

# IOT BASED SMART SPEECH GUIDANCE FOR VISUALLY IMPAIRED USING CORTEX M3

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## ABSTRACT

*This paper describes the development of a navigation aid in order to assist blind and visually impaired people to navigate easily, safely and to detect any obstacles. The system is based on a microcontroller with synthetic speech output. In addition, it consists of two vibrators, two ultrasonic sensors mounted on the user's shoulders and another one integrated into the cane. This aid is able to give information to the blind about urban walking routes and to provide real-time information on the distance of over-hanging obstacles within six meters along the travel path ahead of the user. The suggested system consists then in sensing the surrounding environment via sonar sensors and sending vibro-tactile feedback to the user of the position of the closest obstacles in range. For the ultrasonic cane, it is used to detect any obstacle on the ground. This system enables the caretaker of user to keep track of him/her through IOT, where in case of any emergencies caretaker can easily know where exactly the user is. Additionally caretaker also receives a message to his mobile during emergencies.*

## 1. INTRODUCTION

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. The purpose of this project was to create a prototype of a device that can help blind people to travel with increased independence, safety and confidence. In addition and in order to overcome the imperfections of existing electronic travel aids, the suggested method of measuring distance travelled in this system, is to use the It can supply the blind person with assistance about walking. The proposed system involves a microcontroller with speech output. It is a self contained portable electronic unit. routes by using spoken words to point out what decisions to make. In addition and in order to overcome the imperfections of existing electronic travel aids, the suggested method of measuring distance travelled in this system, is to use the acceleration of a moving body which in this case is the blind person.

An accelerometer, followed by two integrators is used to measure a distance travelled by blind. This technique is considered in inertial navigation system and suffers from drift problems caused by the double integration and offset

of the accelerometer which are overcome by the footswitch. When this footswitch is closed, the acceleration and the velocity are known to be equal to zero and this can be used to apply a correction. In order to help blind travelers to navigate safely and quickly among obstacles and other hazards faced by blind pedestrians, an obstacle detection system using ultrasonic sensor and vibrators has been considered in this aid. The proposed system detects then the nearest obstacle via stereoscopic sonar system and sends back vibro-tactile feedback to inform the blind about its localization. On the other hand, an ultrasonic cane equipped with wheels is considered to detect any obstacle which may be on the ground. The system has then environment recognition and a clear path indicator functions.

## 2. BLOCK DIAGRAM OF THE SYSTEM

The block diagram of the proposed system is as shown in the Fig-1. This system consists of a processor and a controller. The processor that we are using here is CORTEX M3 as shown in Fig-2 which is responsible for the operations of the subsystems especially the voice generation unit (APR) through which output of the system is conveyed to the user to take his next move. It is also supported by additional systems such as sensors, GPS module, GSM module etc. Here in the system, a switch is provided wherein the user can press it if he is in some emergency. On pressing this switch, the caretaker will receive a message and also location details.

We are also using a microcontroller i.e. 8051 as shown in Fig-3 for an additional feature of the system which enables the user to access public transport. This controller part is fitted in the bus and it consists of a RF transmitter and a switch. When the bus approaches towards the user, the processor system with the user receives the signal through the RF receiver and voice alert is given regarding the bus information.

The functions of the subsystems are explained below:

### 2.1 Cortex M3 (LPC1768)



**Fig-2:** Cortex M3 (LPC1768)

This board designed for CORTEX M3 based LPC1768 from NXP. The board is a basic I/O pin out board with options of onboard power. Remaining I/O pins are taken out on 2.54 mm pitch connector. The board has standard serial port so program can be flashed directly from RS232 port from PC, power can be powered from USB also

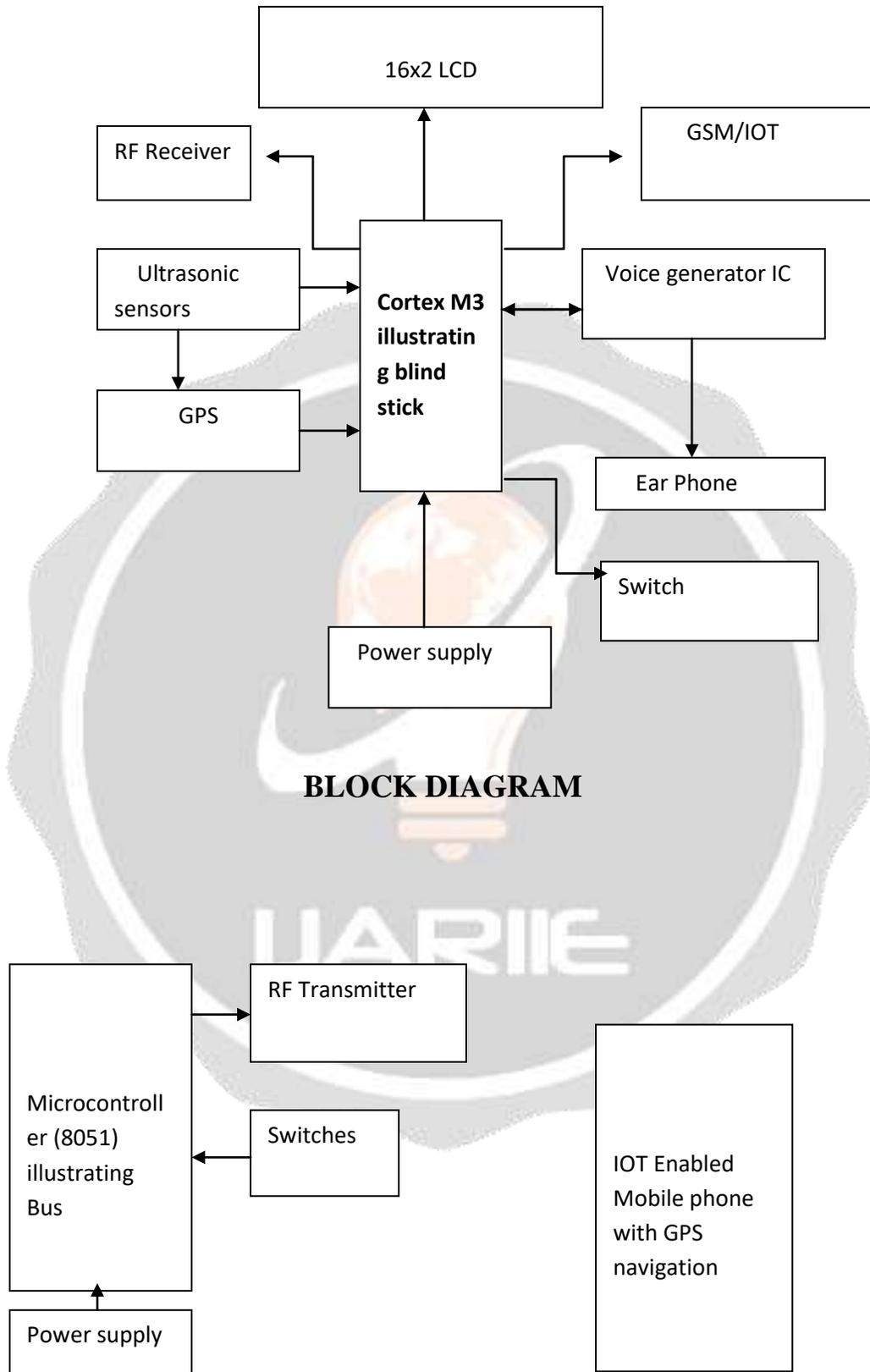


Fig -1: Block Diagram of the system

## 2.2 8051 Microcontroller



**Fig-3 :** 8051 Microcontroller

A general purpose 40 pin 8051 development board with on board power supply circuit, RS232 port for serial interface with computer and other serial devices, reset switch, power status LED and a general purpose switch and LED. The board is compatible with AT89S51/52 and P89V51RD2 microcontrollers. The P89V51RD2 allows serial programming and can be programmed directly with this board through a serial connection to a PC without the need for an additional external parameter. This board is perfect if you are just starting out with 8051 programming and also if you want a reliable tried and tested board for building advanced projects based on it.

### 2.3 Voice generator kit (APR)

The speech synthesizer device is used as an audio output. The chip is a single chip solution offering digital storage capability and up to 16 minutes of high quality, audio record and playback functionality.

On the other hand, the speech synthesizer chip is activated by pulses from the microcontroller. The output gives different actions to the user. For obstacle detection an increase of distance of obstacle results in a decrease in vibration, while a decrease of distance results in an increase in vibration.

### 2.4 Headphone

Since hearing for blind is very important, the headphones would dull this sense. For this system it has been considered to use headphones used in mobile phones and Walkman. The spoken words from the speech synthesizer which represent the different action to be taken will therefore be heard by the blind.

### 2.5 Sensors

Here, we are using two sensors i.e. Ultrasonic sensor and IR sensor. Ultrasonic sensors are used to detect heavy objects such as wall, pole etc. IR sensors are used to detect small obstacles such as potholes, road humps, stairs etc.

### 2.6 RF Transmitter & Receiver

The transmitter/receiver (Tx/Rx) pair operates at a frequency of **434 MHz**. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

### 2.7 Switches

An electrical switch is any device used to interrupt the flow of electrons in a circuit. Switches are essentially binary devices. Here the switches are used in bus part when there is exchange of signals between RF transmitter and receiver.

## 2.8 LCD Display

A 16x2 liquid-crystal display (LCD) is used in our project for the purpose of demonstration. The voice output that the user receives will be displayed on the LCD.

## 2.9 GSM Module

Global System for Mobile communication is a digital mobile telephony system that is widely used. . It operates at either 900MHz or 1800MHz frequency band. It is used to send the message to the varetaker in case of any emergencies.

## 2.10 GPS Module

The GPS QUESTAR TTL is a compact all-in-one GPS module solution intended for a broad range of Original Equipment Manufacturer (OEM) products, where fast and easy system integration and minimal development risk is required. The receiver continuously tracks all satellites in view and provides accurate satellite positioning data. The GPS QUESTAR TTL is optimized for applications requiring good performance, low cost, and maximum flexibility; suitable for a wide range of OEM configurations including handhelds, sensors, asset tracking, PDA-centric personal navigation system, and vehicle navigation products.

## 4. CONCLUSIONS

The proposed navigation aid has been developed in order to enhance the independent mobility of blind individuals. This system also focuses on most of the navigation problems faced by blind in indoor as well as outdoor. This proposal will make blind people to open their eyes by closing it. To conclude, we would like to say that engineering does not just stop at gaining knowledge and innovating, it ends when you are able to use that knowledge for the benefit of your fellow human beings. As the saying goes, —If engineering is the application of science for human benefit, then the engineer must be a student of not only the application of science but of human benefit as well.

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