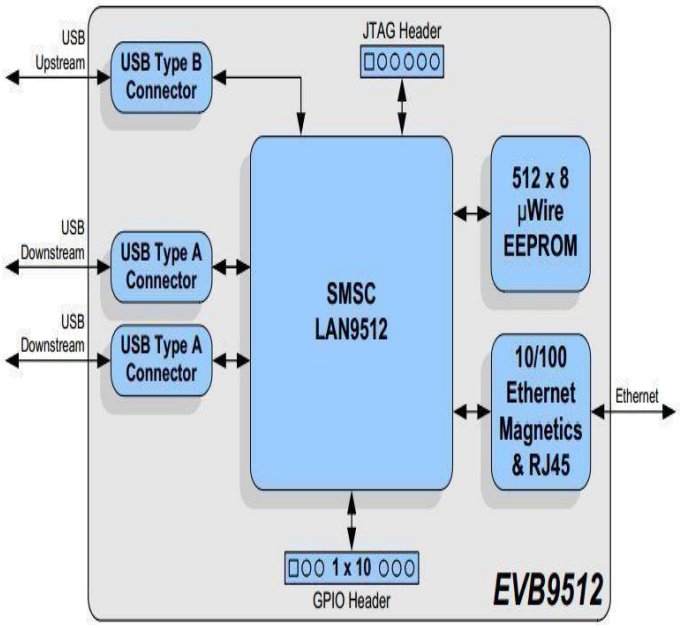
- Timers
- Interrupt controller
- GPIO
- USB
- PCM / I2S

- DMA controller
- I2C master
- I2C / SPI slave
- SPI0, SPI1, SPI2
- PWM
- UART0, UART1

The purpose of this datasheet is to provide documentation for these peripherals in sufficient detail to allow a developer to port an operating system to BCM2835.There are a number of peripherals which are intended to be controlled by the GPU. These are omitted from this datasheet. Accessing these peripherals from the ARM is not recommended.



9) Block diagram



Overview

The LAN9512/LAN9512i is a high performance Hi-Speed USB

2.1 hub with a 10/100 Ethernet controller. With applications ranging from embedded systems, desktop PCs, notebook PCs, printers, game consoles, and docking stations, the LAN9512/LAN9512i is targeted as a high performance, low cost USB/Ethernet and USB/USB connectivity solution.
The LAN9512/LAN9512i contains an integrated USB 2.0 hub, two integrated downstream USB 2.0 PHYs, an integrated upstream USB 2.0 PHY, a 10/100 Ethernet PHY, a 10/100 Ethernet Controller, a TAP controller and EEPROM controller. A block diagram of the LAN9512/LAN9512i is provided in Figure.

The LAN9512/LAN9512i hub provides over 30 programmable features, including:
Port Map (also referred to as port remap) which provides flexible port mapping and disabling sequences. The downstream ports of the LAN9512/LAN9512i hub can be reordered or disabled in any sequence to support multiple platform designs' with minimum effort. For any port that is disabled, the LAN9512/LAN9512i automatically reorders the remaining ports to match the USB host controller's port numbering scheme. Port Swap which adds per-port programmability to USB differential-pair pin locations. Port Swap allows direct alignment of USB signals (D+/D-) to connectors avoiding uneven trace length or crossing of the USB differential signals on the PCB.
PHY Boost which enables four programmable levels of USB signal drive strength in USB port transceivers. PHY Boost attempts to restore USB signal integrity that has been

compromised by system level variables such as poor PCB layout, long cables, etc.

USB Hub

The integrated USB hub is fully compliant with the USB 2.0 Specification and will attach to a USB host as a Full-Speed Hub or as a Full-/High-Speed Hub. The hub supports Low-Speed, Full-Speed and High-Speed (if operating as a High-Speed hub) downstream devices on all of the enabled downstream ports. A dedicated Transaction Translator (TT) is available for each downstream facing port. This architecture ensures maximum USB throughput for each connected device when operating with mixed-speed peripherals.
The hub works with an external USB power distributed switch device to control VBUS switching to downstream ports, and to limit current and sense over-current conditions.
All required resistors on the USB ports are integrated into the hub. This includes all series termination resistors on D+ and D- pins and all required pull-down and pull-up resistors on D+ and D- pins. The over-current sense inputs for the downstream facing ports have internal pull-up resistors. Two external ports are available for general USB device connectivity.

Ethernet Controller

The 10/100 Ethernet controller provides an integrated Ethernet MAC and PHY which are fully IEEE 802.3 10BASE-T and 802.3u 100BASE-TX compliant. The 10/100 Ethernet controller also supports numerous power management wakeup features, including “Magic Packet”, “Wake on LAN” and “Link Status Change”. These wakeup events can be programmed to initiate a USB remote wakeup.
The 10/100 Ethernet PHY integrates an IEEE 802.3 physical layer for twisted pair Ethernet applications. The PHY block includes support for auto-negotiation, full or half-duplex configuration, auto-polarity correction and Auto-MDIX. Minimal external components are required for the utilization of the integrated PHY.
The Ethernet controller implements four USB endpoints: Control, Interrupt, Bulk-in, and Bulk-out. The Bulk-in and Bulk-out Endpoints allow for Ethernet reception and transmission respectively. Implementation of vendor-specific commands allows for efficient statistics gathering and access to the Ethernet controller’s system control and status registers.

EEPROM Controller

The LAN9512/LAN9512i contains an EEPROM controller for connection to an external EEPROM. This allows for the automatic loading of static configuration data upon power-on reset, pin reset, or software reset. The EEPROM can be configured to load USB descriptors, USB device configuration, and the MAC address.

Peripherals

The LAN9512/LAN9512i also contains a TAP controller, and provides three PHY LED indicators, as well as eight general

purpose I/O pins.All GPIOs can serve as remote wakeup events when LAN9512/LAN9512i is in a suspended state.
The integrated IEEE 1149.1 compliant TAP controller provides boundary scan via JTAG.

Power Management

The LAN9512/LAN9512i features three variations of USB suspend: SUSPEND0, SUSPEND1, and SUSPEND2. These modes allow the application to select the ideal balance of remote wakeup functionality and power consumption.

- **SUSPEND0:** Supports GPIO, "Wake On LAN", and "Magic Packet" remote wakeup events. This suspend state reduces power by stopping the clocks of the MAC and other internal modules.
- **SUSPEND1:** Supports GPIO and "Link Status Change" for remote wakeup events. This suspend state consumes less power than SUSPEND0.
- **SUSPEND2:** Supports only GPIO assertion for a remote wakeup event. This is the default suspend mode for the LAN9512/LAN9512i

EEPROM format

- The EEPROM offsets are given in units of 16-bit word offsets. A length field with a value of zero indicates that the field does not exist in the EEPROM.
- The device will use the field's HW default value in this case.
- For Device Descriptors, the only valid values for the length are 0 and 18.
- For Configuration and Interface Descriptors, the only valid values for the length are 0 and 18.
- The EEPROM programmer must ensure that if a String Descriptor does not exist in the
- EEPROM, the referencing descriptor must contain 00h for the respective string index field.
- If no Configuration Descriptor is present in the EEPROM, then the Configuration Flags affect the values of bm Attributes
- bMaxPower in the Ethernet Controller Configuration Descriptor.

X. CONCLUSION

Thus, there are many problems faced by the visually impaired persons in our society. They faces many type of hurdles in performing every day routine works. So, our proposed system overcomes four major issues faced by visually impaired persons like fake note detection, color detection, obstacle detection and finally text detection. So, here we conclude that it will surely help the visually impaired persons in a trouble-free manner.

REFERENCES:

[1] Kok-Meng Lee, fellow IEEE, Min Li and Chun- Yeon Lin, member IEEE "MAGNETIC TENSOR SENSOR AND WAY FINDING METHOD BASED ON GEOMAGNECTIC FIELD EFFECTS WITH APPLICATIONS FOR VISUALLY IMPAIRED USERS" December 2016.

[2] Rushikesh Dhananjay Imade and Akshay Sadashiv Bhoite "EYERING: THE MOTIVATION FOR VISUALLY IMPAIRED PEOPLE" September 2014.

[3] Chucai Yi and Yingli Tian “ASSISTIVE TEXT READING FROM COMPLEX BACKGROUND FOR BLIND PERSONS” June 2012.

[4] Marcin Pazio, Maciej Niedzwieki, Ryszard Kowalik, Jacek Lebiedz “TEXT DETECTION SYSTEM FOR THE BLIND” September 2007.

[5]K.M. Lee, Q.Li, and W.Dakey, “EFFECTS OF CLASSIFICATION METHODS ON COLOR-BASED FEATURE DETECTION WITH FOOD PROCESSING APPLICATIONS” Jan 2007.

[6]J.Y.Bouguet, “PYRAMIDALIMPLEMENTATION OF THE LUCAS-KANADE FEATURE TRACKER DESCRIPTION OF THE ALGORITHM,” Dec 2004.

[7]B.Ando, “A SMART MULTISENSOR APPROACH TO ASSIST BLIND PEOPLE IN SPECIFIC URBAN NAVIGATION TASKS” Dec 2002.

[8]N.B. Priyantha, A.Chakraborty, and H. Balakrishnan, “THE CIRCKET LOCATION-SUPPORT SYSTEM,” Aug 2000.

[9]b. Sensortec, “BMC050 ELECTRONIC COMPASS,” BMC050 DATASHEET, Oct 1999.

[10Jj.Xiao et al., ”AN ASSISTIVE FRAMEWORK FOR THE VISUALLY IMPAIRED” Oct 1988.