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Navigation System for Blind People Using GPS & GSM Techniques

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ABSTRACT: The aim of the project is to provide the navigation information via audible messages and haptic feedback to the visually impaired people helping them to improve their mobility independently. The system with portable self-contained feature that allows the blind people to travel through familiar and unfamiliar environment. The proposed system consists of hardware and software. In this system the Braille capacitive touch screen enables a user friendly communications with the systems. All the operations can be made with this touch screen. The major components are the GPS receiver and path detector used for receiving the current position and finding the current position and finding the shortest path to the destination. The navigation process of the system will start once the user gives the destination as voice command. The system is provided with an emergency button which will trigger an SMS that will send the present location of the user (GPS coordinates) to a remote phone number asking for help, in case emergency. In addition, the device provides user information needed, in audio format, including time, calendar, object colour, alarm, obstacle detection, navigation direction, ambient light and temperature conditions. This project will help the blind people in improving their communication ability and not to depend on none during walking in even unknown areas.

KEYORDS: Navigation, Emergency SMS Trigger, GPS, GSM, Braille capacitive touch screen

I. INTRODUCTION

Blindness is the condition of lacking visual perception due to physiological or neurological factors. Various scales have been developed to describe the extent of vision loss and define blindness. Total blindness is the complete lack of form and visual light perception and is clinically recorded as NLP, an abbreviation for “no light perception”. *Blindness* is frequently used to describe severe visual impairment with residual vision. Those described as having only light perception have no more sight than the ability to tell light from dark and the general direction of a light source [1].

To determine which people may need special assistance because of their visual disabilities, various governmental jurisdictions have formulated more complex definitions referred to as legal blindness. In North America and most of Europe, legal blindness is defined as visual acuity (vision) of 20/200 (6/60) or less in the better eye with best correction possible. This means that a legally blind individual would have to stand 20 feet (6.1 m) from an object to see it—with corrective lenses—with the same degree of clarity as a normally sighted person could from 200 feet (61 m). In many areas, people with average acuity who nonetheless have a visual field of less than 20 degrees (the norm being 180 degrees) are also classified as being legally blind. Approximately ten percent of those deemed legally blind, by any measure, have no vision. The rest have some

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vision, from light perception alone to relatively good acuity. Low vision is sometimes used to describe visual acuities from 20/70 to 20/200 [2].

By the 10th Revision of the WHO International Statistical Classification of Diseases, Injuries and Causes of Death, *low vision* is defined as visual acuity of less than 20/60 (6/18), but equal to or better than 20/200 (6/60), or corresponding visual field loss to less than 20 degrees, in the better eye with best possible correction. *Blindness* is defined as visual acuity of less than 20/400 (6/120), or corresponding visual field loss to less than 10 degrees, in the better eye with best possible correction [3].

Unlike any other physically challenged people the blind and visually impaired people are the people facing loas of difficulties in their daily life. So many methods have been followed and proposed by many scientists across the globe. Those methods were studied carefully and are given briefly in the following passages. Several methods were followed both technically and non-technically to help the mobility of the blind and visually impaired person. These methods are practicing since the history of mankind known by either technically or non-technically.

II. OVERLOOK OF THE SYSTEM

The system is enabled withe GPS & GSM technology that helps in navigating the victim from unknown areas to any desired places. The direction of navigation will be monitored by the MEMS compass. Also the system is enhanced with the obstacle detection that prevents the victim from colliding on any person or wall. This detection will be intimated top the carrier via a vibrating motor attached to the system as a voice input tells the distance from the obstacle.

All the input will be given through the Braille capacitive touch screen which also enables the user to add notes. The required operating system for the embedded system is open source-Linux. The specializes developed program is used to receive the information form the other subsystem for processing the configuration of embedded system consists of 32-bit ARM Cortex-M3 (LPC1000), controls all operations in the device.

The system has power switch and reset switch for power management. Once the system is ON it will starts to receive the information from the GPS through the GPS receiver. The input information is received from the used through the I/O port. The embedded system will collect the respective data from GIS database through SD card. The processed output voice data information will be sent through the I/O ports.

III. HARDWARE DESCRIPTION

The hardware parameter in this system have core multitask with its own individual sub control. Each sun control has their own process and they depend on each other. The hardware parameter has one main system namely embedded controller and other subsystems as GPS module input device, map-interface, path detector power supply and output device with their function and also associated in the main system.

In this various module of devices are used that will help the blind and visually impaired people in different capable ways. These specification about each of the device and their purpose at different stages of mobility were illustrated here in the following hardware descriptions.

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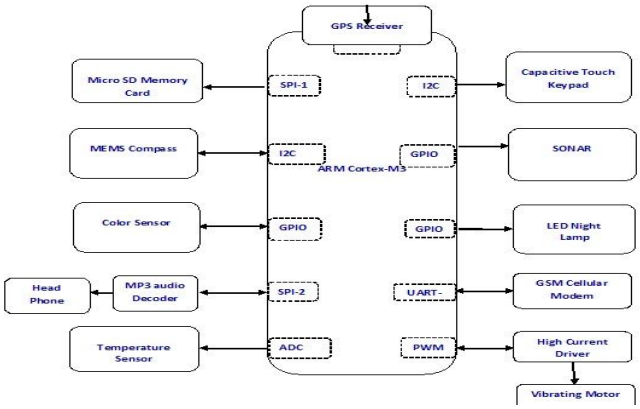


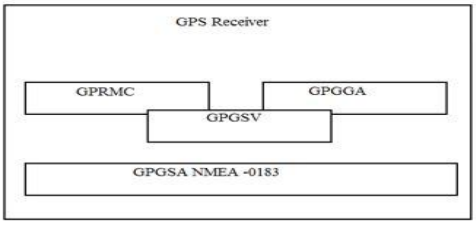
GSM

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services [3]. GSM differs from first generation wireless systems in that it uses digital technology and time division multiple access transmission methods. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3GSM in Australia, Canada and many South American countries.

GSM supports data transfer speeds of up to 9.6 Kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service). Another major benefit is its international roaming capability, allowing users to access the same services when traveling abroad just as at home. This gives consumers seamless and same number connectivity in more than 214 countries. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available [4]

GPS RECEIVER

The GPS receiver receives the coordinate of user's position from the satellite. For every track path functions PD321 GPS module is used to get 10 satellite signals for more accurate. The satellite generates radio signals that allow a receiver to estimate the satellite location and distance between the satellites and receivers. The GPS data are obtained from GPRMC, GPGGA, GPGSV and GPGSA NMEA-0183 [5]. .



GPRMC is used to identify the status of the GPS Module. The function of GPGGA is to define longitude, latitude, and altitude. The importance of GPGSV is to find the speed and direction of the GPS receiver. GPGSA

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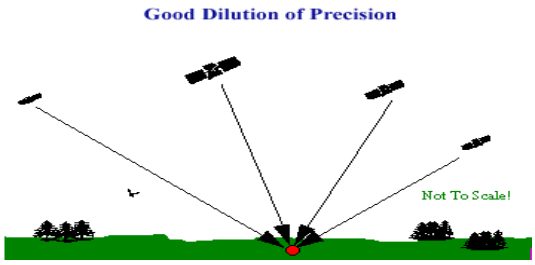
NMEA-0183 is used to find horizontal drop and vertical drop of the GPS receiver. It accurately measures the position to 10m 2DRMS (2 Dimensional Route Mean Square) and velocity 0.1 m/s without Satellite Access. By using the GPS receiver module, we have taken the parameters like latitude, longitude, altitude, UTC, and number of satellites for tracking the signals in the work. The frequency bandwidth of 1575.42 MHz with high sensitivity of -152dBm[6] [7].



MAP INTERFACE

Map interface contains the user area map database which has all the details of the area navigation function. Map database information can be access by specially developed software only. It has the information as highways, roads, streets, narrow path and the important place with respect to the user area map. GIS database contains the point of interest of respective coordinate of the location. The database of the map will be serial no, location name, latitude, longitude, altitude, error half, loop path, path index, and empty space. The information with respective location will hold single row of maximum 200 Bits space. A path contains n number of point of interest according to the start and end point. A path is made of the loop value and path index from where it starts and it ends. Assume the path start now, the position of the path index will be zero and the respective point of interest will be one. The next near point of interest index will be automatically incremented by 1. This process will continue until the path reaches its end. All gathered information will be send through the SD Card slot in the embedded system. E. Input & Output Device The proposed system has single input and output device for gathering the information from input device and resulting through the output device. The MIC is used as an input device for the user sends the queries. As it receives the information as analog signal, we require a convertor to convert analog to digital signal. Realtek ALC5610, convertor with frequency as 44-Khz/ 16 –bit stereo audio sound control function for conversion process The converter filter the noise from the voice to provide higher – quality input through Voiceover IP (VoIP) protocol[8].

ABOUT THE PROCESSOR

The ARM Cortex-M3 processor is the industry-leading 32-bit processor for highly deterministic rea0l-time applications and has been specifically developed to enable partners to develop high-performance low-cost platforms for a broad range of devices including microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors.

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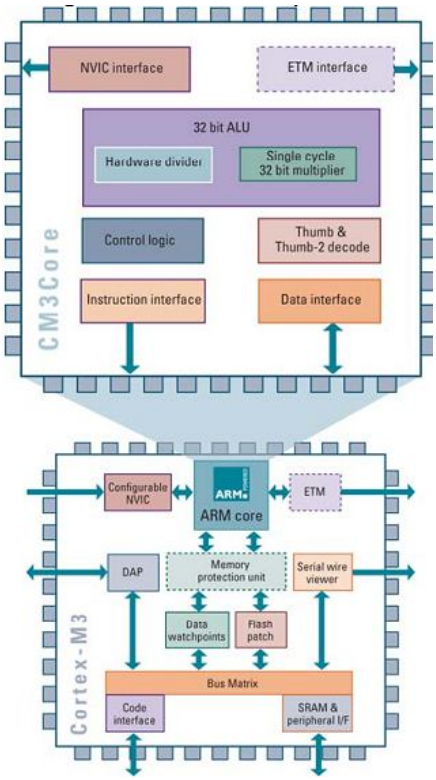

The processor delivers outstanding computational performance and exceptional system response to events while meeting the challenges of low dynamic and static power constraints. The processor is highly configurable enabling a wide range of implementations from those requiring memory protection and powerful trace technology through to extremely cost sensitive devices requiring minimal area [9].

SONAR SENSOR

The SRF02 is a single transducer ultrasonic rangefinder in a small footprint PCB. It features both I2C and a Serial interfaces. The serial interface is a standard TTL level UART format at 9600 baud,1 start, 2 stop and no parity bits, and may be connected directly to the serial ports on any microcontroller. Up to 16 SRF02's may be connected together on a single bus, either I2C or Serial. New commands in the SRF02 include the ability to send an ultrasonic burst on its own without a reception cycle, and the ability to perform a reception cycle without the preceding burst. This has been as requested feature on our sonar's and the SRF02 is the first to see its implementation. Because the SRF02 uses a single transducer for both transmission and reception, the minimum range is higher than our other dual transducer rangers. The minimum measurement range is around 15cm (6 inches). Like all our rangefinders, the SRF02 can measure in uS, cm or inches.

TEMPERATURE SENSOR (MCP9800)

The MCP9800 is a digital temperature sensor capable of reading temperatures from -55°C to +125°C. Temperature data is measured from an integrated temperature sensor and converted to digital word with a user selectable 9 to 12-bit Sigma Delta Analog to Digital Converter (ADC). The MCP9800 notifies the host controller when the ambient temperature exceeds a user programmed set point. The ALERT output is

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programmable as either a simple comparator for thermostat operation or as a temperature event interrupt. Communication with the sensor is accomplished via a two-wire bus that is compatible with industry standard protocols. This permits reading the current temperature, programming the set point and hysteresis and configuring the device. Small physical size, low installed cost and ease of use make the MCP9800 an ideal choice for implementing sophisticated temperature system management schemes in a variety of applications.

Typical Accuracy (°) ----------0.5

Max Input/ Supply Current (µA) ----------400

Max. Accuracy @ 25° (°) ----------1

Temp. Range (°C) ----------55 to +125

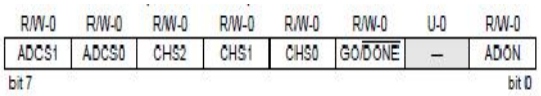
Operating Voltage Range (V) ---------- +2.7 to +5.5.

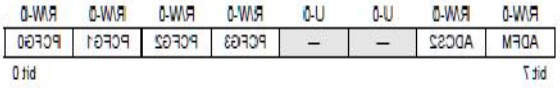
ANALOG TO DIGITAL CONVERTER

An analog-to-digital converter (abbreviated ADC, A/D or A to D) is an electronic integrated circuit, which converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (DAC).

A successive-approximation ADC uses a comparator to reject ranges of voltages, eventually settling on a final voltage range. Successive approximation works by constantly comparing the input voltage to the output of an internal digital to analog converter (DAC, fed by the current value of the approximation) until the best approximation is achieved. At each step in this process, a binary value of the approximation is stored in a successive approximation register (SAR). The SAR uses a reference voltage (which is the largest signal the ADC is to convert) for comparisons.

The Analog-to-Digital (A/D) Converter module has five inputs for the 28-pin devices and eight for the 40/44-pin devices. The conversion of an analog input signal results in a corresponding 10-bit digital number. The A/D module has high and low-voltage reference input that is software selectable to some combination of VDD, VSS, RA2 or RA3. The A/D converter has a unique feature of being able to operate while the device is in Sleep mode. To operate in Sleep, the A/D clock must be derived from the A/D's internal RC oscillator.
The ADCON0 register controls the operation of the A/D module. The ADCON1 register configures the functions of the port pins. The port pins can be configured as analog inputs (RA3 can also be the voltage reference) or as digital I/O.





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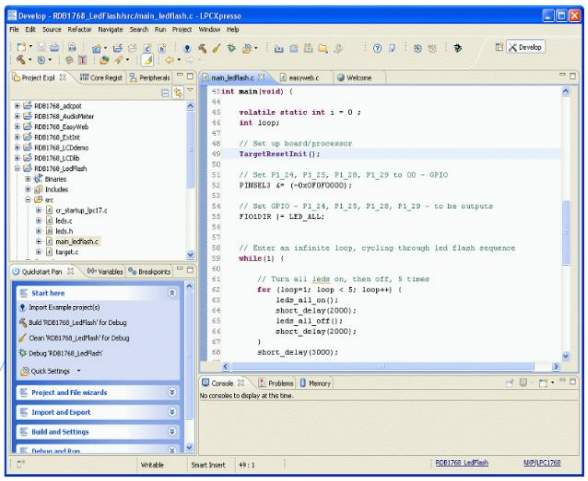
IV. SOFTWARE TOOL USED: LPCXPRESSO IDE



LPCXpresso is a new, low-cost development platform available from NXP. The software consists of an enhanced, Eclipse-based IDE, a GNU C compiler, linker, libraries, and an enhanced GDB debugger. The hardware consists of the LPCXpresso development board which has an LPC-Link debug interface and an NXP LPC ARM-based microcontroller target. LPCXpresso is an end-to-end solution enabling embedded engineers to develop their applications from initial evaluation to final production.

The LPCXpresso IDE, powered by Code Red Technologies (www.code-red-tech.com/lpcxpresso/), is based on the popular Eclipse development platform and includes several LPC-specific enhancements. It is an industry-standard GNU tool-chain with an optimized C library that gives engineers all the tools necessary to develop high-quality software solutions quickly and cost-effectively. The C programming environment includes professional-level features. There is syntax colouring, source formatting, function folding, on- and offline help, and extensive project management automation.

LPCXpresso's IDE is a highly integrated software development environment for NXP's LPC Microcontrollers, which includes all the tools necessary to develop high quality software solutions in a timely and cost effective fashion. LPCXpresso is based on Eclipse with many LPC specific enhancements. It also features the latest version of the industry standard GNU tool chain with a proprietary optimized C library providing professional quality tools at low cost. The LPCXpresso IDE can build an executable of any size with full code optimization and it supports a download limit of 128 kB after registration. LPCXpresso supports the full embedded product design cycle by moving beyond chip evaluation boards and supporting development on external target boards.

Features of LPCXpresso IDE

LPCXpresso is a complete tool chain for LPC1000 series of Cortex-M microcontrollers,

Eclipse based IDE,

GNU Compiler, Linker and Libraries.

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Enhanced GDB Debugger

Supports LPC-Link Programmer and Debugger

Developed by NxP Semiconductors and CodeRed Technologies.

V. CONCLUSION

The system proposed is of great advantage to the people who are blind and visually impaired. But with the more sufficient investment in technology and human resource the system can be enhanced with artificial eyes called Bionic eyes. Several researches are being conducted by various scientists across the globe to have this system implemented in real time with a much more additional features. These systems will be implement in no longer time.

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