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# A Novel Cell Phone Designed For Blind Along With Voice Based Guidance and Location Indication

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**ABSTRACT:** Blind people face tremendous challenges daily in accessing information while on the move or for matter in communicating with world around them. In order to achieve this challenging task we, in this paper propose a novel cell phone which is designed for blind and is used for managing incoming and outgoing calls, sending and receiving SMS, detect obstacles while on move and indicate the location coordinates of the blind. The call can be made by pressing a key on the Braille keypad which is assigned with a specific contact number in the phone book. The messages are typed into Braille keypad and are processed by microcontroller which converts the Braille letters to English alphabets using the look up table then this SMS is sent via GSM. The voice playback unit provides an audio version of the received SMS. When an emergency switch is pressed the location of the blind is provided via GPS and the GSM will forward this information to the pre fed mobile number stored in the phone book. When the object is detected near to the blind the ultrasonic sensor sends signal to voice playback unit.

**KEYWORDS:** Braille keypad, Ultrasonic Sensor, GSM, GPS, AT Commands, Microcontroller

## I. INTRODUCTION

Visually impaired people with reduced vision or no vision at all face difficulties in carrying out day to day activities such as navigating streets, crossing roads, detecting obstacles while on move, feeling unhealthy when they are self-navigating outside well-known environments or during emergency condition communicating with their family or friends to know about their location are some of the daunting task which hamper their confidence and self esteem to a great extent. The statistics by the World Health Organization (WHO) estimates that there are 285 million people are estimated to be visually impaired worldwide: 39 million are blind and 246 have low vision. About 90% of the world's visually impaired live in low-income settings.82% of people living with blindness are aged 50 and above. Globally, uncorrected refractive errors are the main cause of moderate and severe visual impairment cataracts remain the leading cause of blindness in middle- and low-income countries [1]. Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Visually impaired people generally use either the typical white cane or the guide dog to travel independently [2].

Mobile Cell-phones are already available in the market but they are not user friendly for visually impaired people. The existing cell phone technology poses a challenge for blind people, for example a blind person cannot read the SMS sent to him/her. So it is required to develop a sophisticated communication tools specially designed for the visually impaired community to communicate, connect and socialize without vision by enabling the blind to accomplish important tasks with just their sound and touch.

## II. RELATED WORK

To enhance the means that assist blind persons to navigate quickly and safely in unfamiliar environment different technologies like GPS, RFID, Ultrasonic, Laser and GSM were introduced. The guidance system based on ultrasonic

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sensors to aid visually impaired people to cross a road easily and safely. A computer processes ultrasonic signals emitted by a transmitter, which is carried by the impaired user, and provides real-time information on the direction and distance to keep user on the correct track. Instead of time of flight, the system estimates user position by the order of received ultrasonic signals at multiple receivers. Radio transmission is then used to provide guidance information to the user by using of two vibrators that act as tactile feedback. Experimental results are presented to discuss feasibility of this method [3].

Blind people need to become as independent as possible in their daily life in order to guarantee a fully social inclusion. Mobility means the possibility of freely moving, without support of any accompanying person, at home, in public and private buildings, and in open spaces, as the streets of the town. Mobile and wireless technologies, and in particular the ones used to locate persons or objects, can be used to realize navigation systems in an intelligent environment. Such systems open new opportunities to improve the speed, easiness, and safety of the visually impaired person's mobility. Using these technologies together with Text To Speech systems and a mobile-based database the authors developed a cost effective, easy-to-use orientation and navigation system: Radio Virgilio/SesamoNet[1]. The cost effectiveness is due to the recovery of RFID identity tags from cattle slaughtering: these tags are then borrowed to create a grid used for navigation. In this paper the results of a usability analysis of this guide system are presented. A preliminary experiment involving a small group of experts and a blind person is described. In order to evaluate the usability, three cognitive walkthrough sessions have been done to discuss the system's basic functionality and to highlight the most critical aspects to be modified [4].

## III. PROPOSED DESIGN

The proposed design consists of the following components:

- Microcontroller (Arduino Atmega8)
- Braille key pad
- Voice playback module(APR33A3)
- GSM module(SIM 900/SIM 300)
- GPS Receiver (SKG13 From sky lab)
- Obstacles sensor (Ultrasonic sensor GH311)
- Emergency switch (Push buttons)

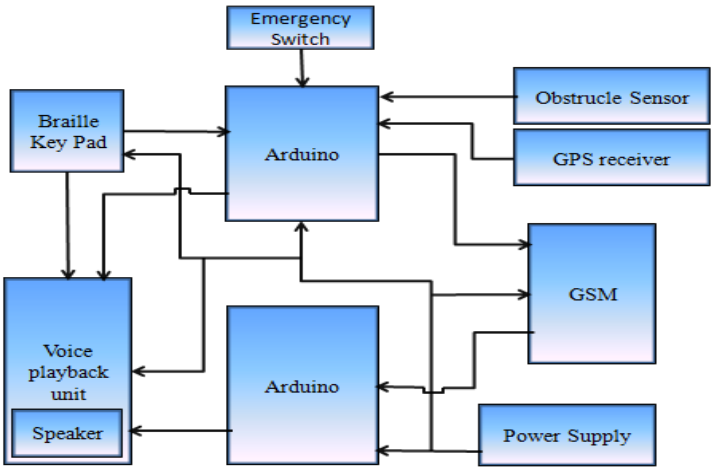


Fig 1: Block Diagram of the Proposed System

The proposed system shown in fig1, has two microcontroller Atmega8 for sending and receiving calls and SMS. The Braille keypad, voice playback module, GSM module, GPS receiver, ultrasonic sensor and emergency switch are interfaced to the microcontroller. The GSM modem is interfaced to the microcontroller via a RS 232 cable. By the respective AT commands given through a computer, the SMS and call facility can be implemented. A phone book is made to store the contacts number. When the blind person wishes to make a call to any of his speed dial contacts he just

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has to give a press to the respective key and the call shall be placed through the AT commands via the GSM modem connected to the microcontroller. The blind person can type a SMS using the Braille keypad provided. The microcontroller then converts the Braille letters to English alphabets using the Look table. After the message is translated into alphanumeric English letters the microcontroller sends the typed SMS via the dedicated GSM modem using AT commands. The voice playback unit provides an audio version of the received SMS. For obstacle detection the ultrasonic sensors will always sends the trigger pulses while the person is walking. The ultrasonic sensor connected to the microcontroller acts as an external interrupt. If any obstacle is detected, the microcontroller detects an interrupt and executes the Interrupt Service Routine which operates the voice playback. If the blind person feeling unhealthy, or any emergency condition, lost the roadway then emergency switch is provided, through GPS the location coordinates information will be routed to the GSM modem through the controller. GSM will forward this information to the pre fed mobile number stored in the phone book.

## IV. HARDWARE DESCRIPTION

**Microcontroller:** The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed.

**Braille Keypad:** Braille is a system of reading and writing by touch used by the blind. It consists of arrangements of dots which make up letters of the alphabet, numbers, and punctuation marks. The basic Braille symbol, called the Braille cell, consists of six dots arranged in the formation of a rectangle, three dots high and two across. Other symbols consist of only some of these six dots. The six dots are commonly referred to by number according to their position in the cell.

**Obstacles Sensor:** The proposed system uses ultrasonic sensor which basically works on the principle of the ultrasonic sound generation and alert mechanism. Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. As the distance to an object is determined by measuring the time of flight and not by the intensity of the sound, ultrasonic sensors are excellent at suppressing background interference.

**GPS Receiver:** GPS receiver has a parallel, multichannel design. That means the receiver has between 5 and 12 receiver circuits, each locked onto a particular satellite and all of them operating at the same time. When a GPS circuit detects a satellite's broadcast, the GPS device uses the ephemeris and almanac data to set its own clock and saves the data for use when it's called upon to calculate its position. When the unit's receivers have locked onto at least four satellites, the receiver can begin navigating through the process of trilateration. The first step is for the receiver to determine how far away each satellite is. To do this, each of the receiver circuits, in effect, tries to sing along with its designated satellite. The receiver generates the same pseudorandom code that the satellite is broadcasting, beginning at the same time as the satellite begins transmitting the next loop of the code. Even though the code from the satellite is rushing to the receiver at the speed of light 186,000 miles a second and has to cover a distance of only 12,000 to 15,000 miles, there is still a measurable delay. If a satellite were right overhead, the travel time would be something like 0.06 second. The result is that the satellite's code and the receiver's code will be out of sync. The cure for that is code phase. The receiver moves its signal through time by shifting the signal pattern and adding the electrical values of the two patterns at parallel points. Wherever the added values are highest is where the codes are in phase synced. Subtracting the time at that point from the original time before the pattern was moved tells the receiver how long it took the radio signals to travel from the satellite to the receiver. The receiver multiplies that time difference by the speed of light and gets the approximate distance, or range as it's called in GPS circles, from the satellite to the receiver.

**GSM Module:** GSM is a digital, mobile radio standard developed for mobile, wireless, voice communications. GSM uses a combination of both the time division multiple access (TDMA) and frequency division multiple access (FDMA). With this combination, more channels of communications are available, and all channels are digital. The GSM service is available with frequency bands of 900-MHz & 900 E, 1800-MHz, 1900-MHz

A GSM network consists of the following network components:

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- Mobile station (MS)
- Base transceiver station (BTS)
- Base station controller (BSC)
- Mobile switching centre (MSC)
- Authentication centre (AuC)
- Home location registers (HLR)
- Visitor location registers (VLR)

**Voice playback Module (APR33A3):** The single chip voice recording and playback module is used in our system for alerting the blind person about the obstacles. The voice playback module consists of a 16 bit digital voice processor IC APR33A3 which is having the 8 voice channels with record and playback. In each channel, we can record 340 – 680sec of voice clip in it. The module will have a microphone and a speaker output pins on it. We have to interface a speaker to get the recorded voice playback audible. There is a button for switching between the recording mode and playback mode. In either the mode we have to select the channel to record or playback. The selection of the voice channel can be done by grounding the particular channel pin among the eight channels

## V. SOFTWARE IMPLEMENTATION

The flowcharts for the system fig2 and fig3 are shown below. The microcontroller is initialized for managing incoming and outgoing calls, sending and receiving SMS using AT commands. GSM and GPS module keeps on checking for network status once it makes sure that the module is connected the system will start a subroutine for checking obstacles and indicate location of the blind.

The project needs two types of software in it. They are

- KeiluVision
- Flash Magic

The Keilu Vision is the C and C++ compiler for various microcontrollers. In this we will have the required library managers for Atmega8. It is having the inbuilt editor, compiler and debugger for C/C++. The program written in the Keil is to be written on to the microcontroller's flash memory. The microcontroller will only accept the machine level language. So, we have to convert the high level program code into machine level code. The Keil inbuilt it generates the Hex file which is a machine level language code all data in Hexadecimal format. The Flash magic is the tool for writing the code on to the Atmega8. The Hex file generated from the Keil is opened by the Flash magic and can be written in the Flash memory of the Atmega8. In addition, the Flash magic is also having the internal terminal to interface the communication devices to the computer. [5]

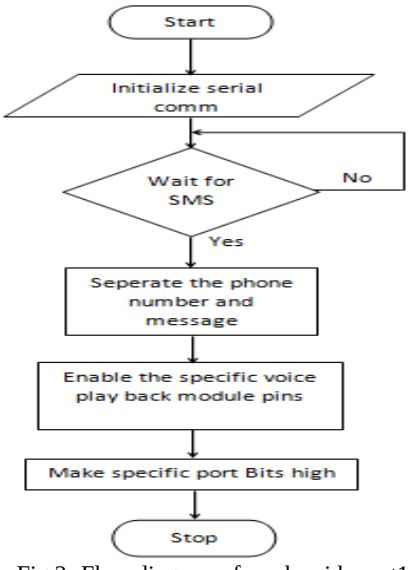


Fig 2**:** Flow diagram of sender side part1

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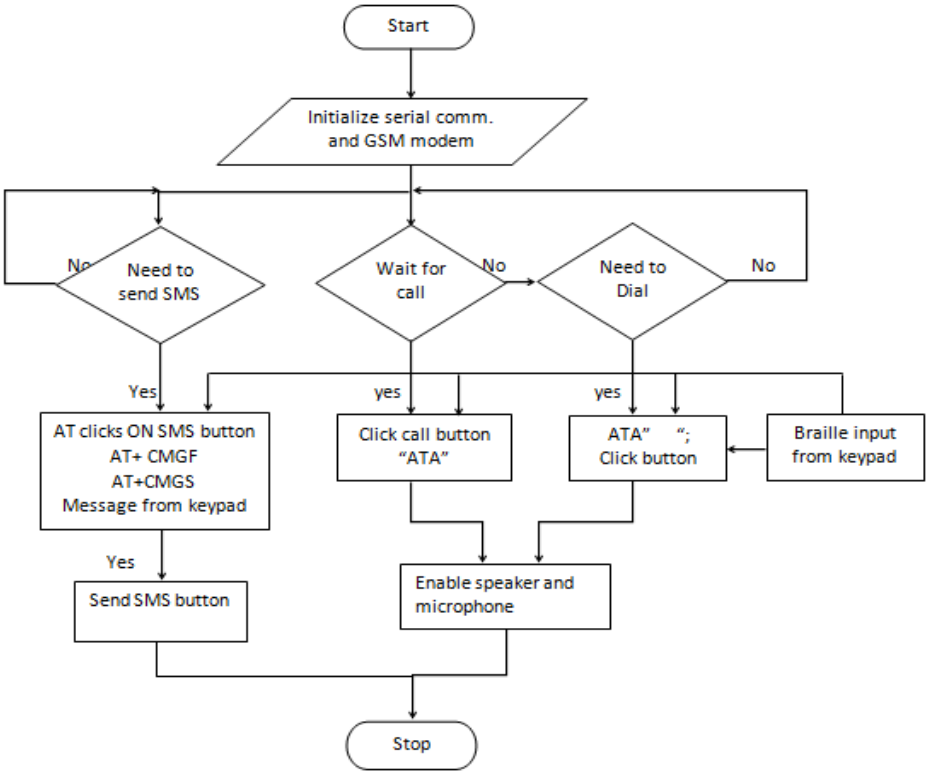


Fig 3: Flow diagram of sender side part2

## VI. CONCLUSION

The propose system provides features such as managing calls, SMS which are designed to ease the use of cell phone when compared to present systems. The combination of various working units of the proposed system makes a real-time system which also monitors position of the blind and provides dual feedback making navigation more safe and secure.

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