

**OBJECT RECOGNITION FOR THE BLIND – A SPECIALIZED  
APPROACH TO OBJECT DETECTION WITH DISTANCE**

Submitted in partial fulfilment of the required for the award of

**Bachelor of Computer Science**

**By**

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**SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade “A++” by NAAC**

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**April 2024**

**DEPARTMENT OF COMPUTER SCIENCE**  
**BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of **NISHANTHINI (41290039)** , **RENIGRACE REBEKKAL B (41290045)** who Carried out the project entitled “**OBJECT RECOGNITION FOR THE BLIND – A SPECIALIZED APPROACH TO OBJECT DETECTION WITH DISTANCE**” under our supervision from NOVEMBER 2024 to MAY 2024.

  
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Submitted for Viva voce examination held on 27/04/2024

  
**Internal Examiner**

  
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## **DECLARATION**

We **NISHANTHINI P(41290039),RENIGRACE REBEKKAL B (41290045)** here by declare that the Project Report entitled “**OBJECT RECOGNITION FOR THE BLIND – A SPECIALIZED APPROACH TO OBJECT DETECTION WITH DISTANCE**” done by us under the Guidance of **MS.RAJESWARY, M.SC., Assistant Professor**, Department of Computer Science at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY**, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai-600 119 is submitted in partial fulfillment of The requirements for the award of bachelor of Science degree in Computer Science.

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## **ABSTRACT**

Vision is one of the most crucial senses that humans use to interact with their surroundings. Visual Impaired Person individuals worldwide, and being vision impaired makes many daily activities difficult. As a result, it is critical for blind persons to grasp their environment and the items with which they interact. To assist Visual impaired persons in seeing using a portable device to Check such as a cell phone. It combines many approaches to create a comprehensive application that not only recognizes items in real time around visually impaired individuals but also provides an audio output to aid them as promptly as feasible. The Algorithm is utilized for both object recognition and detection. Furthermore, this approach produces almost exact results for real-time object detection and has been shown to be quicker than other comparable algorithms. When a person crosses the road, he sees a car, determines the speed, distance and color of the car and a screen appears in his ears. If someone slipped around the area, the GPS will send the location via GSM to your mobile number. The main objective is to use new object detection techniques to identify users and objects in their surroundings in real time, with special attention to cars. When a vehicle is detected, the system provides important information such as distance, speed and color to understand the dynamic environment.

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# **CHAPTER 1**

## **INTRODUCTION**

The number of visually impaired is so large that it has a huge impact on the economy of the country. In fact in this busy world, common man doesn't have time to even look at these differently able ones. Thus, the visually impaired people constantly require the support of someone in their daily works, especially while on roads. Most often these people are considered a burden by others while some just ignore their presence and leave them to care for themselves all alone. This creates a feel of loneliness in them. This concept of being dependant on someone creates a feeling of demotivation and loss of self –confidence in some cases as well. Some of the major challenges include difficulty in moving from one place to another without the assistance of someone. Other challenges include difficulty in recognizing people, detecting obstacles on their way and so on. Some devices available in the market help them to overcome a few of these challenges. There is always a huge number of researches involved with the sole aim of building devices to help these visually challenged people.

## **CHAPTER 2**

### **LITRATURE REVIEW**

**TITLE:** Object Identification for Visually Impaired

**AUTHOR:** A. Jothimani, Shirly Edward, G. K. Divyashree and Lavanya

**YEAR:**2016

#### **DESCRIPTION:**

Objectives: This paper is based on a device that helps blind people to identify a set of objects used in everyday routine thereby enabling them to work independently. Method/Analysis: A new portable camera based method to recognize indoor objects for helping blind people is introduced. A more improvised algorithm called as the Coarse Description Technique has been employed. The coarse description technique can be implemented in two ways: Euclidian distance measurement method and another method that relies on semantic similarity measure modeled by means of Gaussian process estimation. Findings The proposed concept in this paper utilizes a completely different alternative scheme termed as coarse description. Its main objective is to expand the recognition task to multiple objects and keep the processing period under control at the same time. While the Euclidian distance measurement method evaluates every image based on a matrix created using details regarding the pixels of each image, the Gaussian process estimation method compares images using a number of image attributes. Novelty/Improvement: PIC controller used in the existing system is replaced by a Raspberry Pi board which provides a computation speed twice as fast as the former.

**TITLE:** A Deep Learning Approach using Arabic Annotation

**AUTHOR:** Nada Alzahrani and Heyam H. Al-Baity

**YEAR:** 2023

**DESCRIPTION:**

Object detection is an important computer vision technique that has increasingly attracted the attention of researchers in recent years. The literature to date in the field has introduced a range of object detection models. However, these models have largely been English-language-based, and there is only a limited number of published studies that have addressed how object detection can be implemented for the Arabic language. As far as we are aware, the generation of an Arabic text-to-speech engine to utter objects' names and their positions in images to help Arabic-speaking visually impaired people has not been investigated previously. Therefore, in this study, we propose an object detection and segmentation model based on the Mask R-CNN algorithm that is capable of identifying and locating different objects in images, then uttering their names and positions in Arabic. The proposed model was trained on the Pascal VOC 2007 and 2012 datasets and evaluated on the Pascal VOC 2007 testing set. We believe that this is one of a few studies that uses these datasets to train and test the Mask R-CNN model. The performance of the proposed object detection model was evaluated and compared with previous object detection models in the literature, and the results demonstrated its superiority and ability to achieve an accuracy of 83.9%. Moreover, experiments were conducted to evaluate the performance of the incorporated translator and TTS engines, and the results showed that the proposed model could be effective in helping Arabic-speaking visually impaired people understand the content of digital images.

**TITLE:** Real-Time Objects Recognition Approach for Assisting Blind People

**AUTHOR:** Jamal S. Zraqou, Wissam M. Alkhadour and Mohammad Z. Siam!

**YEAR:**2017

**DESCRIPTION:**

Blind assistance is promoting a widely challenge in computer vision such as navigation and path finding. In this paper, two cameras placed on blind person's glasses, GPS free service, and ultra-sonic sensor are employed to provide the necessary information about the surrounding environment. A dataset of objects gathered from daily scenes is created to apply the required recognition. Objects detection is used to find objects in the real world from an image of the world such as faces, bicycles, chairs, doors, or tables that are common in the scenes of a blind. The two cameras are necessary to generate the depth by creating the disparity map of the scene, GPS service is used to create groups of objects based on their locations, and the sensor is used to detect any obstacle at a medium to long distance. The descriptor of the Speeded-Up Robust Features method is optimized to perform the recognition. The proposed method for the blind aims at expanding possibilities to people with vision loss to achieve their full potential. The experimental results reveal the performance of the proposed work in about real time system.

**TITLE:** Distance Assessment by Object Detection—For Visually Impaired Assistive Mechatronic System

**AUTHOR:** Ciprian DragneORCID,Isabela Todirițe,Mihaiela IliescuORCID

andMarius Pandealea

**YEAR:**2022

**DESCRIPTION:**

Techniques for the detection and recognition of objects have experienced continuous development over recent years, as their application and benefits are so very obvious. Whether they are involved in driving a car, environment surveillance and security, or assistive living for people with different disabilities, not to mention advanced robotic surgery, these techniques are almost indispensable. This article presents the research results of a distance assessment using object detection and recognition techniques. The first is a new technique based on low-cost photo cameras and special sign detection. The second is a classic approach based on a LIDAR sensor and an HQ photo camera. Its novelty, in this case, consists of the concept and prototype of the hardware subsystem for high-precision distance measurement, as well as fast and accurate object recognition. The experimentally obtained results are used for the motion control strategy (directional inverse kinematics) of the robotic arm (virtual prototype) component in special assistive devices designed for visually impaired persons. The advantages of the original technical solution, experimentally validated by a prototype system with modern equipment, are the precision and the short time required for the identification and recognition of objects at relatively short distances. The research results obtained, in both the real and virtual experiments, stand as a basis for the further development of the visually impaired mechatronic system prototype using additional ultrasonic sensors, stereoscopic or multiple cameras, and the implementation of machine-learning models for safety-critical tasks.

**TITLE:** Object Recognition By visually impaired using machine learning.

**AUTHOR:** J. Meenakshi, MCA., M.Phil., Ph.D., Dr. G. Thailambal, MCA., M.Phil., Ph.D.,

**YEAR:**2021

**DESCRIPTION:**

Machine learning is an application of Artificial Intelligence. It provides the system the ability to learn automatically and improve from experience. Machine learning needs no explicit programming to implement. It aims in development of computer programs which can access Data and use those data to learn on their own. Machine learning can be has got huge number of applications such as Image Recognition, Speech Recognition, Self-driving cars, Virtual Personal Assistant, etc. Machine Learning has a good set of algorithms which help in creating applications in it. Machine Learning tools are portable and aids in easy development of applications.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 HARDWARE REQUIRMENTS**

- RASPBERRY PI
- GPS
- GSM
- CAMERA
- RASPBERRY PI
- SD-CARD
- MEMS SENSOR
- HEADPHONE
- CONNECTING WIRES
- SOLDERING KIT

#### **3.2 SOFTWARE REQUIRMENT**

- THONNY IDE
- PYTHON
- PHP-MYSQL

### **3.3 EXISTING SYSTEMS**

Existing systems for object recognition for the blind typically rely on a combination of technologies to provide users with real-time information about their surroundings. These systems often incorporate cameras for image capture, GPS for location tracking, GSM for data transmission, MEMS sensors for environmental data, and SD cards for storage. However, there is a growing need for a more specialized approach that not only detects objects but also provides distance information to help users navigate safely. This specialized approach aims to integrate these technologies into a compact and portable device, such as a Raspberry Pi-based system, to offer enhanced functionality. By combining object detection algorithms with distance measurement capabilities, this system can provide auditory feedback through headphones, allowing users to perceive their surroundings and obstacles more effectively. Such a system could greatly improve the independence and mobility of visually impaired individuals, empowering them to navigate Limited Distance Measurement : Many existing systems lack accurate distance measurement capabilities, leaving users unaware of the proximity of detected objects until they are dangerously close

- **Dependence on Cloud Processing** : Some systems heavily rely on cloud-based processing, introducing delays and requiring constant internet connectivity, which may not be feasible in all situations.
- **Complexity and Bulkiness** : Certain systems are complex and bulky, making them cumbersome to carry and use in everyday situations, reducing their practicality and usability. navigate unfamiliar environments with greater confidence and safety.

### **EXISTING SYSTEMS DISADVANTAGES**

- **High Cost** : The cost associated with acquiring and maintaining some existing systems can be prohibitive, limiting accessibility for visually impaired individuals who may not have the financial means to afford them.

- **Environmental Limitations** : Many current systems lack robustness and reliability in various environmental conditions, such as low light or adverse weather, further diminishing their utility and effectiveness.
- **Limited Compatibility** : Some existing systems may have limited compatibility with other assistive devices or technologies, restricting their integration into the broader ecosystem of accessibility tools.
- **Inadequate Feedback** : Feedback mechanisms in certain systems may be insufficient or not customizable to users' preferences, resulting in ineffective communication of vital information about the surroundings.
- **Difficulty in Learning Curve** : The complexity of operation and setup procedures in some systems may pose a steep learning curve for users, potentially discouraging adoption or consistent use.

### **3.4 PROPOSED SYSTEM**

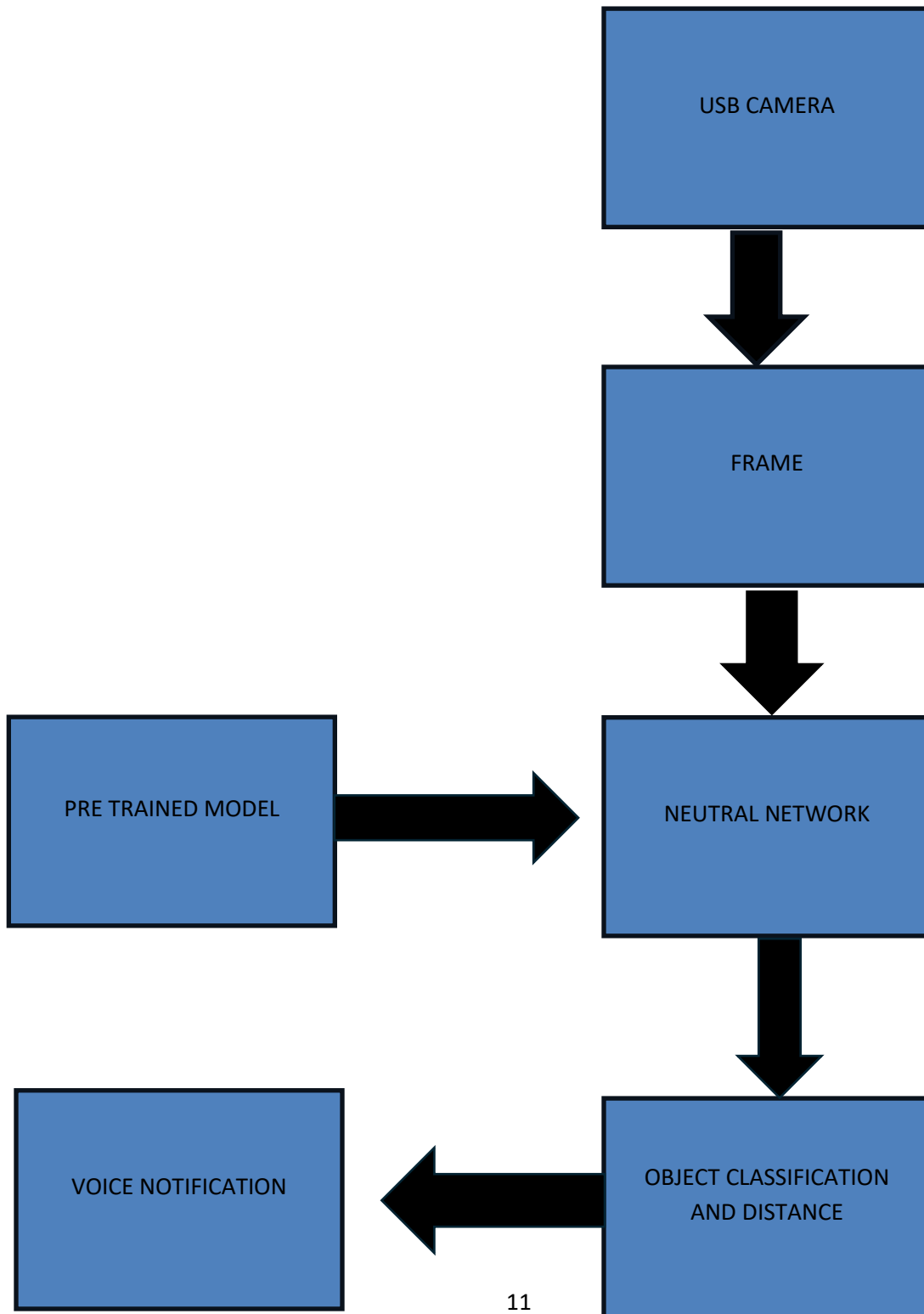
The proposed system aims to revolutionize object recognition for the blind by leveraging cutting-edge technologies in a compact and accessible platform. Building upon the foundation of existing systems, our approach integrates a Raspberry Pi for computational power and flexibility. The system incorporates a GPS module to provide accurate location data, a GSM module for seamless communication, a camera for real-time image capture, MEMS sensors for environmental data collection, and an SD card for storage. What sets our system apart is its focus on providing precise distance information alongside object detection capabilities. By incorporating advanced algorithms, the system can not only identify objects but also calculate their distance from the user in real-time. This crucial feature enables the system to offer auditory feedback through headphones, providing users with vital spatial awareness to navigate safely through their surroundings. With its compact design and enhanced functionality, our proposed system has the potential to significantly enhance the independence and mobility of visually impaired individuals, empowering them to explore the world with greater confidence and freedom.

## PROPOSED SYSTEM ADVANTAGES

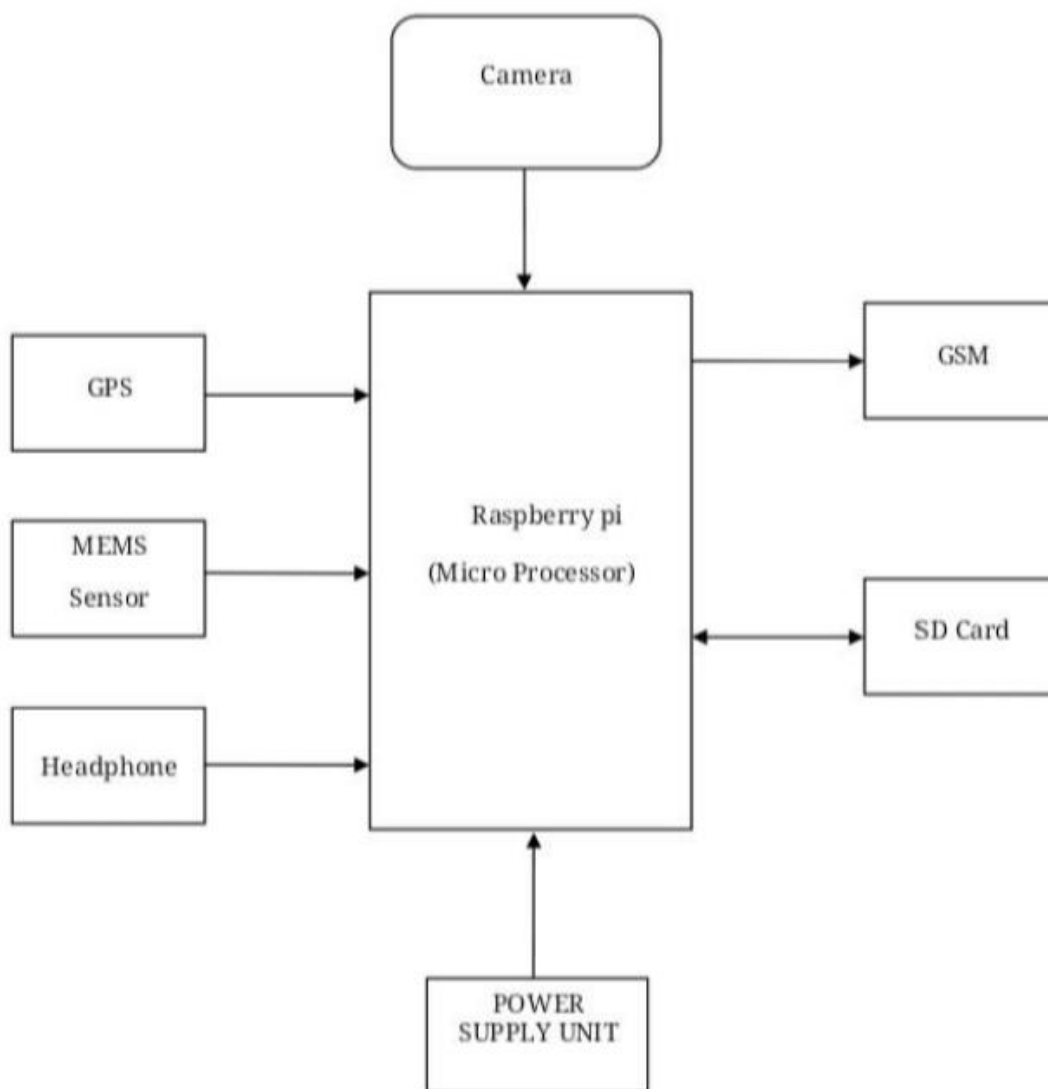
- **Precise Distance Measurement** : The proposed system integrates accurate distance measurement capabilities, providing users with real-time information about the distance of detected objects, enhancing safety and spatial awareness.
- **Offline Functionality** : Unlike systems heavily reliant on cloud processing, our proposed system prioritizes offline functionality, reducing dependency on internet connectivity and ensuring real-time feedback without delays.
- **Compact and Portable Design** : With a focus on portability, the proposed system boasts a compact and lightweight design, enhancing usability and convenience for visually impaired users in various environments.
- **Affordability** : By leveraging cost-effective components and prioritizing efficiency, the proposed system aims to be affordable and accessible to a broader population of visually impaired individuals, promoting inclusivity.
- **Robust Environmental Adaptability** : Our system is designed to operate reliably in diverse environmental conditions, including low light and adverse weather, ensuring consistent performance and utility for users in any situation.
- **Integration and Compatibility** : The proposed system emphasizes compatibility with existing assistive devices and technologies, facilitating seamless integration into users' accessibility toolkits and enhancing overall usability and effectiveness.
- **Customizable Feedback** : Users can customize feedback mechanisms according to their preferences, ensuring effective communication of vital information about their surroundings and enhancing user experience and satisfaction.
- **User-Friendly Interface** : With intuitive operation and simplified setup procedures, our system minimizes the learning curve for users, promoting adoption and consistent use among visually impaired individuals.

## CHAPTER 4

### ARCHITECTURE DIAGRAM



## 4.1 BLOCK DIAGRAM



## CHAPTER 5

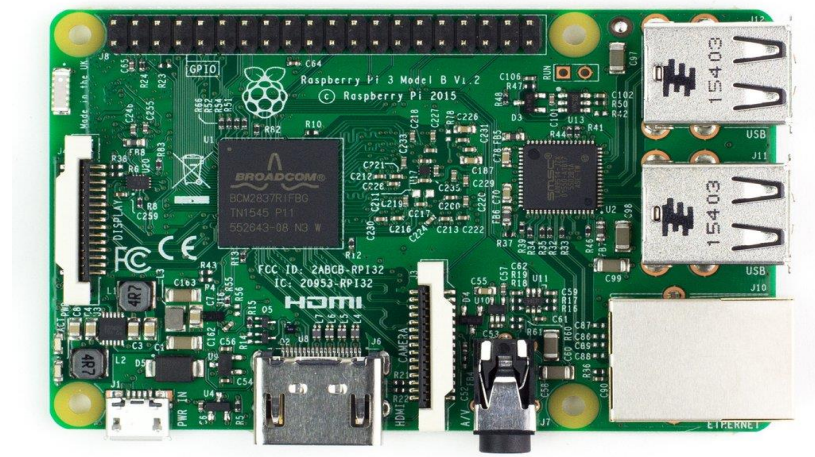
### HARDWARE DESCRIPTION

#### 5.1.RASPBERRY PI 3

##### DESCRIPTION

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B.

Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processor, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.



#### RASPBERRY PI 3

The Raspberry Pi 3 is the third generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016. The Raspberry Pi 3 has an identical form factor to the previous Pi 2 (and Pi 1 Model B+) and has complete compatibility with Raspberry Pi 1 and 2.

The best part about all this is that the Pi 3 keeps the same shape, connectors, and mounting holes as the Pi 2. Dual Core Video Core IV® Multimedia Co-Processor. Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode.

## **FEATURES**

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.0
- Bluetooth Low Energy (BLE)
- 1GB RAM
- 40 GPIO pins
- Ethernet port

## **APPLICATIONS**

- Server/cloud server
- Security monitoring
- Environmental sensing/monitoring (e.g. weather station)
- IOT applications
- Robotics
- Wireless access point
- Print server

## **5.2 POWER SUPPLY UNIT**

### **DESCRIPTION**

A power supply unit (or PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some power supplies have a manual switch for selecting input voltage, while others automatically adapt to the mains voltage.

A power supply is used to reduce the mains electricity at 240 volts AC down to something more useable, say 12 volts DC. There are two types of power supply, linear and switch mode. A linear power supply uses a transformer to reduce the voltage. The AC signal is rectified and regulated to produce a high DC voltage.

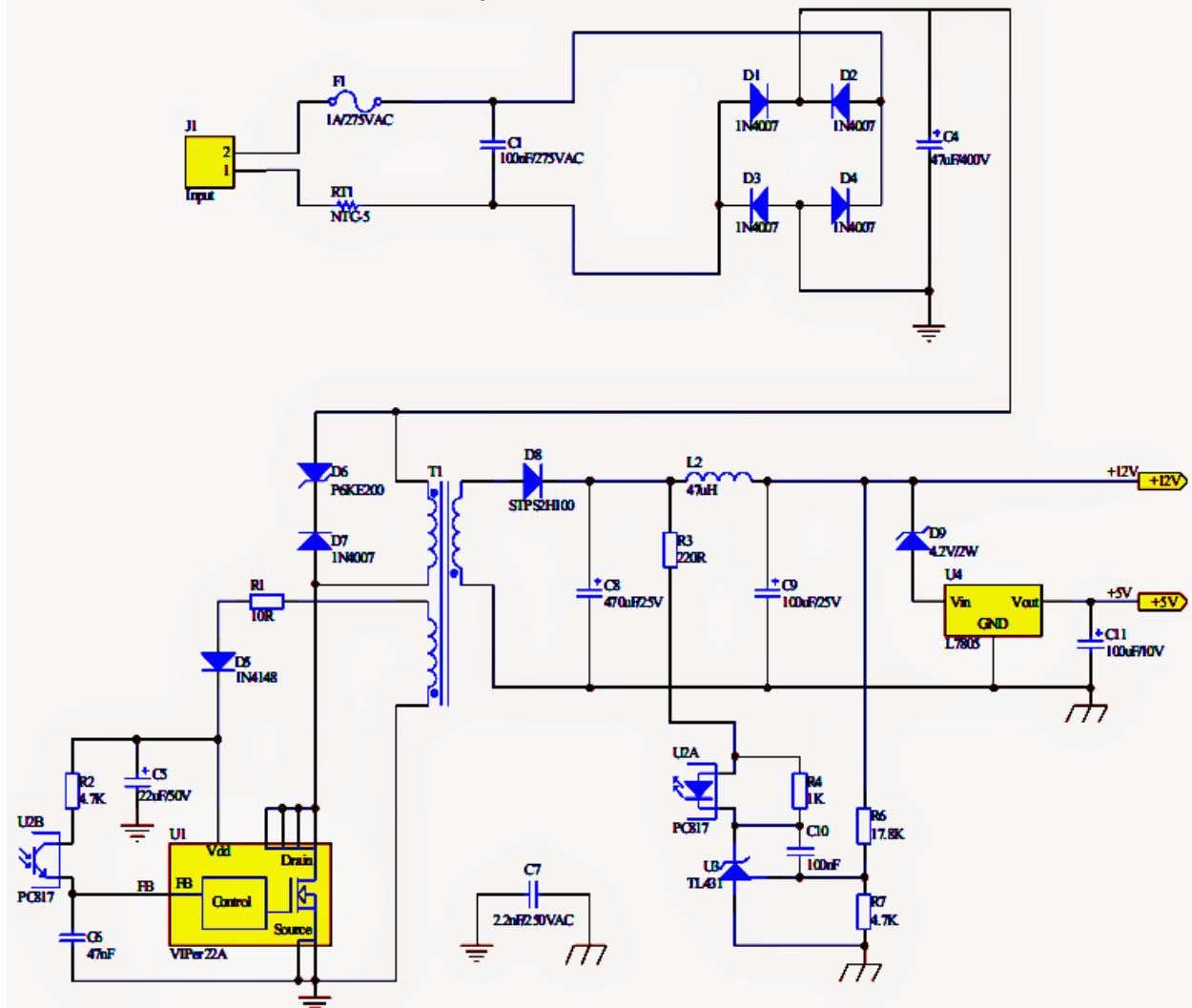
AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from main power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply.



### **ADAPTER (12V 1AMP)**

An adapter is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another. In a computer, an adapter is often built into a card that can be inserted into a slot on the computer's motherboard. The card adapts information that is exchanged between the computer's microprocessor and the devices that the card supports.

## 12V, 1 Amp SMPS Circuit



### 5.3 CIRCUIT DIAGRAM

An electric power adapter may enable connection of a power plug, sometimes called, used in one region to a AC power socket used in another, by offering connections for the disparate contact arrangements, while not changing the voltage. An AC adapter, also called a "recharger", is a small power supply that changes household electric current from distribution voltage) to low voltage DC suitable for consumer electronics.

Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another. For computers and related items, one kind of serial port adapter

enables connections between 25-contact and nine-contact connectors, but does not affect electrical power- and signalling-related attributes

## **FEATURES**

- Output current:1A
- Supply voltage: 220-230VAC
- Output voltage: 12VDC
- Reduced costs
- Increased value across front-office and back-office functions
- Access to current, accurate, and consistent data
- It generates adapter metadata as WSDL files with J2CA extension.

## **APPLICATIONS**

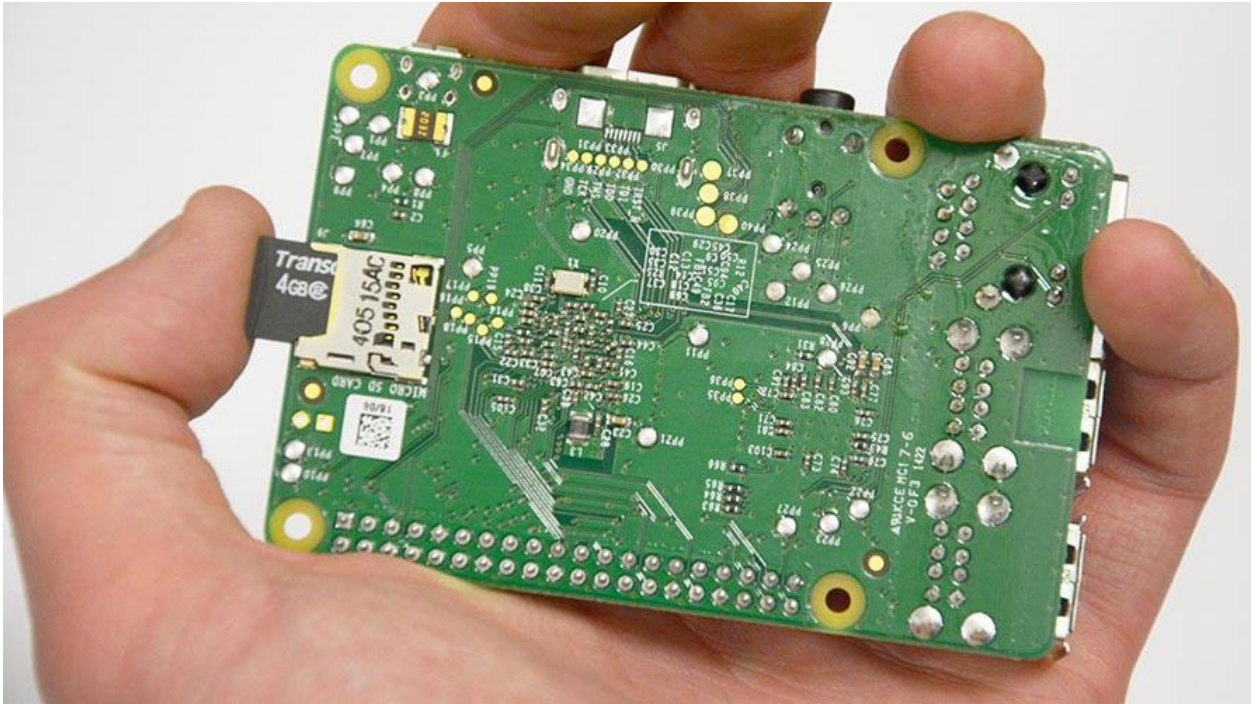
- Back-end systems which need to send purchase order data to oracle applications send it to the integration service via a integration server client.
- SMPS applications.

## **5.4 SD CARD PORT**

### **DESCRIPTION**

Secure Digital (SD) cards are removable \_ash-based storage devices that are gaining in popularity in small consumer devices such as digital cameras, PDAs, and portable music devices. Their small size, relative simplicity, low power consumption, and low cost make them an ideal solution for many applications.

This application note describes the implementation of an SD Card interface for the Texas Instruments MSP430, a low-power 16-bit microcontroller . This interface, combined with the MSP430, can form the foundation for a low-cost, long-life data logger or media player or recorder.



## **SD CARD PORT IN RASPBERRY PI**

The SD card standard is a standard for removable memory storage designed and licensed by the SD Card Association . The SD Card standard is largely a collaborative effort by three manufacturers, Toshiba, SanDisk, and MEI and grew out of an older standard, MultiMediaCard (MMC). The card form factor, electrical interface, and protocol are all part of the SD Card specification. The SD standard is not limited to removable memory storage devices and has been adapted to many different classes of devices, including 802.11 cards, Bluetooth devices, and modems.

| Pin | Name     | Function (SD Mode) | Function (SPI Mode)                          |
|-----|----------|--------------------|----------------------------------------------|
| 1   | DAT3/CS  | Data Line 3        | Chip Select/Slave Select ( $\overline{SS}$ ) |
| 2   | CMD/DI   | Command Line       | Master Out Slave In (MOSI)                   |
| 3   | VSS1     | Ground             | Ground                                       |
| 4   | VDD      | Supply Voltage     | Supply Voltage                               |
| 5   | CLK      | Clock              | Clock (SCK)                                  |
| 6   | VSS2     | Ground             | Ground                                       |
| 7   | DAT0/DO  | Data Line 0        | Master In Slave Out (MISO)                   |
| 8   | DAT1/IRQ | Data Line 1        | Unused or IRQ                                |
| 9   | DAT2/NC  | Data Line 2        | Unused                                       |

## 5.5 SD CARD PIN DETATILS

The SD 1-bit protocol is a synchronous serial protocol with one data line, used for bulk data transfers, one clock line for synchronization, and one command line, used for sending command frames. The SD 1-bit protocol explicitly supports bus sharing. A simple single-master arbitration scheme allows multiple SD cards to share a single clock and DAT0 line.

The SD 4-bit protocol is nearly identical to the SD 1-bit protocol. The main difference is the bus width – bulk data transfers occur over a 4-bit parallel bus instead of a single wire. With proper design, this has the potential to quadruple the throughput for bulk data transfers. Both the SD 1-bit and 4-bit protocols by default require CRC protection of bulk data transfers. A CRC, or Cyclic Redundancy Check, is a simple method for detecting the presence of simple bit-inversion errors in a transmitted block of data.

In SD 4-bit mode, the input data is multiplexed over the four bus (DAT) lines and the 16-bit CRC is calculated independently for each of the four lines. In an all-software implementation,

calculating the CRC under these conditions can be so complex that the computational overhead may mitigate the benefits of the wider 4-bit bus. A 4-bit parallel CRC is trivial to implement in hardware, however, so custom ASIC or programmable-logic solutions are more likely to benefit from the wider bus.

## **5.6 BLOCK READ**

The block read command is a bulk data command. The command response is followed by a delay, then followed by a `_start of block_` token, and then followed by the actual block itself.

In order to make the most efficient use of resources and enable fast block transfers, the block read function uses the DMA (Direct Memory Access) controller on the MSP430. First, the command is sent and the response is received. Then, the function waits until the start token is received. When it is received, the function starts a DMA transfer. Since SPI requires that a byte be sent for a byte to be received, two DMA units are used to complete the transfer.

DMA0 is triggered by a UART receive. The source for the DMA transfer is the USART receive buffer, `U0RXBUF`.

The source is set to byte-wide, no increment. The destination for the DMA transfer is the data buffer. The destination is set to byte-wide, with an increment. The count is fixed at 512, the default block size for a typical SD card.

DMA1 is also triggered by a UART receive. The source for this register is a constant `0xFF` (the idle bus condition).

The output is the USART transmit buffer, `U0TXBUF`.

DMA priorities ensure that a byte will be received before a new `0xFF` (idle byte) is sent. Since both DMA units use the same trigger, DMA0 will always be serviced before DMA1.

Finally, the receive and transmit interrupt flags are reset and the entire block transfer is triggered by manually sending a single idle byte.

The function `sd_read_block()` implements the block read. The function will return immediately and normal program execution can continue while the block transfer finishes. `sd_wait_notbusy()` can be used to synchronously wait for any pending block transfers to finish.

## **5.7 BLOCK WRITE**

The block write is similar to the block read function in that it uses a DMA transfer and also starts with a data token. However, since no bytes need to be received during the block transfer, the block transfer only requires one DMA trigger

DMA0 is triggered by a UART send. The destination for the DMA transfer is the USART receive buffer, `U0RXBUF`. The destination is set to byte-wide, no increment. The source for the DMA transfer is the data buffer. The source is set to byte-wide, with an increment. The count is fixed at 512, the default block size for typical SD card.

Finally, the receive and transmit interrupt flags are reset and the entire block transfer is triggered by manually sending a single idle byte.

The function `sd_write_block()` implements the block write. The function will return immediately and normal program execution can continue while the block transfer finishes. `sd_wait_notbusy()` can be used to synchronously wait for any pending block transfers to finish.

## **5.8 USB CAMERA**

Active WebCam captures images up to 30 frames per second from any video device including USB cameras, Analog cameras connected to capture card, TVboards, camcorders with FireWire (IEEE 1394) interface and from Network cameras. When the program detects motion in the monitored area, it can sound an alarm, e-mail you the captured images, and start broadcasting or record a video. The program has features to add text captions and image logos to the images, to

place a date/time stamp on each video frame, and to adjust the frame rate, picture size, and quality.



A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and email as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

## FEATURES

- Frame rate(30 frames per second and above)
- Resolution
- Continuous autofocus
- Microphones

## **APPLICATIONS**

- Video calling and video conferencing.
- Video monitoring.
- Health care (for capturing arterial pulse rate).
- Input control devices.
- Commerce (e.g Webcam social shopper)
- Home security

## **5.9 GPS MODULE**

### **DESCRIPTION**

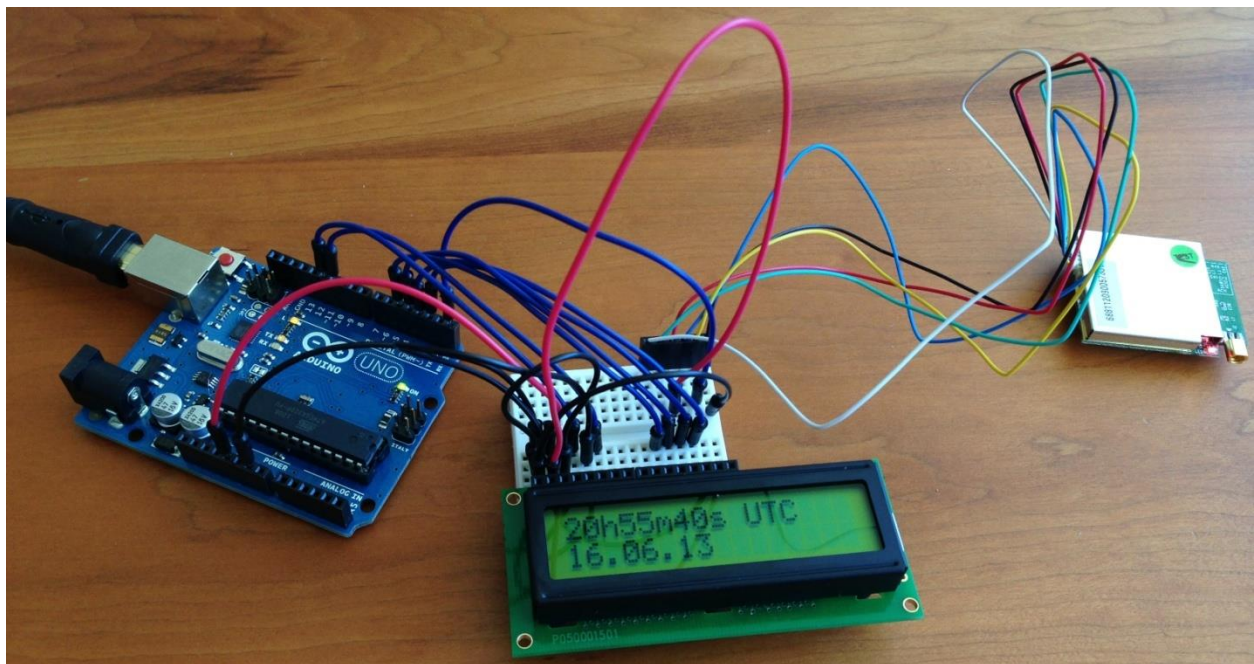
The Global Positioning System (GPS), originally Navstar GPS, is a space-based radio navigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geo location and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

The GPS system does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.



## GPS MODULE

The Global Positioning System (GPS) is a global navigation satellite system that provides location and time information in all weather conditions. The GPS operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. GPS satellites transmit signal information to earth. This signal information is received by the GPS receiver in order to measure the user's correct position.



## **5.10 GPS MODULE INTERFACE WITH ARDUINO**

The GPS concept is based on time and the known position of specialized satellites. GPS satellites continuously transmit their current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the precise position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities

Each GPS satellite continually broadcasts a signal (carrier wave with modulation) that includes a pseudorandom code (sequence of ones and zeros) that is known to the receiver and a message that includes the time of transmission (TOT) of the code epoch and the satellite position at that time

### **FEATURES**

- Supply voltage: 12v DC
- Interface: UART RS232
- Optional T-TL uart also available
- Precision: 5 meters
- Automatic antenna switching function

### **APPLICATIONS**

- GPS trackers
- Automated vehicle
- Robotics
- Fleet tracking

## **5.11 GSM MODEM**

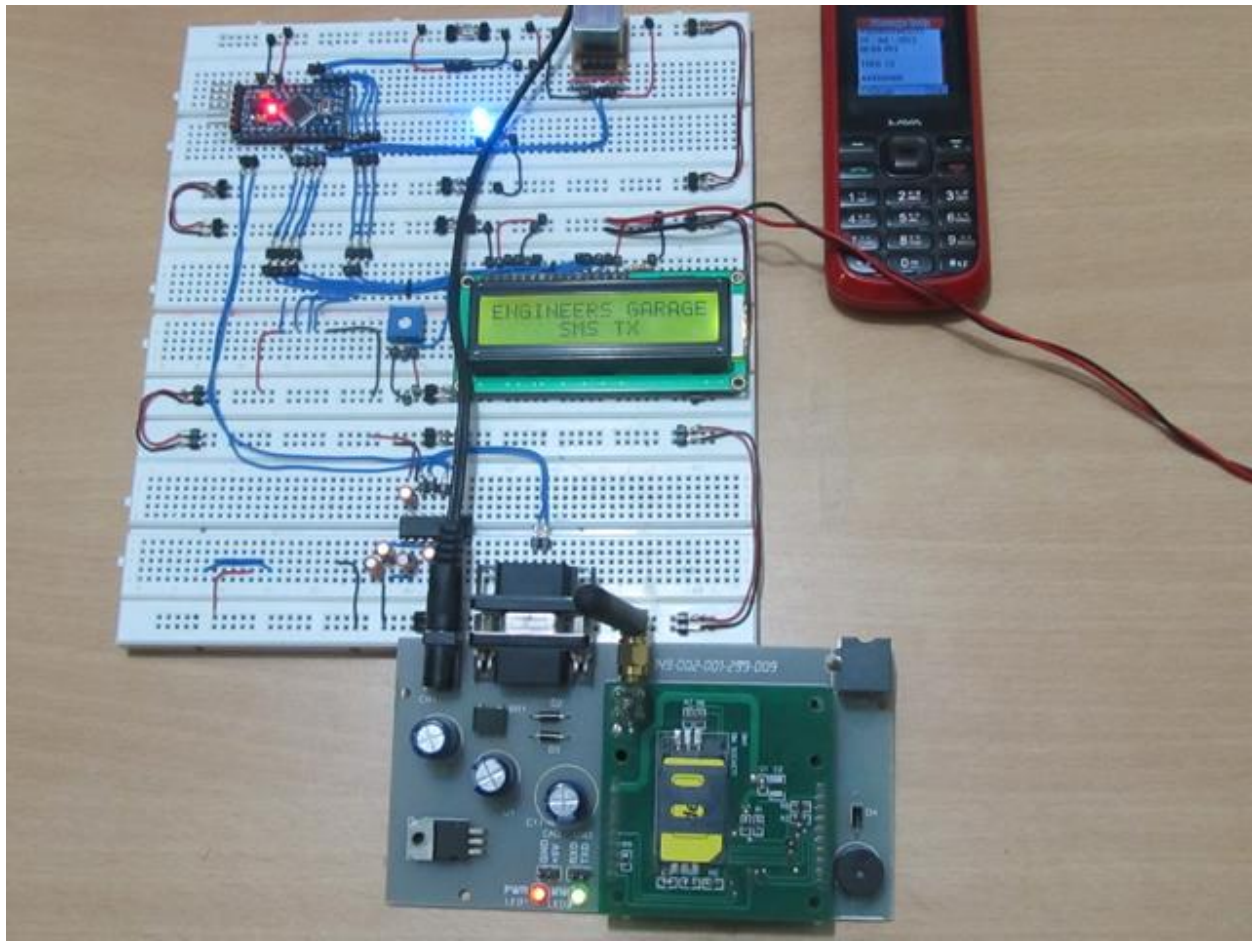
### **DESCRIPTION**

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. This tutorial will explain how to interface a GSM modem with Toradex modules.



## **GSM MODEM**

SIMCom Wireless Solutions is a subsidiary of SIM Technology Group Ltd (stock code: 2000.H.K). It is a fast-growing wireless M2M company, designing and offering a variety of wireless modules based on GSM/GPRS/EDGE, WCDMA/HSDPA and TD-SCDMA technical platforms. By partnering with third parties, SIMCom Wireless provides customized design solutions in M2M, WLL, Mobile Computing, GPS and other applications. SIMCom Wireless also provides ODM services for customers. According to ABI Insight report, SIMCom Cellular Module was number two provider of wireless modules worldwide in 2008 with 20% acquisition of global market share.



## 5.12 GSM MODEM INTERFACE WITH CONTROLLER

This GSM Modem can accept any GSM network act as SIM card and just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module featuring an industry-standard interface; the SIM800 delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM800 can fit almost all the space requirements in your applications, especially for slim and compact demand of design.

### FEATURES

- High Quality Product
- RS232 interface @ RMC Connector for direct communication with computer or MCU kit
- Configurable baud rate
- SMA connector with GSM Antenna.
- SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Audio interface Connector
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 4.5V-12V DC

## **APPLICATIONS**

- Short Message Service(SMS)
- Internet
- Incoming /outgoing calls

## **5.13 MEMS SENSOR**

### **DESCRIPTION**

Microelectromechanical system (MEMS, also written a micro-electro-mechanical, MicroElectroMechanical or microelctronic and microelectromechanical systems and the related micromechatronics) is the technology of microscopic devices, particularly those with moving parts.

The accelerometer is a low power, low profile capacitive micro machined Accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature Compensation, self test, 0g-Detect which detects linear freefall, and g-Select which Allows for the selection between 2 sensitivities Zero-g offset and sensitivity is Factory set and requires no external devices. This

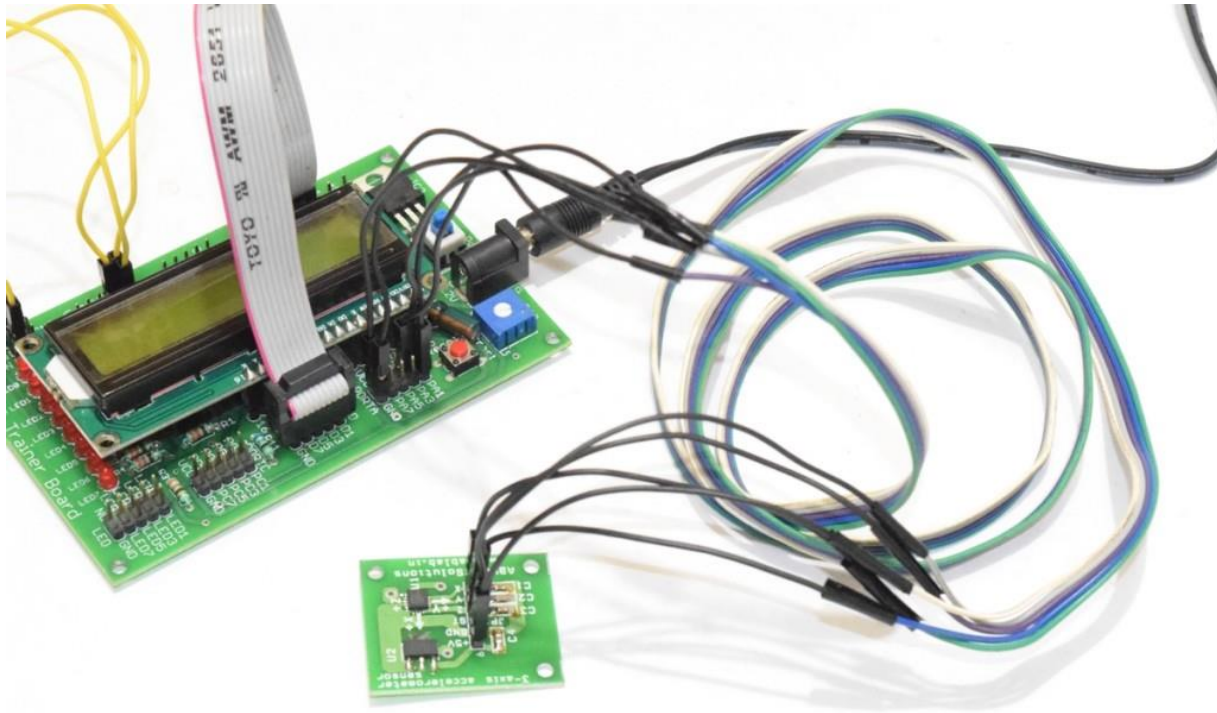
includes a Sleep Mode that makes it ideal for handheld battery powered elect



## 5.14 TILT SENSOR

You can use an accelerometer's ability to sense acceleration to measure a variety of things that are very useful to electronic and robotic projects and designs:

- Acceleration
- Tilt and tilt angle
- Incline
- Rotation
- Vibration
- Collision
- Gravity



## 5.15 SENSOR INTERFACE WITH CONTROLLER

Acceleration is a measure of how quickly speed changes. Just as a speedometer is a meter that measures speed, an accelerometer is a meter that measures acceleration. Accelerometers are useful for sensing vibrations in systems or for orientation applications. Accelerometers can measure acceleration on one, two, or three axis. 3-axis units are becoming more common as the cost of development for them decreases. You can use an accelerometer's ability to sense acceleration to measure a variety of things that are very useful to electronic and robotic projects.

### FEATURES

- Low Current Consumption: 400 Ma
- Sleep Mode: 3 $\mu$ A
- Low Voltage Operation: 2.2 V – 3.6 V
- High Sensitivity (800 mV/g @ 1.5g)
- Selectable Sensitivity ( $\pm 1.5g$ ,  $\pm 6g$ )

- Fast Turn on Time (0.5 ms Enable Response Time)
- Self Test for Freefall Detect Diagnosis

### **APPLICATIONS:**

- Self balancing robots
- Tilt-mode game controllers
- Model airplane auto pilot
- Car alarm systems
- Crash detection/airbag deployment

## CHAPTER 6

### SOFTWARE DESCRIPTION

#### 6.1.PYTHON

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

Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software [28] and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation.

Python is a multi-paradigm programming language. Object-oriented programming and structured programming are fully supported, and many of its features support functional programming and aspect-oriented programming (including by metaprogramming and metaobjects (magic methods)). Many other paradigms are supported via extensions, including design by contract and logic programming.

Python uses dynamic typing, and a combination of reference counting and a cycle-detecting garbage collector for memory management. It also features dynamic name resolution (late binding), which binds method and variable names during program execution.

Python's design offers some support for functional programming in the Lisp tradition. It has `filter()`, `map()`, and `reduce()` functions; list comprehensions, dictionaries, and sets; and generator expressions.<sup>[45]</sup> The standard library has two modules (`itertools` and `functools`) that implement functional tools borrowed from Haskell and Standard ML.<sup>[46]</sup>

The language's core philosophy is summarized in the document *The Zen of Python* (PEP 20), which includes aphorisms such as:<sup>[47]</sup>

- Beautiful is better than ugly.
- Explicit is better than implicit.

- Simple is better than complex.
- Complex is better than complicated.
- Readability counts.

Rather than having all of its functionality built into its core, Python was designed to be highly extensible. This compact modularity has made it particularly popular as a means of adding programmable interfaces to existing applications. Van Rossum's vision of a small core language with a large standard library and easily extensible interpreter stemmed from his frustrations with ABC, which espoused the opposite approach. While offering choice in coding methodology, the Python philosophy rejects exuberant syntax (such as that of Perl) in favor of a simpler, less-cluttered grammar. As Alex Martelli put it: "To describe something as 'clever' is *not* considered a compliment in the Python culture." Python's philosophy rejects the Perl "there is more than one way to do it" approach to language design in favor of "there should be one—and preferably only one—obvious way to do it".

Python's developers strive to avoid premature optimization, and reject patches to non-critical parts of CPython that would offer marginal increases in speed at the cost of clarity. When speed is important, a Python programmer can move time-critical functions to extension modules written in languages such as C, or use PyPy, a just-in-time compiler. Python is also available, which translates a Python script into C and makes direct C-level API calls into the Python interpreter. An important goal of Python's developers is keeping it fun to use. This is reflected in the language's name—a tribute to the British comedy group Monty Python—and in occasionally playful approaches to tutorials and reference materials, such as examples that refer to spam and eggs (from a famous Monty Python sketch) instead of the standard foo and bar.

A common neologism in the Python community is *pythonic*, which can have a wide range of meanings related to program style. To say that code is pythonic is to say that it uses Python idioms well, that it is natural or shows fluency in the language, that it conforms with Python's minimalist philosophy and emphasis on readability. In contrast, code that is difficult to understand or reads like a rough transcription from another programming language is called *unpythonic*.

## **CHAPTER 7**

### **MODULES**

- SENSOR INTERFACING
- PREPARING POWER SUPPLY UNIT
- MICRO-CONTROLLER PROGRAMMING
- READING ANALOG DATA
- TEST AND DEBUG

### **7.1MODULE DESCRIPTION**

#### **7.1.1 SENSOR INTERFACING**

Sensor interfacing is a mix of amplification, filtering, and other signal conditioning as well as analog-to-digital conversion. The analog-to-digital converter (ADC) may be in your microcontroller, but you will still need to make the sensor compatible with the ADC input.

#### **7.1.2 PREPARING POWER SUPPLY UNIT**

A power supply unit (or PSU) converts mains AC to low-voltage regulated DC power for the internal components of a controller. A power supply is used to reduce the mains electricity at 240 volts AC down to something more useable, say 12 volts DC. There are two types of power supply, linear and switch mode. A linear power supply uses a transformer to reduce the voltage. The AC signal is rectified and regulated to produce a high DC voltage. An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from main power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply.

### **7.1.3 MICRO-CONTROLLER PROGRAMMING**

A microcontroller is a programmable IC, capable of multiple functions depending on how it's programmed. Many different kinds of microcontrollers exist that offer a wide range of functionality. The versatility of the microcontroller is what makes it one of the most powerful tools in modern design. This guide will explain the basics of microcontrollers and how they are programmed.

### **7.1.4 READING ANALOG DATA**

The microcontroller of the board has a circuit inside called an analog-to-digital converter or ADC that reads this changing voltage and converts it to a number between 0 and 1023. When the shaft is turned all the way in one direction, there are 0 volts going to the pin, and the input value is 0. When the shaft is turned all the way in the opposite direction, there are 5 volts going to the pin and the input value is 1023. In between, `analog Read` (returns a number between 0 and 1023 that is proportional to the amount of voltage being applied to the pin.

### **7.1.5 TEST AND DEBUG**

Testing means verifying correct behavior. Testing can be done at all stages of module development: requirements analysis, interface design, algorithm design, implementation, and integration with other modules. In the following, attention will be directed at implementation testing. Implementation testing is not restricted to execution testing. An implementation can also be tested using correctness proofs, code tracing, and peer reviews, as described below.

Debugging is a cyclic activity involving execution testing and code correction. The testing that is done during debugging has a different aim than final module testing. Final module testing aims to demonstrate correctness, whereas testing during debugging is primarily aimed at locating errors. This difference has a significant effect on the choice of testing strategies.



## CHAPTER 8

### SAMPLE CODE

```
# import cv2

#

# vid = cv2.VideoCapture(0)

#

# while(True):

#     ret, frame = vid.read()

#

#     cv2.imshow('frame', frame)

#

#     if cv2.waitKey(1) & 0xFF == ord('q'):

#         break

#

# vid.release()

# cv2.destroyAllWindows()

#-----GSM Code-----

Import serial

Import time
```

```

# import RPi.GPIO as GPIO

Def send_sms(recipient_numbers, a):

    Ser = serial.Serial("/dev/ttyS0", baudrate=9600, timeout=1)

    If not ser.is_open:

        Ser.open()

    Def Send_at_command(command, expected_response, timeout=1):

        Ser.write((command + '\r\n').encode())

        Time.sleep(timeout)

        Response = ser.read(ser.in_waiting or 1).decode()

        Return response.strip()

    Send_at_command('AT', 'OK')

    Send_at_command('AT+CMGF=1', 'OK') Send_at_command('AT+CNMI=2,1,0,0,0', 'OK')

    Message = ""

    Print(message)

    If a == 1:

        Message = "Hello"

        Print(message)

    Elif a == 2:

        Message = "Hi"

        Print(message)

    Else:

```

```
Print("Invalid value for 'a'. Message not sent.")
```

```
Return
```

```
For recipient_number in recipient_numbers:
```

```
Send_at_command('AT+CMGS="{}"'.format(recipient_number), '>')
```

```
Message_bytes = (message + '\x1a').encode
```

```
Ser.write(message_bytes)
```

```
Time.sleep(2)
```

```
Ser.close()
```

```
Recipient_numbers = ['9791988357','9791988357']
```

```
A = 1
```

```
Send_sms(recipient_numbers, a)
```

## **CHAPTER 9**

### **CONCLUSION**

In conclusion, the development of a specialized object recognition system for the blind holds tremendous promise in revolutionizing the way visually impaired individuals navigate the world around them. By addressing the shortcomings of existing systems and leveraging advanced technologies such as precise distance measurement, offline functionality, and compact design, this proposed solution offers a comprehensive and accessible tool for enhancing safety and independence. With its affordability, robust environmental adaptability, and compatibility with other assistive devices, the system not only improves accessibility but also promotes inclusivity for a broader range of users. The customizable feedback mechanisms and user-friendly interface further contribute to a seamless and empowering user experience. Moving forward, continued research and development in this field are crucial to refining and expanding the capabilities of such systems, ultimately enabling visually impaired individuals to navigate their environments with greater confidence, autonomy, and dignity.

## CHAPTER 10

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