INTEGRATED SMART SHOE FOR BLIND PEOPLE

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INTRODUCTION

Blindness, low vision, visual impairment and vision loss have dramatic impacts on individuals experiencing such disabilities. These carry with them physiological, psychological, social, and economic outcomes, hence impacting the quality of life and depriving such individuals from performing many of the Activities of Daily Living (ADL), the most crucial of which is navigation and mobility.

Blindness is a qualitative term that describes the clinical condition whereby individuals have no light perception as a result of total vision loss. Blindness also refers to those who have so little vision that they have to rely predominantly on other senses as vision substitution skills. On the other hand, visual impairments is a qualitative term used when the condition of vision loss is characterized by a loss of visual functions at the organ level, such as the loss of visual acuity or the loss of visual field.

This project presents a prototype model and a system concept to provide a smart electronic aid for blind people. This system is intended to provide overall measures object detection, and send information related to blind people. The system consists of microcontroller, ultrasonic sensor, and a vibratory circuit. This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the shoe. When the object is detected near to the shoe alerts them with the help of vibratory circuit and also in advancement with help of speakers or head phones that is voice command with the help of android application. Here the power supply is main criteria the shoe is integrated with self-power generation unit such that there is no power backup problem.
1.1 Problem statement

Artificial Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The statistics by the World Health Organization (WHO) in 2014 estimates that there are 285 billion people in world with visual impairment, 39 billion of people which are blind and 246 with low vision. The oldest and traditional mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The drawbacks of these aids are range of motion and very little Information conveyed. With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind people to navigate safely and independently. Also high-end technological solutions have been introduced recently to help blind persons navigate independently.

The IR sensor and buzzer will not give accurate result to the blind people, this is the main drawback of previous project, in previous project IR sensor are the object detecting sensor, the problem associated with these reasons and less efficiency and loss the accuracy to detect object and one more problem is it will not provide clean information to blind people.

1.2 Solution to the problem

With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind people to navigate safely and independently. Also high-end technological solutions have been introduced recently to help blind persons navigate independently. In this project, an effort has been made to improve the quality of the system to be more helpful for the blind people. In this project, the system is has been made as a part of the blind person’s shoe. and in this project we are using ultra sonic sensor and speaker which provide more accuracy of object detection and given clean information to blind people respectively.
1.3 Proposed system

This project presents a prototype model and a system concept to provide a smart electronic aid for blind people. This system is intended to provide overall measures object detection, human detection, and real-time Assistance system consist of microcontroller, ultrasonic sensor and a smart phone (GSM Module) and vibratory circuit and Zigbee unit. This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the shoe. When the object is detected near to the shoe and if any person coming in front it alerts them with the help of vibratory circuit and also in advancement with help of speakers or head phones that is voice command with the help of android application. Here the power supply is main criteria the shoe is integrated with self-power generation unit such that there is no power backup problem.

1.4 Methodology

This project presents a prototype model and a system concept to provide a smart electronic aid for blind people. This system is intended to provide overall measures object detection, and real-time Assistance via Global Positioning System. The system consist of microcontroller, ultrasonic sensor and a smart phone (GSM Module) and vibratory circuit and Bluetooth unit. This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the shoe. When the object is detected near to the shoe and if any person coming in front it alerts them with the help of vibratory circuit and also in advancement with help of speakers or head phones that is voice command. Here the power supply is main criteria the shoe is integrated with self-power generation unit such that there is no power backup problem.
CHAPTER 2

LITERATURE SURVEY

Reference paper [1]: S.Gangwar (2013) designed a smart stick for blind which can give early warning of an obstacle using Infrared (IR) sensors. After identifying the obstacles, the stick alerts the visually impaired people using vibration signals. However the smart stick focused only for obstacle detection but it is not assisting for emergency purposes needed by the blind. And also the IR sensors are not really efficient enough because it can detect only the nearest obstacle in short distance.

Reference paper [2]: S.Chew (2012) proposed the smart white cane, called Blind spot that combines GPS technology, social networking and ultra-sonic sensors to help visually impaired people to navigate public spaces. The GPS detects the location of the obstacle and alerts the blind to avoid them hitting the obstacle using ultra-sonic sensors. But GPS did not show the efficiency in tracing the location of the obstacles since ultra-sonic tells the distance of the obstacle.

Reference paper [3]: Benjamin etal (2014) had developed a smart stick using laser sensors to detect the obstacles and down curbs. Obstacle detection was signalized by a high pitch “BEEP” using a microphone. The design of the laser cane is very simple and intuitive. The stick can only detect obstacle, but cannot provide cognitive and psychological support. There exists only beep sound that triggers any obstacle and there is no any assistance to direct them.

Reference paper [4]: Central Michigan University (2009) developed an electronic cane for blind people that would provide contextual information on the environment around the user. They used RFID chips which are implanted into street signs, store fronts, similar locations, and the cane reads those and feeds the information back to the user. The device also features an ultrasound sensor to help to detect objects ahead of the cane tip. The Smart Cane, which has an ultrasonic sensor mounted on it, is paired with a messenger-style bag that is worn across the shoulder. A speaker located on the bag strap voice alerts when an obstacle is detected and also directs the user to move in different direction.
**Reference paper [5]:** Mohd Helmy Abd Wahab and Amirul A. Talib et al. (2013) developed a cane that could communicate with users through voice alert and vibration signal. Ultrasonic sensors are used to detect obstacles in front, since ultrasonic sensors are good at detecting obstacles in a few meters range and this information will be sent in the form of voice signal. This voice signal is sent via speaker to the user. Here blind people might find it difficult in travelling without any emergency alert rather than having only ultrasonic sensors.

**Reference paper [6]:** Alejandro R. Garcia Ramirez and Renato Fonseca Livramento da Silva et al. (2012) designed an assistive technology device called the electronic long cane to serve as a mobility aid for blind and visually impaired people. The author implements the cane with an ergonomic design and an embedded electronic system, which fits inside the handle of a traditional long cane. The system was designed using haptic sensors to detect obstacles above the waistline. It works in such a way when an obstacle is detected; the cane vibrates or makes a sound. However, this system only detects obstacles above the waistline.

**Reference paper [7]:** Joao Jose, Miguel Farrajota, Joao M.F. Rodrigues (2013) designed a smart stick prototype. It was small in size, cheap and easily wearable navigation aid. This blind stick functions by addressing the global navigation for guiding the user to some destiny and local navigation for negotiating paths, sidewalks and corridors, even with avoidance of static as well as moving obstacles. Rather than that, they invented a stereo camera worn at chest height, a portable computer in a shoulder-strapped pouch or pocket and only one earphone or small speaker. The system is inconspicuous, and with no hindrance while walking with the cane. Also it does not block normal sound in the surroundings.

**Reference paper [8]:** Shruti Dambhare and A. Sakhare (2011) designed an artificial vision and object detection with real-time assistance via GPS to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them.
2.1 Summary

Blind and visually impaired people are at a disadvantage when they travel because they do not receive enough information about their location and orientation with respect to traffic and obstacles on the way and things that can easily be seen by people without visual disabilities. The conventional ways of guide dog and long can only help to avoid obstacles not to know what they are. Navigation system usually consist of three parts to help people travel with a greater degree of psychological comfort and independence sensing the immediate environment for obstacles and hazards, providing information about the location and orientation during travel. Today in market different technologies are used to navigate visually impaired people.

1) Guidance of dog: A specially trained dog assisting the blind in obstacle avoidance, but usually not aiding in way finding, e.g. the dog is trained to stop before obstacles, reacts to commands on walking directions. In spite of their great usefulness, guide dogs are a rarely used aid- only about 1% of the visually impaired use it. Advantage: Good in following familiar paths, good overall obstacle avoidance, trained for selective disobedience when sensing danger to his owner. Disadvantage: Very costly, guide dog service period in on average 6 years, regular dog up-keeping cost and lifestyle changes.

2) Human guide: A blind person walks hand in hand with a sighted guide. Advantage/Disadvantage: The most obvious, but in practice not a permanent solution for aiding the blind in mobility and navigation. A blind lacks privacy and can have a feeling of being a burden to his or her guide.

Over the years of human nature development and behavior pattern development shows that he sees, realizes, he understood. In case of blind person, it is painful that he cannot see but he tries to ask and get realization of locality and put it into memories when he moves around by sensing the noises and some pick point he understood the situation/locality. If by mistake he removes the kept memorized tag from his mind he cannot realize the locality and he got confused and has to ask his fellow or other moving persons for assistance.
Similar case is about direction finding for moving towards desired destiny. It clearly shows that any persons/whether impaired or not person keep memorizing the locality information and sense tags in to memory and recover it when they wants to moves around. Literature analysis shows that there are mainly four technologies and combinations are used to work in context with similar objective for blind personals. They are mainly as below:

(1) RFID information grid

(2) Mobile platform devices /sensors and Client server architectural systems and devices.

Let us discuss about above one by one

Since it uses geospatial satellites signals, to calculate the positional difference from satellite; the accuracy is quite in the range of 100m to 300m. For the person who is walking on the road can receive these signals, but for indoor it is very hard to receive the same. Also the accuracy required is not achievable; hence it is a void solution for blind person to use for navigating device. RFID information grid: RFID is radio frequency identification device. It holds unique information such as number or symbol or text etc. It is passive device which is energized by interrogators emf field.

To form a information grid the RFID tags are arranged in such a way that it could describe the longitudinal and latitudinal position. The searching device enquires about the positional information and sends it to server by sms. The server holds database with relational description of local position for reference send by sms. It search in database for same and broadcast it on FM which could be heard by the enquirer’s device. The big issue To Design RFID Based Cognition Device for Assistance to Blind and Visually Challenged Personal for Indoor Use in system is that the sms sending and delivering time.

Again the air calls traffic congestions. The personal device may work properly but server failure detection case cannot be solved. Hence addressed solution is more of problems than the solu0tion. The two three device on different location should work in tune with single fetched query make more dependable which is not viable. The same about remaining technological solutions more or less they are combinations of two or more type of technical mix hybrid device.
The RFID grid system with an RFID reader integrated into the user’s shoe and walking cane with Bluetooth connection to the user’s cell phone. Mobile Platform Devices: Mobility is one of the main problems encountered by the blind in their life. Overtime, blind and visually impaired people have used some methods and devices such as the long white cane and guide dog, to aid in mobility and to increase safe and independent travel.

Due to the development of modern technologies, many different types of devices are now known as electronic travel aids. Among these aids are sonic pathfinder, Mowat –Sensor and Guide cane which are called clear path indicators or obstacle detectors since the blind can only know whether there is an obstacle in the path ahead. These devices are used to search for obstacle in front of the blind person, and they operate in a manner similar to a flashlight, which has very narrow directivity.

Sonic-sensor since it has wide directivity enabling it to search for several obstacles at the same time. Portability, low cost, and above all simplicity of controls are most important factors which govern the practicality and user acceptance of such devices. The electronic travel aid (ETA) is a kind of portable device. Hence it should be a small sized and lightweight device to be proper for portability. The blind is not able to see the display panel, control buttons, or labels. Hence the device should be easy to control. No complex, control buttons, switches and display panel should be present. Moreover, the ETA device should be low –price to used by more blind persons.
CHAPTER-3

BLOCK DIAGRAM

3.1 Working Concept

This project is intended to be developed as tool or aid that will help blind people in moving or travelling. The dependency on others is reduced and these people can become more self-reliant.

The project is built around ARDUINO UNO controller. The project has features to detect obstacles using ultrasonic module and IR module in conjunction. These sensors are
mounted on the shoes of the blind person. The person is alerted and will information on the surroundings.

Zigbee module will inform the tracking person about the movement of the person who is wearing the shoe. Vibration is used to alert the blind person if there are any obstacles in his path.

Gyro sensor is used to detect whether the person is able to balance when he is walking. In case he is losing the balance the person is alerted.

3.2 Circuit Description

The project mainly consists of many important electronic components, and has the PIC Microcontroller. These main components are explained in brief followed by their internal working of the used components in the forthcoming sections. The circuit diagram consists of the following:

- Microcontroller ARDUINO UNO.
- Zigbee module interface.
- Vibration unit.
- GSM.
- Voice storage & voice reply.
- Ultrasonic distance measurement module.
- Gyroscope interface.
- Power supply.

3.3 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

• **Zigbee Module**

  Zigbee Module is used in this project so as to intercommunicate between the transmitter and receiver which is a wireless module.

• **GSM Module**

  GSM module is a mobile module that can be used and controlled by giving commands through its serial port. This command set is a standard AT command set. A SIM is used along with the module.

• **Vibration Sensor**

  The vibration sensor is used for testing the impact force. It has high vibration detection sensitivity and the environmental of sound signal suppression, which has strong ability to engage in interference.

• **LCD Module**

  LCD Module is an integral part of the project which is used in all the four modules for the display of information. LCD is 16X2 types. This is interfaced in 4-bit mode. The four data lines are connected to PORTE E0-E3 pins, E4 and E5 lines are connected to RS and EN pins of LCD.
• **LEDs**

As many as four LEDs have been provided on the Controller board. They can be used for several kinds of indications.

• **Power Supply**

Input the controller board is given by 12V dc adaptor. This 12V is used to drive the relays. A regulator IC 7805 is used to regulate voltage to +5V which is needed for powering the controller and other device used on the board.

• **Ultrasonic Module**

Ultrasonic Module is devices that use electrical–mechanical energy transformation to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along the direction of wave propagation through the medium. Apart from distance measurement, they are also used in ultrasonic material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc.

These sensors are categorized in two types according to their working phenomenon – piezoelectric sensors and electrostatic sensors. Here we are discussing the ultrasonic sensor using the piezoelectric principle. Piezoelectric ultrasonic sensors use a piezoelectric material to generate the ultrasonic waves.

![Ultrasonic Sensor](image.jpg)

*Figure 3.2: Ultrasonic Sensor*
An ultrasonic sensor consists of a transmitter and receiver which are available as separate units or embedded together as single unit. The above image shows the ultrasonic transmitter and receiver.

*Figure 3.3: Working of Ultrasonic Sensor*

**Working Principle of ultrasonic sensor**

Ultrasonic sensors for outdoors use are sealed to protect them from dew, rain and dust. Piezoelectric ceramics are attached to the top inside of the metal case. The entrance of the case is covered with resin.
For use in industrial robots, accuracy as precise as mm and acute radiation are required. By flexure vibration of the conventional vibrator, no practical characteristics can be obtained in frequencies higher than 70 kHz and, therefore, vertical thickness vibration mode of piezoelectric ceramics is utilized for detection in high frequency. In this case, the matching of acoustic impedances of the piezoelectric ceramics and air becomes important. Acoustic impedance of piezoelectric ceramics is $2.6 \times 0.7 \text{kg/m}^2\text{s}$, while that of air is $4.3 \times 0.2 \text{kg/m}^2\text{s}$. This difference of 5 powers causes large loss on the vibration radiating surface of the piezoelectric ceramics. Matching the acoustic impedances with air is performed by bonding a special material to the piezoelectric ceramics as an acoustic matching layer. This construction enables the ultrasonic sensor to work in frequencies of up to several hundred kHz.
Figure 3.5: Construction of High Frequency Ultrasonic Sensors
• Hardware And Software Architecture Zigbee Module

Figure 3.6: Zigbee Module

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. ZigBee is the set of specs built around the IEEE 802.15.4 wireless protocol. The IEEE is the Institute of Electrical and Electronics Engineers, a non-profit organization dedicated to furthering technology involving electronics and electronic devices. The 802 group is the section of the IEEE involved in network operations and technologies, including mid-sized networks and local networks. Group 15 deals specifically with wireless networking technologies, and includes the now ubiquitous 802.15.1 working group, which is also known as Bluetooth. The standard itself is regulated by a group known as the ZigBee Alliance, with over 150 members worldwide.

While Bluetooth focuses on connectivity between large packet user devices, such as laptops, phones, and major peripherals, ZigBee is designed to provide highly efficient connectivity between small packet devices. As a result of its simplified operations, which are one to two full orders of magnitude less complex than a comparable Bluetooth device, pricing for these devices is extremely competitive, with full nodes available for a fraction of the cost of a Bluetooth node. They are also actively limited to a through-rate of 250 Kbps,
compared to the much larger pipeline of 1 Mbps for Bluetooth®, and operate on the
2.4 GHz ISM band, which is available throughout most of the world. There are three
different ZigBee device types that operate on these layers in any self-organizing application
network.

These devices have 64-bit IEEE addresses, with option to enable shorter addresses to
reduce packet size, and work in either of two addressing modes – star and peer-to-peer.

1. The ZigBee coordinator node: There is one, and only one, ZigBee coordinator in
each network to act as the router to other networks, and can be likened to the root of a
(network) tree. It is designed to store information about the network.

2. The full function device FFD: The FFD is an intermediary router transmitting
data from other devices. It needs lesser memory than the ZigBee coordinator node, and
entails lesser manufacturing costs. It can operate in all topologies and can act as a
 coordinator.

3. The reduced function device RFD: This device is just capable of talking in the
network; it cannot relay data from other devices. Requiring even less memory, (no flash, very
little ROM and RAM), an RFD will thus be cheaper than an FFD. This device talks only to a
network coordinator and can be implemented very simply in star topology.

These features are enabled by the following characteristics (technical data from)

✓ 2.4GHz and 868/915 MHz dual PHY modes. This represents three license-free
bands: 2.4-2.4835 GHz, 868-870 MHz and 902-928 MHz. The number of channels
allotted to each frequency band is fixed at sixteen (numbered 11-26), one
(numbered 0) and ten (numbered 1-10) respectively. The higher frequency band is
applicable worldwide, and the lower band in the areas of North America, Europe,
Australia and New Zealand.

✓ Low power consumption, with battery life ranging from months to years.
Considering the number of devices with remotes in use at present, it is easy to see
that more numbers of batteries need to be provisioned every so often, entailing
regular (as well as timely), recurring expenditure. In the ZigBee standard, longer battery life is achievable by either of two means: continuous network connection and slow but sure battery drain, or intermittent connection and even slower battery drain.

- Maximum data rates allowed for each of these frequency bands are fixed as 250 kbps @2.4 GHz, 40 kbps @ 915 MHz, and 20 kbps @868 MHz.
- High throughput and low latency for low duty-cycle applications (<0.1%).
- Channel access using Carrier Sense Multiple Access with Collision Avoidance (CSMA - CA).
- Addressing space of up to 64 bit IEEE address devices, 65,535 networks.
- 50m typical range.
- Fully reliable “hand-shaked” data transfer protocol.
- Different topologies as illustrated below: star, peer-to-peer, mesh.

- Zigbee V/s Bluetooth

The “Why ZigBee” question has always had an implied, but never quite worded follower phrase “when there is Bluetooth”. A comparative study of the two can be found in ZigBee: 'Wireless Control That Simply Works’.

The bandwidth of Bluetooth is 1 Mbps; ZigBee's is one-fourth of this value. The strength of Bluetooth lies in its ability to allow interoperability and replacement of cables, ZigBee's, of course, is low costs and long battery life.

In terms of protocol stack size, ZigBee's 32 KB is about one-third of the stack size necessary in other wireless technologies (for limited capability end devices, the stack size is as low as 4 KB).
Most important in any meaningful comparison are the diverse application areas of all the different wireless technologies. Bluetooth is meant for such target areas as wireless USB’s, handsets and headsets, whereas ZigBee is meant to cater to the sensors and remote controls market and other battery operated products.

In short, it may be said that they are neither complementary standards nor competitors, but just essential standards for different targeted applications. The earlier Bluetooth targets interfaces between PDA and other device (mobile phone / printer etc) and cordless audio applications.

The IEEE 802.15.4–based ZigBee is designed for remote controls and sensors, which are very many in number, but need only small data packets and, mainly, extremely low power consumption for (long) life. Therefore they are naturally different in their approach to their respective application arenas.

- **GSM/GPS Module**

  GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two different streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

  GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

  There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.
Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries. SIM cards (Subscriber Identity Module) holding home network access configurations may be switched to those will meter local access, significantly reducing roaming costs while experiencing no reductions in service.

GSM, together with other technologies, is part of the evolution of wireless mobile telecommunications that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio System (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS).

TDMA technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64kbps to 120Mbps of data rate.

Features of GSM Module:

- Improved spectrum efficiency.
- International roaming.
- Compatibility with integrated services digital network (ISDN).
- Support for new services.
- SIM phonebook management.
- Fixed dialing number (FDN).
- Real time clock with alarm management.
- High-quality speech.
- Uses encryption to make phone calls more secure.
- Short message service (SMS).

In this Project, Fibocom G610 has been used. FIBOCOM G610 modules are designed based on the application traits of portable products. They have low power consumption, are small in size, and they adopt LCC package. Connectors are omitted for the convenience of bulk processing, thus helping customers reduces the total cost of terminals systematically.
The G610 module supports GSM/GPRS 850/900/1800/1900 MHz. It has a built-in TCP/IP protocol stack and a reliable GPRS data connection. The AT instruction set and G600 are both fully compatible. Numerous extended interfaces such as I2C and definable GPIO can be easily integrated with peripheral equipment and the design of products is simpler and more flexible.

The G610 module meets industrial-grade demands and its production and manufacturing fully conform to ISO/TS16949 certification. It can adapt to severe working environments with high temperatures, high humidity, and electromagnetic interference.

The combination of extremely compact design and broader temperature range has made the G610 the ideal choice for portable products in the field of M2M technology applications, such as personal location and tracking, vehicle team management, handheld devices, environment monitoring, and remote medical services.

GSM, here uses the network to send the emergency SMS automatically which will be controlled by the Microcontroller.

- **Vibration Sensor**

  The vibration sensor is used for testing the impact force. It has high vibration detection sensitivity and the environmental of sound signal suppression, which has strong ability to engage in interference.

![Figure 3.7: Vibration Sensor](image)
Operation of Vibration Sensor

It works on electromechanical principle vibration velocity sensors operate in accordance with the electro dynamic principle and are used for measuring the bearing absolute vibration based on the peizo-electric effect. Change in resistance due to the force acting on it and convert it into 4 - 20 mA. They're measuring differences in oscillation, so they probably want a -12 and +12swing with 0 as the base line and we have piezoelectric sensor which detects the vibration created on the surface. We can also use shock sensor to detect vibrations.

Accelerometers for the measurement of acceleration, shock or vibration come in many types using different principles of operation.

Inside a piezoelectric version, the sensing element is a crystal which has the property of emitting a charge when subjected to a compressive force.

In the accelerometer, this crystal is bonded to a mass such that when the accelerometer is subjected to a 'g' force, the mass compresses the crystal which emits a signal. This signal value can be related to the imposed 'g' force.

The sensing element is housed in a suitable sensor body to withstand the environmental conditions of the particular application. Body is usually made in stainless steel with welding of the various parts to prevent the ingress of dust, water, etc.

Electrical connection can be via a sealed cable or a plug/socket arrangement. Many present accelerometers have internal electronic circuitry to give outputs which can be directed used by the associated acquisition or control systems.

Mechanical fixing of the sensor is important in order to achieve true transfer of the vibration or acceleration. Many fixing methods are used including beeswax, hard glues, and threaded stud (male or female), magnetic mounts.

Accelerometers are used in many scientific and industrial applications such as predictive maintenance, aerospace, automotive, medical, process control, etc.
• **Piezoelectric sensor**

![Piezoelectric sensor](image)

*Figure 3.8: Piezoelectric sensor*

Although piezo pressure sensors are primarily recommended for dynamic pressure measurements, some quartz pressure sensors have long discharge time constants that extend low-frequency capability to permit static calibration and measurement of quasi-static pressures over a period of a few seconds. Virtually all sensors are provided with an individual NIST-traceable calibration certificate. Dynamic pressure calibrators are available for our customers who prefer the convenience of on-site recalibration of their sensors.

Piezo pressure sensors may be categorized as either charge mode or ICP® voltage mode output. Charge mode sensors are generally used for higher temperature applications above 275° F. They generate a high-impedance charge signal (pC/psi) that couples to readout instruments through a low-noise cable and charge amplifier. The charge amplifier serves to convert the sensor’s high-impedance charge output signal to a usable low-impedance voltage.
signal, normalize the signal, and provide for gain, ranging, and filtering. High-impedance charge mode systems must be kept very clean. Consequently, they do not operate well in applications requiring long input cables in factory, field, outdoor, or humid environments. The more popular Integrated Circuit Piezoelectric (ICP) voltage mode sensors incorporate a built-in microelectronic signal conditioner and output a low-impedance voltage signal (mV/psi). ICP sensors operate from a low-cost, constant-current signal conditioner or may connect directly to a readout instrument with a built-in constant-current source.

![Diagram of Typical ICP Sensor System](image)

![Diagram of Typical High Impedance Charge System](image)

*Figure 3.9: Typical ICP sensor system and Typical High impedance Charge system*
• **Transistor Driver Circuit**

As shown in the schematic, the transistor acts like a switch. When the output from the Microcontroller is logic low, the transistor acts like an open switch and buzzer will be disabled. When the output from the Microcontroller is logic high, the transistor acts like a closed switch and buzzer will be enabled indicating the fault or emergency condition.

• **LCD**

Liquid Crystal Display abbreviated as LCD constitutes as one of the important parts in this project. Basically LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. It is very helpful in providing user interface as well as for debugging purposes. A liquid crystal display (LCD) is a flat panel display that uses the light modulating properties of liquid crystals (LCs). LCD Modules can present textual information to the user.

The liquid-crystal display has the distinct advantage of having low power consumption than the LED. It is typically of the order of microwatts for the display in comparison to the some order of milli watts for LEDs. Low power consumption requirement has made it compatible with MOS integrated logic circuit. Its other advantages are its low cost, and good contrast. The main drawbacks of LCDs are additional requirement of light source, a limited temperature range of operation (between 0 and 60°C), low reliability, short operating life, poor visibility in low ambient lighting, slow speed, and the need for an ac drive.

Simple facts that should be considered while making an LCD:

1. The basic structure of LCD should be controlled by changing the applied current.
2. We must use a polarized light.
3. Liquid crystal should be able to control both of the operation to transmit or can also able to change the polarized light.

In this project, 2X16 character LCD has been intended to use. The LCD shows the total length manufactured per machine and other such parameters. For every node, LCD is to be placed to display the same.
Figure 3.10: Interfacing LCD with the Microcontroller

Figure 3.10 shows the LCD interfacing to the PIC Microcontroller. Here 8/4-bit data lines can be used to send the data from microcontroller to the LCD. If 4-bit data is been used, then rest 4 data lines will be not connected or connected to ground. The data will be sent in form of nibble at a time for processing. Depending on the requirement, the data can be read or written into the LCD.
- **Power Source**

![Circuit Diagram](image-url)

*Figure 3.11: Circuit of power adapter*

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage (no frequency) with the amplitude of +5V and +12V for various applications.

In this section we have Transformer, Bridge rectifier, are connected serially and voltage regulators for +5V and +12V (7805 and 7812) via a capacitor (1000µF) in parallel are connected parallel as shown in the circuit diagram below. Each voltage regulator output is again is connected to the capacitors of values (100µF, 10µF, 1 µF, 0.1 µF) are connected
parallel through which the corresponding output (+5V or +12V) are taken into consideration.

- **Voice storage and voice replay**

  Today’s consumers demand the best in audio/voice. They want crystal-clear sound wherever they are in whatever format they want to use. APLUS delivers the technology to enhance a listener’s audio/voice experience.

  The aPR33A series are powerful audio processor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The aPR33A series are a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing and analog output functionality. The aPR33A series incorporates all the functionality required to perform demanding audio/voice applications. High quality audio/voice systems with lower bill-of-material costs can be implemented with the aPR33A series because of its integrated analog data converters and full suite of quality-enhancing features such as sample-rate convertor.

  The aPR33A series C2.0 is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch. It is suitable in simple interface or need to limit the length of single message, e.g. toys, leave messages system, answering machine etc. Meanwhile, this mode provides the power-management system. Users can let the chip enter power-down mode when unused. It can effectively reduce electric current consuming to 15μA and increase the using time in any projects powered by batteries.
Figure 3.12: pin details of aPR33A

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6 / MSEL0</td>
<td>1</td>
</tr>
<tr>
<td>M7 / MSEL1</td>
<td>2</td>
</tr>
<tr>
<td>M4</td>
<td>3</td>
</tr>
<tr>
<td>M5</td>
<td>4</td>
</tr>
<tr>
<td>VSSP</td>
<td>5</td>
</tr>
<tr>
<td>V0UT2</td>
<td>6</td>
</tr>
<tr>
<td>V0UT1</td>
<td>7</td>
</tr>
<tr>
<td>VDDP</td>
<td>8</td>
</tr>
<tr>
<td>M3</td>
<td>9</td>
</tr>
<tr>
<td>VDD</td>
<td>10</td>
</tr>
<tr>
<td>VSSL</td>
<td>11</td>
</tr>
<tr>
<td>REC</td>
<td>12</td>
</tr>
<tr>
<td>M0</td>
<td>13</td>
</tr>
<tr>
<td>M1</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>23</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td>21</td>
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<tr>
<td></td>
<td>20</td>
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<tr>
<td></td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>
FEATURES:

- Operating Voltage Range: 3V ~ 6.5V
- Single Chip, High Quality Audio/Voice Recording & Playback Solution
  - No External ICs Required
  - Minimum External Components
  - User Friendly, Easy to Use Operation
  - Programming & Development Systems Not Required
- Powerful 16-Bits Digital Audio Processor.
- Nonvolatile Flash Memory Technology
  - No Battery Backup Required
- External Reset pin.
- Powerful Power Management Unit
  - Very Low Standby Current: 1uA
  - Low Power-Down Current: 15uA
  - Supports Power-Down Mode for Power Saving
- Built-in Audio-Recording Microphone Amplifier
  - No External OPAMP or BJT Required
  - Easy to PCB layout
- Configurable analog interface
  - Differential-ended MIC pre-amp for Low Noise
  - High Quality Line Receiver
- High Quality Analog to Digital and PWM module
  - Resolution up to 16-bits
- Simple And Direct User Interface
- Averagely 1,2,4 or 8 voice messages record & playback
### PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin Names</th>
<th>Pin No</th>
<th>TYPE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDDP</td>
<td>8</td>
<td></td>
<td>Positive power supply.</td>
</tr>
<tr>
<td>VDD</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDDA</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDDL</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSSP</td>
<td>5</td>
<td></td>
<td>Power ground.</td>
</tr>
<tr>
<td>VSSL</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSSA</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDDO</td>
<td>25</td>
<td>INPUT</td>
<td>Internal LDO output.</td>
</tr>
<tr>
<td>VCORE</td>
<td>16</td>
<td></td>
<td>Positive power supply for core.</td>
</tr>
<tr>
<td>VREF</td>
<td>19</td>
<td></td>
<td>Reference voltage.</td>
</tr>
<tr>
<td>VCM</td>
<td>20</td>
<td></td>
<td>Common mode voltage.</td>
</tr>
<tr>
<td>Rosc</td>
<td>26</td>
<td>INPUT</td>
<td>Oscillator resistor input.</td>
</tr>
<tr>
<td>RSTB</td>
<td>27</td>
<td>INPUT</td>
<td>Reset. (Low active)</td>
</tr>
<tr>
<td>SRSTB</td>
<td>28</td>
<td>INPUT</td>
<td>System reset, pull-down a resistor to the VSSL.</td>
</tr>
<tr>
<td>MIC+</td>
<td>21</td>
<td>INPUT</td>
<td>Microphone differential input.</td>
</tr>
<tr>
<td>MIC-</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MICG</td>
<td>23</td>
<td>OUTPUT</td>
<td>Microphone ground.</td>
</tr>
<tr>
<td>VOUT2</td>
<td>6</td>
<td>OUTPUT</td>
<td>PWM output to drive speaker directly.</td>
</tr>
<tr>
<td>VOUT1</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/REC</td>
<td>12</td>
<td>INPUT</td>
<td>Record Mode. (Low active)</td>
</tr>
<tr>
<td>M0</td>
<td>13</td>
<td>INPUT</td>
<td>Message-0.</td>
</tr>
<tr>
<td>M1</td>
<td>14</td>
<td>INPUT</td>
<td>Message-1.</td>
</tr>
<tr>
<td>M2</td>
<td>15</td>
<td>INPUT</td>
<td>Message-2.</td>
</tr>
<tr>
<td>M3</td>
<td>9</td>
<td>INPUT</td>
<td>Message-3.</td>
</tr>
<tr>
<td>M4</td>
<td>3</td>
<td>INPUT</td>
<td>Message-4.</td>
</tr>
<tr>
<td>M5</td>
<td>4</td>
<td>INPUT</td>
<td>Message-5.</td>
</tr>
<tr>
<td>M6 / MSEL0</td>
<td>1</td>
<td>INPUT</td>
<td>Message-6, Message select 0.</td>
</tr>
<tr>
<td>M7 / MSEL1</td>
<td>2</td>
<td>INPUT</td>
<td>Message-7, Message select 1.</td>
</tr>
</tbody>
</table>
RECORD MESSAGE

During the /REC pin drove to VIL, chip in the record mode. When the message pin (M0, M1, M2 … M7) drove to VIL in record mode, the chip will playback “beep” tone and message record starting. The message record will continue until message pin released or full of this message, and the chip will playback “beep” tone 2 times to indicate the message record finished. If the message already exist and user record again, the old one’s message will be replaced. The following fig. showed a typical record circuit for 8-message mode. We connected a slide-switch between /REC pin and VSS, and connected 8 tact-switches between M0 ~ M7 pin and VSS. When the slide-switch fixed in VSS side and any tact-switch will be pressed, chip will start message record and until the user releases the tact-switch. After reset, /REC and M0 to M7 pin will be pull-up to VDD by internal resistor.

*Figure 3.13: Circuit for Recording Message*
- **PLAYBACK MESSAGE**

  During the /REC pin drove to VIH, chip in the playback mode. When the message pin (M0, M1, M2 … M7) drove from VIH to VIL in playback mode, the message playback starting. The message playback will continue until message pin drove from VIH to VIL again or end of this message. The following fig. showed a typical playback circuit for 8-message mode. We connected a slide-switch between /REC and VSS, and connected 8 tact-switches between M0 ~ M7 and VSS. When the slide-switch fixed in float side and any tact-switch will be pressed, chip will start message playback and until the user pressed the tact-switch again or end of message. After reset, /REC and M0 to M7 pin will be pull-up to VDD by internal resistor.

![Circuit for Playback Message](image)

**Figure 3.14: Circuit for Playback Message**
- **VOICE INPUT**

The aPR33A series supported single channel voice input by microphone or line-in. The following fig. showed circuit for different input methods: microphone, line-in and mixture of both.

![Circuit Diagram](image)

*Figure 3.15: (A) Microphone*
Figure 3.16: (B) Line-In

Figure 3.17: (C) Microphone + Line-In
CHAPTER-4

SYSTEM REQUIREMENTS

4.1 Hardware requirements

- Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

![Arduino UNO Board](image_url)

*Figure 4.1: ARDUINO UNO Board*
"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and VIN pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V** the regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND** Ground pins.

The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the boot loader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).
The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required.

![Arduino Uno Pin Diagram](image)

*Figure 4.2: ARDUINO UNO PIN Diagram*

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected
computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nano farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the boot loader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

➢ Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and VIN pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable.

If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows: VIN. The input voltage
to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. +5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7-12V), the USB connector (5V), or the VIN pin of the board (7-12V).

Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA. GND. Ground pins.

➤ AVR Architecture

Microcontroller ATmega328 Operating Voltage 5V Input Voltage (recommended) 7-12V Input Voltage (limits) 6-20V Digital I/O Pins 14 (of which 6 provide PWM output) Analog Input Pins 6 DC Current per I/O Pin 40 mA DC Current for 3.3V Pin 50 mA Flash Memory 32 KB of which 0.5 KB used by boot loader SRAM 2 KB EEPROM 1 KB Clock Speed 16 MHz

The 16-bit dsPIC30F Digital Signal Controller (DSC) is Microchip’s newest and most advanced processor family. The dsPIC30F is an advanced 16-bit processor that offers true DSP capability with the fundamental real-time control capabilities of a microcontroller.
Figure 4.3: AVR Architecture
Memory

The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode, digital Write, and digital Read functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 ohms. In addition, some pins have specialized functions:

- **Serial**: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
  1. **External Interrupts**: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt function for details.
  2. **PWM**: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write function.
- **SPI**: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- **LED**: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (that is 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference function. Additionally, some pins have specialized functionality:

- **TWI**: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library. There are a couple of other pins on the board: AREF. Reference voltage for the analog inputs. Used with analog Reference, Reset.

  Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board. See also the mapping between Arduino pins and ATmega328 ports. The mapping for the Atmega8, 168, and 328 is identical.


Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .info file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Programming

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno" from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno comes pre-burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by. On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and
Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU boot loader). See this user-contributed tutorial for more information.

- **Automatic (Software) Reset**

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the boot loader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications.

When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

- **USB Over current Protection**

The Arduino Uno has a resettable poly fuse that protects your computer's USB ports from shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.
Physical Characteristics

The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16”), not an even multiple of the 100 mil spacing of the other pins.

4.2 Software requirements

- Proteus.
- HyperTerminal.
- Arduino IDE software.

PROTEUS

Proteus 8.0 represents over three years continuous development and includes improvements to every area of the software suite. Major work on the application framework together with the introduction of a common database provides a much smoother workflow for users while the rich new feature set saves time and effort in the design lifecycle. A demonstration version can be downloaded directly from the Lab centre website and you can then either watch getting started movies from the application home page or access the tutorial documentation for evaluation.

Overview

The main theme of the Proteus 8 release is integration. Development has therefore been focused on taking the various discrete parts of an electronic design and coupling them together to achieve a better workflow. In order to achieve this, three major architectural changes were necessary: a unified application framework, a common database and a live net list.
➢ **The Application Framework**

Proteus 8 consists of a single application with many modules (ISIS, BOM, ARES, 3D Viewer, etc.). Modules open in tabs within the application window but can then be dragged and dropped to create additional windows and enable side-by-side viewing.

This allows you to not only work with ISIS and ARES in the design phase as you did in previous versions but also to split off other modules according to the work you are doing at a particular time. For example, ISIS and VSM Studio for debugging, ISIS and BOM for report generation, ARES and 3D Viewer for verification and so on.

➢ **Common Database & Live Net listing**

The common database and live net listing features provide system wide access to the properties of the parts and the connectivity between them. Features like pin swap, gate swap and annotation are both automatic and bi-directional between schematic and PCB and connectivity changes on the schematic can be automatically reflected in any other module (BOM, Design Explorer, ARES). These features also lay the foundation for a number of development projects such as design snippets which we plan to bring forth during the lifetime of Proteus 8. Proteus 8 stores the design (DSN), layout (LYT) and common database in a single project file (PDSPRJ).
➢ **HYPERTERMINAL**

  **Connecting to the meter**

  ➢ From the Windows Start

  ![Figure 4.4: Snapshot of RUN](image)

  Menu on the lower left side of your computer screen,

  Choose Run... and type the word telnet. Click OK.

  ➢ Type Open and press Return.

  ➢ Type in the meter IP address when prompted and press Enter.
Type your meter’s login and press Enter. See below for details

![Figure 4.5: Snapshot of IP address]

Connecting to the meter using HyperTerminal

- If you have not already done so, set the COM port you are using on the meter to “Factory”
- Launch HyperTerminal from the Start > Programs > Accessories > Communications > Hyper Terminal menu.
- A window requesting a modem install appears. If you wish to install a modem, click yes and follow the steps. If you do not need to install a modem, click no. The Connect Description window appears. Type in the name for this HyperTerminal session in the Name Box. Press Enter. The Connect To window appears.
Figure 4.6: Connection Description

- In the Connect Using box, select your PC COM port (e.g. COM1). Press Enter. The COM1 Properties window appears.
- In the Bits per Second box, select 9600.
- In the Flow Control box, select none.
- For the other settings, use the defaults. The COM Properties window should resemble the window below.
Figure 4.7: Communication Port

- Press Enter. A HyperTerminal session window appears
- Press Enter. A response indicating an “invalid command” appears. Below this there is a prompt that indicates the meter type and the PC port where the meter is connected.
- Type “?” and press Enter for the Terminal menu.

As you toggle between the different Terminal Commands menu options you are required to enter

- Login - see “Meter Logins” on page 3.
- Password - type the meter password (default is “0”).
**ARDUINO IDE SOFTWARE**

**Reading a Potentiometer (analog input)**

A potentiometer is a simple knob that provides a variable resistance, which we can read into the Arduino board as an analog value. In this example, that value controls the rate at which an LED blinks.

We connect three wires to the Arduino board. The first goes to ground from one of the outer pins of the potentiometer. The second goes from 5 volts to the other outer pin of the potentiometer. The third goes from analog input 2 to the middle pin of the potentiometer.

By turning the shaft of the potentiometer, we change the amount of resistance on either side of the wiper which is connected to the center pin of the potentiometer. This changes the relative "closeness" of that pin to 5 volts and ground, giving us a different analog input. When the shaft is turned all the way in one direction, there are 0 volts going to the pin, and we read 0. When the shaft is turned all the way in the other direction, there are 5 volts going to the pin and we read 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.

**Examples**

Analog Read to LED

* Turns on and off a light emitting diode (LED) connected to digital
* pin 13. The amount of time the LED will be on and off depends on
* The value obtained by analog Read(). In the easiest case we connect
* A potentiometer to analog pin 2.
* Created 1 December 2005

int potPin = 2; // select the input pin for the potentiometer
int ledPin = 13; // select the pin for the LED
int val = 0; // variable to store the value coming from the sensor

void setup() { pinMode(ledPin, OUTPUT); // declare the ledPin as an OUTPUT }

void loop() { val = analogRead(potPin); // read the value from the sensor }
digitalWrite(ledPin, HIGH); // turn the ledPin on

delay(val);                // stop the program for some time

digitalWrite(ledPin, LOW);  // turn the

ledPin off  delay(val);    // stop the program for some time

*Figure 4.8: Program Developed Snapshot*
CHAPTER 5

SYSTEM DESIGN AND IMPLEMENTATION

5.1 Hardware design

Figure 5.1: Circuit Diagram
This project is intended to be developed as tool or aid that will help blind people in moving or travelling. The dependency on others is reduced and these people can become more self-element.

The project is built around ARDUINO UNO controller. The project has features to detect obstacles using ultrasonic module. These sensors are mounted on the shoes of the blind person. The person is alerted and will information on the surroundings.

Zigbee module will inform the tracking person about the movement of the person who is wearing the shoe. Vibration is used to alert the blind person if there are any obstacles in his path.

Gyro sensor is used to detect whether the person is able to balance when he is waling. Inc case he is losing the balance the person is alerted.

The project mainly consists of many important electronic components, and has the PIC Microcontroller. These main components are explained in brief followed by their internal working of the used components in the forthcoming sections. The circuit diagram consists of the following:

- Microcontroller ARDUINO UNO.
- Zigbee module interface.
- Vibration unit.
- GSM.
- Voice storage & voice reply.
- Ultrasonic distance measurement module.
- Gyroscope interface.
- Power supply.

Input the controller board is given by 12V dc adaptor. This 12V is used to drive the relays. A regulator IC 7805 is used to regulate voltage to +5V which are needed for powering the controller and other device used on the boar
5.2 Flow chart

![System flow diagram](image)

*Figure 5.2: System flow diagram*
5.2 Pin details

- Pin number A0 = connected to straight audio card.
- Pin number A1 = connected to straight audio card.
- Pin number A2 = connected to straight audio card.
- Pin number A3 = connected to straight audio card.
- Pin number A4 = connected to straight audio card.
- Pin number A5 = connected to left audio card.
- Pin number 0   = connected to left audio card.
- Pin number 1   = connected to left audio card.
- Pin number 2   = connected to power to the vibratory sensor.
- Pin number 3   = connected to output to the vibratory sensor.
- Pin number 4   = connected to trigger to the ultrasonic sensor.
- Pin number 5   = connected to echo to the ultrasonic sensor.
- Pin number 6   = connected to trigger to the ultrasonic sensor.
- Pin number 7   = connected to echo to the ultrasonic sensor.
- Pin number 8   = connected to Tx to the GSM.
- Pin number 9   = connected to Rx to the GSM.
- Pin number 10  = connected to Tx to the GSM.
CHAPTER 6

EXPERIMENTAL RESULTS

<table>
<thead>
<tr>
<th>Distance (from the shoe in cms)</th>
<th>Type of signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 to 300</td>
<td>Very slow Audio</td>
</tr>
<tr>
<td>250 to 200</td>
<td>Slow Audio</td>
</tr>
<tr>
<td>150 to 100</td>
<td>Audio + vibration</td>
</tr>
<tr>
<td>30 to 20</td>
<td>Fast Audio + vibration</td>
</tr>
</tbody>
</table>

Table 6.1 Test case
Figure 6.1: Prototype of SMART SHOE

The figure 6.1 shows the prototype of “SMART SHOE”, which is going to be weared by the blind persons, and the prototype consists of as follows;

- Ultrasonic Sensor.
- Vibrating Sensor.
- ARDUINO UNO.
- Audio playback device.
- Speaker.
- Water detector.
- GSM.
- GPS.
- Headset.
- Power Adopter.
- Power generation unit.
CHAPTER 7

ADVANTAGES AND LIMITATIONS

1) Low design time.

2) Low production cost.

3) This system is applicable for both the indoor and outdoor environment.

4) It is dynamic system.

5) Less space.

7) Low power consumption.
CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

8.1 CONCLUSION

We would like to conclude that the proposed system completed successfully. As we stated earlier in a problem statement, the previous problem like a less information conveyed, poor efficiency of IR sensor and dependency on stick are overcome and successfully implemented with efficiency of object detection and with a clear information to a blind people for their guidelines.

Hence, it can be concluded that this project is able to play a great contribution to the state of the art and will play a great role to assist the blinds to walk easily.

8.2 FUTURE ENHANCEMENT

Future work will be focused on enhancing the performance of the system and reducing the load on the user by adding the camera to guide the blind exactly. Images acquired by using web camera and NI-smart cameras helps in identification of objects as well as scan the entire instances for the presence of number of objects in the path of the blind person. It can also detect the material and shape of the object. Matching percentage has to be nearly all the time correct as there no chance for correction for a blind person if it is to be trusted and reliable one. The principles of mono pulse radar can be utilized for determining long range target objects. The other scope may include a new concept of optimum and safe path detection based on neural networks for a blind person.
BIBLIOGRAPHY


