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Smart Navigation System for Visually Impaired Person

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Abstract: In market there is many navigation systems like guide dog, assistive systems which are used for visually impaired person (VIP). Smart navigation system is a different than above mentioned systems because it gives combined service foe VIP. This system provides indoor navigation by using Radio Frequency Identifier (RFID), outdoor navigation by using Global Position System (GPS) as well as obstacle detection by using ultrasonic sensor. User will give the starting and ending location then this system will give voice instruction to reach at destination by detecting obstacle also. This system can specially use in big campus like industries, big institutes where it will act as guiding map.

Keywords: Smart navigation system, Global position System (GPS), Radio Frequency Identifier (RFID), and obstacle detection.

I. INTRODUCTION

The World Health Organization calculated that there are 285 million visually impaired people worldwide, mainly in developing places. Visually impaired persons mean those people who have low visual capacity [3]. VIP can be blind or partially sighted people.

Visually impaired people are unable to do visual task in day today life. Visually impairment makes life difficult for people with who have this health problem. Mostly VIP uses white cane to go anywhere to find way. In this case they face many problems while the travel in crowded places. But using many technologies, their life becomes easy, independent and comfortable. These technologies includes Electronic Travel Aid (ETA), navigation systems etc. these technologies have some drawback. Some VIP is use guide dog which requires many years to guide and they are very costly. Some system gives only indoor navigation, some provides only outdoor navigation which are not able to use in big industries where VIP want indoor as well as outdoor navigation. Everyday people visit many places like shopping mall, industries etc. If that places are unknown then they follow map which are present at entry. People can see that map visually but Visually Impaired People (VIP) cannot see that map. This project is solution for visually impaired people. Using this proposed system, VIP can easily move in campus of any shopping places, colleges or big industries. The proposed system is one module which consist

1. Global Positioning System (GPS) receiver for outdoor navigation,
2. Radio-frequency identification (RFID) for indoor navigation and
3. Ultrasonic sensor for obstacle detection.

This system is different from other system because it will be used for indoor as well as outdoor navigation by detecting obstacle by listening instruction through audio signal. In this system first user will give starting location and end location by pressing one key Then system will give the instruction by following stored map of industry.

II. PREVIOUS WORK

Karen Duarte et al. [2] design an innovative indoor navigation and information system for any places, like shopping malls based on existing technologies. This will be a comfortable and helpful system forblind person in shopping malls. This proposal system is based on user's smart phone and wireless sensors.

Nandish M S et al. [3] designed the system which provides information using audio signal. This system does VIP confidant and self-dependent. Blind guide software application can be entered into the app after a successful login by the user using speech recognition security.

Byeong-Seok Shin et al. [4] designed a wearable system for visually impaired users which allows them to detect and avoid obstacles.

Scooter Willis et al. [5] gives a navigation and location determination system for the VIP using an RFID. Each RFID tagged is programmed after installation with spatial coordinates and information describing the nearby places.

J.Ramprabu et al. [6] designed system smart cane which is used for the smart navigation for visually impaired people in indoor and outdoor environment respectively using camera.

HarshaGawari et al. [7] describes the architecture and implementation of a system which will help to navigate visually impaired people (VIP). In this system, GPS and speech recognition along with obstacle detection for the purpose to guide VIP.

Dhruv Jain et al. [8] represent the design of an omnipresent cell phone based active indoor way finding system for the visually impaired person. This system givesstep-by-step direction to the destination from any

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location in the building using minimal additional infrastructure.

Alshbatat et al. [9] have proposed intelligent system for guiding individuals who are visually impaired person, and they have described the system which enables those people to move with the confidence as a sighted people.

III. PROPOSED SYSTEM BLOCK DIAGRAM

By observing above systems, we proposed following block diagram

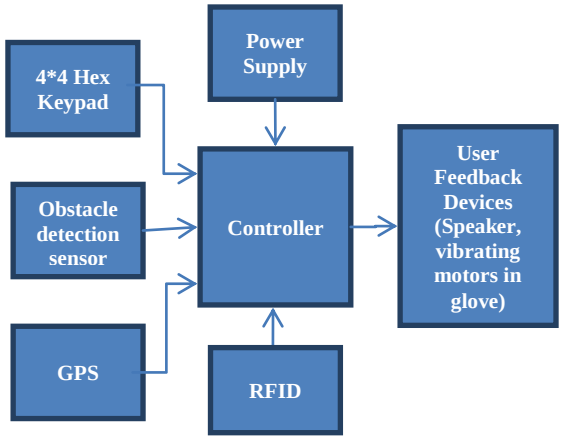

Fig. 1 Proposed Block Diagram

This is proposed system which will be with visually impaired person. It consist

- 4*4 Keypad for VIP from which he/she will give the destination.
- GPS Receiver which will receives coordinates and it will be saved as required by user
- Ultrasonic sensor will be used for detecting obstacle.
- ARM7 used as a controller
- Speaker will be used as a output feedback for user. All instruction will be get by audio signal.

This module will be with Visually Impaired. This system will follow following map.

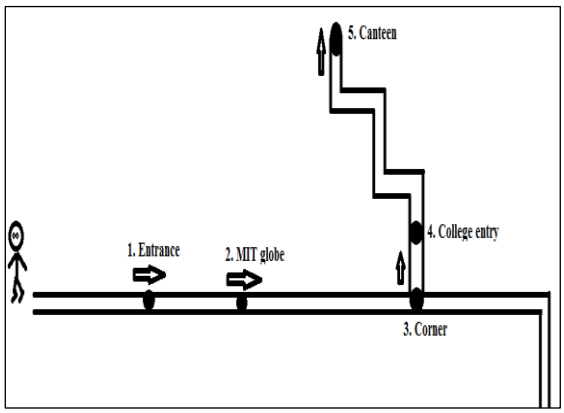

Fig.2 Map of MIT College

Fig2. Mentioned a map of MIT college consist of five location that are entrance, MIT globe, Corner, college entry and canteen. When VIP enters in college campus then he/she will start the system. Then system will ask user about starting location and destination. VIP will press keys that are starting point and destination number. After this, system will start to give instruction in the form of voice. Location 1 to location 4 is outdoor location so from 1 to 4 GPS will work as navigation for outdoor place. When VIP will enter in college entry then indoor navigation will start. System will switch from GPS to RFID. From location 4 to 5, RFID will help VIP for indoor navigation using RFID reader. If the obstacle will be detected by system then VIP will get voice instruction that there is obstacle detected. Obstacle is detected by using ultrasonic sensor. This is total working of system.
This project is used anywhere only we have to save co-ordinates according to map of place. This system is programmed by C language using keil software.

IV. HARDWARE REQUIREMENT

The main hardwares required for this project are GPS receiver module, RFID reader module, ARM7 controller (LPC2148), 4*4 keypad and Speaker. This hardware are explained as following

A. LPC2148 (ARM7 Microcontroller)

LPC2148 is high-performance 32-bit RISC Microcontroller with Thumb extensions 512KB on-chip Flash ROM which is based on ARM7TDMI-S.It has 128-bit wide memory interface as well as unique accelerator architecture which will enable 32-bit code execution. It has maximum clock rate. It has 16-bit Thumb mode which reduces code by more than 30 % with minimal performance penalty for critical code size applications. Fig 3 shows the ARM 7 microcontroller which has lcd, LPC2148etc.

Fig.3 ARM 7(LPC 2148)

It has following features

- 16/32-bit ARM7TDMI-S microcontroller
- On-chip static RAM is 8 kB to 40 kBand on-chip flash memory 32 kB to 512 kB.
- Single 10-bit D/A converter provide variable analog output.

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- Two 32-bit timers with four capture and four compare channels each, PWM unit with six outputs and watchdog.
- It has low power real-time clock with independent power and 32 kHz clock input.
- Multiple serial interfaces with two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities
- Up to 45 general purpose I/O pinsof 5 V tolerant in a tiny LQFP64 package.
- Power-down and idle power saving modes

B. GPS Receiver Module

GPS is the Global positioning system is to determine your position on earth: east- west north-south and vertical (longitude, latitude and altitude). In this project GPS is used for outdoor navigation. GPS receiver receives the coordinates by using antenna and it will send to controller. There are two main important role of GPS receiver that are it is used to save the coordinates of location and second is to tell the received locations which are outdoor location. The Global position System module continuously transmits serial data in the form of lines of words according to NMEA standards. It gives latitude and longitude values of the location which contains in the **GPGGA** sentence (refer NMEA format).

C. RFID(Radio Frequency Identifier)

RFID (Radio Frequency Identifier) is used for indoor navigation purpose. It helps to user when he/she will enter in building.

Fig.4 RFID Reader Module

EM18 RFID reader module is used in this project which is shown in fig 4. Following are the features of RFID reader

- Serial and TTL output.
- Along with two RFID cards.
- Excellent read performance without an external circuit.
- Compact size and cost-effective

D. Ultrasonic Sensor

In this project obstacle detection will be done by using ultrasonic sensor. HCSR04 is used in this system. It gives 2cm to 400cm non-contact measurement function; the ranging accuracy will be reach to 3mm.

Fig.5 Ultrasonic sensor

The ultrasonic modules consist ultrasonic transmitters, receiver and control circuit. Fig 5 shows the ultrasonic sensor which have following basic standards

- It uses IO trigger for at least 10us high level signal,
- The Module will automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time × velocity of sound) (340M/S) / 2

V. SOFTWARE REQUIREMENTS

There are two main software are used in this project that are Keil uVersion4 & flash magic. KeiluVersion software is used in which embedded c programme can be run and it converts C programme in to Hex file. The hex file will be uploaded in ARM7 using flash magic software. The interfacing program is written for GPS receiver, RFID reader, and Ultrasonic sensor and voice playback device

VI. EXPERIMENTAL RESULTS

This section consists of experimental results of this project. Following figures shows the output in the form of text which can get by voice to visually impaired person.

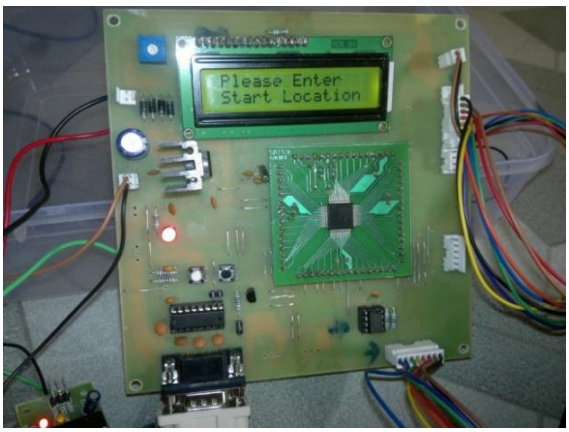

Fig.6 output of first instruction

Fig 6 shows one of the output in which system will ask used to enter start location. Then user will press one key.

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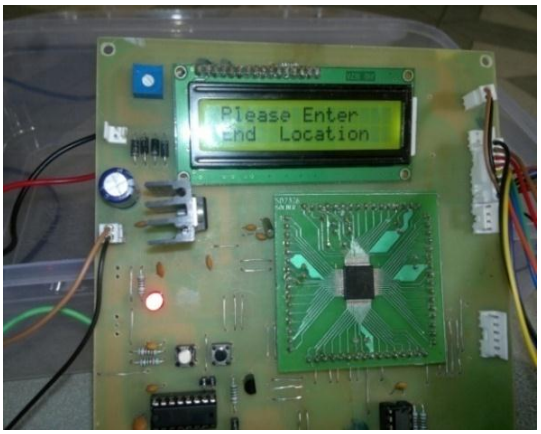

Fig.7 Output of Second Instruction

Fig 7 shows one output in which system will tell to enter end location that is destination place. Then user will press end location.

Fig.8 Output of Third Instruction

After pressing key for end location, system will give instruction that get to start location. It is shown in fig.8. When VIP will reach at first location then system will instruct by audio voice.

Fig.9 Output of Forth Instruction

Fig.9 shows the next stage that is where to move according to map. There is straight direction so it will display 'go straight'.

Fig.10 Output of Fifth Instruction

Fig.10 shows the output when user will reach at second location. VIP will get voice 'reached at second location'. Since system will follow the map and it will assist the visually impaired person how to reach at destination. When obstacle will detect in between any path then it will tell to user that obstacle is detected. The output is shown in fig 11.

Fig.11 Output of Obstacle Detection

Since system will work for this map. If user want to use this system for other map then it can be possible.

VII. FUTURE SCOPE

This system can either use for VIP or normal person who is unknown for location. There are five location saved in this system. If user want to add more location then it can be possible. In future the camera can use for movable obstacle detection.

VIII. CONCLUSION

This system is smart navigation system for visually impaired person. This will help user for outdoor navigation using GPS receiver, indoor navigation by using RFID and obstacle detection by ultrasonic sensor by giving audio instruction. This system will work according to map of location. It will be used specially in big industries, offices, shopping mall or college campus which is unknown to VIP.

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