MULTIPURPOSE GADGET FOR BLIND PERSON USING GPS, OBSTACLE DETECTION, GSM MODEM AND ARM7

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Abstract: The objective of this paper is to provide an overview of the system used to assist blind person in the real time environment. This hand held device is used to assist blind person in detecting obstacles in his path, to give him information through voice signals, This system is a device that measures and announces temperature, detects obstacle and warns user by announcement, reads position and announce it, reads time and announce. The system has special feature of panic Switch. In case of any emergency or panic condition the person can press the button to send a message to concern person.

Keywords: Global Positioning System (GPS), Global System for Mobile Communication (GSM), ultrasonic sensor, Temperature sensor, Serial Peripheral Interface (SPI).

1. INTRODUCTION

This gadget is specially designed for a visually impaired person. We are developing a system to assist the blind person in real time environment. This paper presents a theoretical 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 (GPS) [1]. It is very difficult for a blind person to commute daily just using a stick, so we have designed a system which not only detects the obstacles but also informs him about the time and temperature also. One more privilege of this device is that if a blind person gets lost in the unknown area, he can inform the concerned person about his location by using the GPS and GSM module. One more feature of this device is that it gives a voice command through headphones about current time and temperature. The device has a keypad; every key has assigned a specific function as for detecting temperature a specific key has been assigned so when the person presses the key temperature will be announced through headphones.
2. SYSTEM DEVELOPMENT

To design a multipurpose gadget for a blind person we have to develop a system having multiple functions. So to provide multiple functions in this system, we are interfacing different devices with the LPC 2138 microcontroller. The system should be able to detect obstacles as well as sense temperature. More over it should be able to send the exact location of the blind person. All this data is conveyed to the blind person in the form of stored voice samples. So to store the voice samples we need to have a memory where we can store the voice samples. The block diagram bellow figure 1 shows the devices which are interfaced with the ARM 7 microcontroller.

\[\text{Fig.1: System Block Diagram.}\]

2.1 Gps Modem

GPS is a radio navigation system using satellites and it is developed by USA Department of Defense for military use navigation but it can be used by citizens with a limited range. It predicts radio coverage from satellites to a receiver, then it shows the exact 3D location, speed and time. This system can be universally used for 24 hours, and many people can use it. This GPS system can be dived into 3 different segments; SS (Space Segment), CS (Control Segment), and US (User Segment). SS (Space Segment) represents the location of 24 satellites that rotate around the Earth every 12 hours. As of April, 2007, there is a total of 36 GPS satellites with 30 of them are active and 6 of them are preparatory satellites in case of malfunction. CS (Control Segment) represents a general observation post that manages and tracks GPS satellites. US (User Segment) represents GPS users and GPS receiver [2].

A GPS tracker essentially contains a GPS module to receive the GPS signal and calculate the coordinates. For data loggers it contains large memory to store the coordinates, data pushers additionally contain the GSM/GPRS modem to transmit this information to a central computer either via SMS or via GPRS in form of IP packets.
2.2 GSM Modem

GSM (Global System for Mobile communication) is a digital mobile telephony system. With the help of GSM module interfaced. GSM module is provided by sim uses the mobile service provider and send sms to the respective authorities as per programmed. 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 other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

2.3 Ultrasonic Sensor

Ultrasonic transducer uses the physical characteristics and various other effects of ultrasound of a specific frequency. It may transmit or receive the ultrasonic signal of a particular strength. These are available in piezoelectric or electromagnetic versions. The piezoelectric type is generally preferred due to its lower cost and simplicity to use [4]. The proposed system uses ultrasonic sensor [3]. The ultrasonic sensor is basically used to measure the distances between the obstacle / object and the sensor. The ultrasonic sensor works on Doppler Effect. It consists of a ultrasonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So the total time taken by the signal to get transmitted and to receive back will be used to calculate the distance between the ultrasonic sensor and the obstacle.

2.4 Memory

The AT24C02A/04A/08A provides 2048/4096/8192 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 256/512/1024 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C02A/04A/08A is available in a space saving 8-pin PDIP, 8-pin, 14-pin SOIC, and 8-pin TSSOP packages and is accessed via a 2-wire serial interface. In addition, the entire family is available in 5.0V (4.5V to 5.5V), 2.7V (2.7V to 5.5V), 2.5V (2.5V to 5.5V) and 1.8V (1.8V to 5.5V) versions. Here we are using AT24C04A, 4K SERIAL EEPROM: The 4K is internally organized with 256 pages of 2-bytes each. Random word addressing requires a 9 bit data word address.

3. MICROCONTROLLER LPC 2138 SPECIFICATIONS

16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 or HVQFN package. 
8/16/32 kB of on-chip static RAM and 32/64/128/256/512 kB of on-chip flash program memory. 128-bit wide interface/accelerator enables high-speed 60 MHz operation. In-System Programming/In-Application Programming (ISP/IAP) via on-chip bootloader software. Single flash sector or full chip erase in 400 ms and programming of 256 B in 1 ms. Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the On-chip Real Monitor software and high-speed tracing of instruction execution. 8-channel 10-bit ADCs provide a total of up to 16 analog inputs, with conversion times as low as 2.44 ms per channel. Single 10-bit DAC provides variable analog output. Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog. Low power Real-time clock with independent power and dedicated 32 kHz clock input. Multiple serial interfaces including two UARTs.
(16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities. On-chip integrated oscillator operates with external crystal in the range of 1 MHz to 30 MHz and with an external oscillator up to 50 MHz. Power saving modes include Idle and Power-down. CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pads.

3.1 Circuit Diagram

Fig.2: System Circuit Diagram

4. WORKING

The objective is met without using any speech playback ICs or subsystems. The project interfaces a temperature sensor and measures the temperature. The voltage from the sensor is sampled using the onboard ADC of the ARM Microcontroller. We are also using in-built RTC to announce time. The ultrasonic sensor is used to detect obstacles and warn via voice announcement. Another feature we have added into this is position announcement.
We are using a GPS receiver for this purpose. We are using 4x4 key pad. Different keys are assigned for different announcement. The value of the selected parameter is spoken out by the system using stored voice samples of numbers and other words.

Each key is assigned a specific function except the obstacle detection the ultrasound sensors continuously scan the objects in front of the blind person when an obstacle is detected a voice command is announced through the speakers. If a blind person wants to see the time or the temperature around him, then a specific key is assigned to each function the time or temperature can be heard by pressing that particular key on the keypad.

For location detection A GPS and GSM module are used if the person presses the key for sending the location, then the GPS module will send the GPS coordinates to the controller and then the controller will send those coordinated to the GSM module.

5. SYSTEM ADVANTAGE

- Less time delays
- Quick response time
- Fully automate system
- Robust system
- Low power requirement

6. RESULTS

![GPS Module](image1)

*Fig. 6.1: GPS Module*

![GSM Module](image2)

*Fig. 6.2: GSM Module*
Fig. 6.3: GPS Coordinates

Fig. 6.4: Sending GPS Coordinates

SOFTWARES USED

- Embedded C Programming in Keil
- Circuit & Layout Designing: Proteus 7.7
- Programming at PC Using VB 6.0

7. CONCLUSION

The multipurpose gadget has the potential to assist the blind person on a daily basis. This device will resolve many problems for a visually impaired person and make their path easy. Our first objective was to create a device for a handicapped person physically or visually. After we decided to create a gadget for a blind person, our first step was to observe the issues which a blind person can face during his day to day life. First, we designed the obstacle sensing part using ultrasound sensors. Our second concern was to develop a GPS location system if in case the blind person gets lost in the city, so that he should be able to send his location to a concerned person. This was followed by time announcement using a flash memory and ARM 7 in built RTC.

The proposed project can be improved using multiple sensor for obstacle detection. Two vibratory motors can be used to help the blind person to decide the direction of avoiding the obstacle.
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REFERENCES


