

Navigation System for the Blind

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Abstract: This paper is intended to provide overall measures – object detection and real time assistance using a Global Positioning System (GPS) module. This paper aims at the development of system to the blind people to find obstacle free path. When an object is detected in front a blind persons stick, it alerts them speakers or head phones. The system consists of an IR sensor, GPS Module, GSM Module and speakers or head phones. The location of the blind is found using Global System for Mobile communications (GSM) and Global Position System (GPS).

1. Introduction

The visually impaired are often, at a high risk of accidents. Both, at home and outside. This project aims at helping them by using recent advances in technology. This project describes a user friendly, cost effective Blind Navigation system with SOS features like panic switch buttons in case of emergencies. The system will be mounted on a stick that can be used by the person to maneuver around. GPS and GSM modules will basically provide Location services. This project is an amalgamation of a number of Blind-friendly services in a way that it is easily portable, effortless to use and relatively cheap.

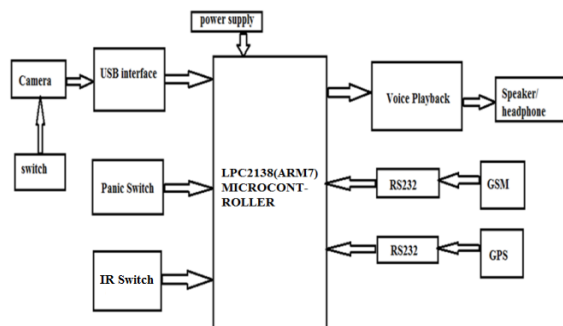


Figure 1. Hardware Architecture

2. Microcontroller

The microcontroller used in this project is a GPS and GSM based device with user input interface. It is

an ARM7TDMI based LPC2138 microcontroller, which has a 512KB flash memory and 8 to 40 KB of SRAM and several peripherals. The ARM7TDMI-S is a general purpose 32-bit microprocessor. Unique accelerator architecture and a 128-bit wide memory interface enable 32-bit code execution at the maximum clock rate. The GSM module and GPS will communicate using RS232 protocol with microcontroller.

3. GSM and GPS Modules

The Global Positioning System (GPS) [3] and Global System for Mobile communications (GSM) [4] are interfaced to the microcontroller to detect the user's location. The proposed architecture consists of a GPS signal receiver, GSM and a vibratory circuitry (speakers or Headphones) connected to ARM7. This complete setup will be fixed to a stick. The GPS will send the location information to the controller continuously. The same will be routed to the GSM modem through the controller.

4. IR Sensor

Obstacle Detecting Sensor is used to detect objects and obstacles in front of sensor in a narrow angle useful in robotics applications. The sensory systems emit ultrasonic or laser beams to the environment, which are reflected by the object; the system calculates the distance from the object according to the time difference between the emitted and received beam.

The principle of an IR sensor working as an obstacle detecting Sensor can be explained using Figure 2. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto – Coupler. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

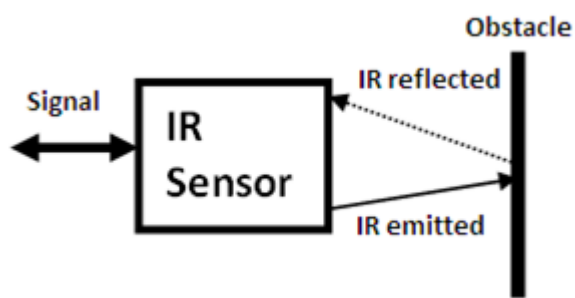


Figure 2. IR Sensor

5. GPS Module

GPS uses satellite data to determine an accurate position on the earth. These calculations can relate the user's position to almost any map projection within milli-seconds [6].

The Global Positioning System (GPS) is a network of about 30 satellites orbiting the Earth at an altitude of 20,000 km. Originally developed by the US government for military navigation; it is now being used for innumerable purposes like road transport, aviation, shipping etc. Anyone with a GPS device can receive the radio signals that the satellites broadcast.

Wherever you are on the planet, at least four GPS satellites are 'visible' at any time. Each one transmits information about its position and the current time at regular intervals. These signals, travelling at the speed of light, are intercepted by your GPS receiver, which calculates how far away each satellite is based on how long it took for the messages to arrive. Once it has information on how far away at least three satellites are, your GPS receiver can pinpoint your location using a process called trilateration.



Figure 3. GPS Module

6. GSM Module

GSM is a mobile communication modem; it stands for global system for mobile communication

(GSM). GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot [3]. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.



Figure 4. GSM Module

7. Working

This system, when faced with an obstacle, within 1 meter distance, it will sense the obstacle through an IR sensor and produce voice based signal as "path guiding obstacle detected". The objects at 6-7 meter distance to the blind person will be detected by sonar sensor, gives voice based alert as "path guiding object detected". Whenever the care taker from another place wants to know the location of the blind person, he has to send an sms to ETA system which will then send the location in terms of longitude and latitude co-ordinates through GSM with the help of GPS.

8. Conclusion

This is the design and architecture of a new concept of Smart Electronic Travel Aid Stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind persons worldwide. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure. The system consists of ultrasonic sensor, GPS Module, GSM Module and vibratory circuit (speakers or head phones). When the object is detected near to the blinds stick it alerts them with the help of vibratory circuit (speakers or head phones). The location of the blind is found using

Global System for Mobile communications (GSM) and Global Position System.

9. Result

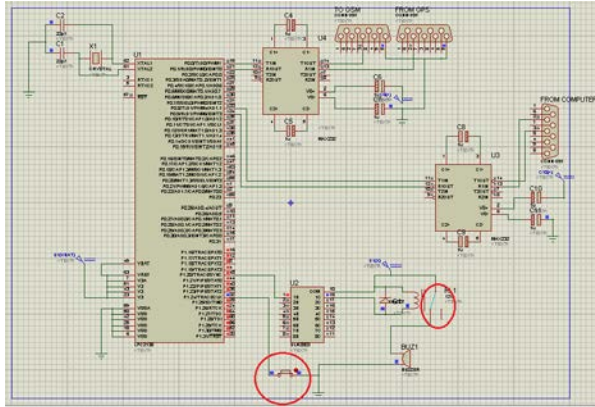


Figure 5. Simulation Screen Grab

Figure 5. shows that when the switch is pressed by the user, the relay buzzer will switch on and the users location will get captured by the GPS Module and it will be sent through the GSM Module to a family member.

10. References

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