Third Eye for the Blind

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***Abstract* - This paper describes ultrasonic blind walking stick with the use of Arduino. Smart cane is an innovative stick designed for visually impaired person for improved navigation. It combines with two devices by wireless module (NRF24L01). It is smart cane and watch. Smart cane is using an Ultrasonic sensor with an Arduino for detecting the obstacles. This cane is integrated with ultrasonic sensor along with obstacle sensing. The cane can automatically detect an obstacle and give the user feedback response by vibrating the walking stick. If the user forgets the stick away from the watch he wore in limited distance, the stick not only will give a warning sound but also will send message to connected phone number with cane. The connected one can know the location of the blind via GPS in the watch. Visually impaired person can also know the location of the stick by pressing the button on the watch.**

***Keywords* - Arduino Uno; Wireless Module; GPS Module; GSM Module; Ultrasonic Sensor**

I. INTRODUCTION

Vision is the most important for human. The statistics by the World Health Organization (WHO) estimates that there are 39 billion blind people and 246 billion with low vision in the world. There are about 1.24 million blind people in Myanmar. Mostly, blind people use a white stick for directing them when they move or walk. Now, we develop IOT Smart cane and Watch for blind man for more efficient and helpful than white stick. This will help blind people when they walking when the sensor detects the obstacle, give alert sound and vibrating from cane. When the blind people miss the stick, they can easily find the cane, by pressing the button for smart watch.

II. OVERVIEW OF THE SYSTEM

Third eye for the blind is a product of aiding the visually impaired person. In the system, there are two parts: smart cane and smart watch. The distance between them must be 100 meters at most. When the smart cane finds the obstacle, the vibrating motor will vibrate and buzzer will alarm. If the user lost his cane, he can press the button on the watch.

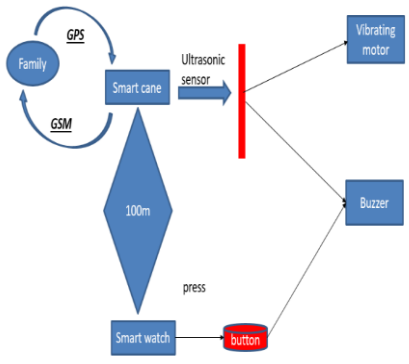

Fig. 1 Overview of the System

At that time, the buzzer will also alarm to help in the process of finding his cane. The family members can also know the location of smart cane via GPS. They can also get the message from the cane when the user press the button on the watch. The cane and the watch are connected by the wireless module (NRF24l01). The detail of the system will be described in Figure. 1.

III. SYSTEM REQUIREMENTS AND DESIGN

Hardware and Software systems are interface to implement of this system are expressed as the following.

A. Hardware Requirements

Hardware requirements of the system are shown in Table I:

Table I Component List

Sr.	Components
1	Arduino Uno
2	Ultrasonic Sensor
3	Wireless Module
4	GSM Module
5	GPS Module
6	9V Battery and clips
7	Stick
8	Vibrator
9	Watch

B. Software Requirements

The system requires a program that must be the implement to the microcontroller. Programming language for the Arduino microcontroller is C language. To run the program to the microcontroller needed software that is Arduino IDE.

C. System Design

The system design includes software implementation and hardware implementation. Arduino Uno microcontroller, Wireless Module (NRF24L01), Ultrasonic Sensor, Vibrator, Watch, Buzzer, GSM SIM 900A Module and GPS Module (neo 6M) are used for hardware implementation. C programming language is used for software implementation.

1) *Arduino Uno Microcontroller Board*: It is an open source platform used for building electronics projects. It consists of both a physical programmable circuit board and a piece of software, or IDE that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with Electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware in order to load new code onto the board you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard from factor that breaks out the functions of the microcontroller into a more accessible package. An Arduino Uno board is shown in Figure. 2.

Fig. 2 Arduino Uno Microcontroller

2) *Ultrasonic Sensor:* Ultrasonic sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the ultrasonic transmitter and receiver. The ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor. This reflected wave is observed by the Ultrasonic receiver module. The Ultrasonic sensor is shown in Figure. 3.

Fig. 3 Ultrasonic Sensor

3) *Neo 6M GPS Module:* The u-blox NEO-6M GPS engine on these modules is quite a good one, and it also has high sensitivity for indoor applications. Furthermore, there is one MS621FE-compatible rechargeable battery for backup and EEPROM for storing configuration settings. The module works well with a DC input in the 3.3- to 5-V range (thanks to its built-in voltage regulator). The GPS modules are based on the u-blox NEO-6M GPS engine. The type number of the NEO-6M is NEO-6M-0-001, and its ROM/FLASH version is ROM 7.0.3 (PCN reference UBX-TN-11047-1). The NEO-6M module includes one configurable UART interface for serial communication, but the default UART (TTL) baud rate here is 9,600. Because the GPS signal is right-hand circular-polarized (RHCP), the style of the GPS antenna will be different from the common whip antennas used for linear polarized signals. The most popular antenna type is the patch antenna. Patch antennas are flat, generally have a ceramic and metal body, and are mounted on a metal base plate. They are often cast in a housing. GPS stands for Global Positioning System and can be used to determine position, time and speed if you are travelling. Neo-6M GPS Module is also compatible with other microcontroller boards. Neo-6M GPS Module is shown in Fig. 4.

Fig. 4 Neo-6M GPS Module

Pin out

- ✓ Pin1(GND)=Ground
- ✓ Pin2(TX)=D6

- ✓ Pin3(RX)=D5
- ✓ Pin4(VCC)=VCC

4) *GSM SIM 900A Module:* This module is a breakout and minimum system of SIM900A Dual-band GSM/GPRS Module. It can communicate with controllers via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT commands). This module supports software power and resets. This is an ultra-compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. It is a GSM/GPRS based device used for sending and receiving of the messages. A GSM Sim 900A module is described in Figure. 5.

Fig. 5 SIM 900A GSM Modem

Features

- ✓ Based on SIMCOM Sim 900A chip
- ✓ Dual band GSM/GPRS module
- ✓ Serial port circuit with protection
- ✓ Control via AT command
- ✓ SMS text or PDU mode
- ✓ Signal and RING LED indicator
- ✓ Compatible with ARDUINO, RESPBERRY-PI, ARM, PIC, 8051, etc.
- ✓ Can be directly connected to computer via Serial Port (Use GSM tester or write your own software)
- ✓ Best suited for GSM based microcontroller projects (better than Sim 300 and other GSM modems)

Specifications

- ✓ Rated operating voltage: 5V DC
- ✓ Low power consumption: 1.5mA (sleep mode)
- ✓ Dual band: 900/1800 MHz
- ✓ Default baud rate: 9600 bps
- ✓ Embedded TCP/IP stack
- ✓ GPRS multi-slot class 10/8
- ✓ GPRS mobile station Class B
- ✓ Meet GSM 2/2 + standards
- ✓ Class 4 (2W @ 900MHz)
- ✓ Class 1 (1W @ 1800MHz)
- ✓ Controlled by AT commands (GSM 07.07,07.05 and SIMCOM enhance AT command set)
- ✓ Antenna interface circuit (flip SIM slot)

Packet Included

- ✓ 1x SIM 900A
- ✓ 1x Power Cable
- ✓ 1x Antenna

Pin Out

- ✓ VCC5=5V supply in
- ✓ GND=Ground
- ✓ 3VT=TXD (unused)
- ✓ 3VR=RXD
- ✓ 5VT=TXD (output,5V): Connect this pin to Arduino Pin 9
- ✓ 5VR=RXD (input,5V); Connect this pin to Arduino Pin 10
- ✓ VCC=Unused
- ✓ GND=Unused
- ✓ DB9-2=RS232 TX(Unused)
- ✓ DB9-3=RS232 RX(Unused) and GND=Ground

5) *Wireless Module (NRF24L01):* NRF24L01 is basically a wireless transceiver, which is used to send and receive data by using radio waves. It is a single chip transceiver module. It uses SPI protocol for transmitting data. Its data transmission speed is up to 2Mbps.It is mostly used in computer, toys, remote control, games, and other electronic devices. NRF24L01 uses the 2.4 GHZ band and it can operate with baud rates from 250 kbps up to 2Mbps. If used in open space and with lower baud rate its range can reach up to 100 meters. The power consumption of this module is just around 12 mA during transmission, which is even lower than a single LED. The operating voltage of the module is from 1.9 to 3.6V but the good thing is that the other pins tolerate 5V logic, so we can easily connect it to an Arduino without using any logic level converters. Wireless Module (NRF24L01) is shown in Figure. 6.

Fig. 6 NRF24L01 Wireless Module

IV. IMPLEMENTATION OF THE SYSTEM

In this paper, C Programming language is used for implementation the software program to interface the hardware circuit. Proteous Design Suite is just used to implement this paper for simulation before interfacing the C program and hardware circuit design must be interfaced practically by using Proteous compiler to test the operation of the system.

A. Flow Chart of the Software System

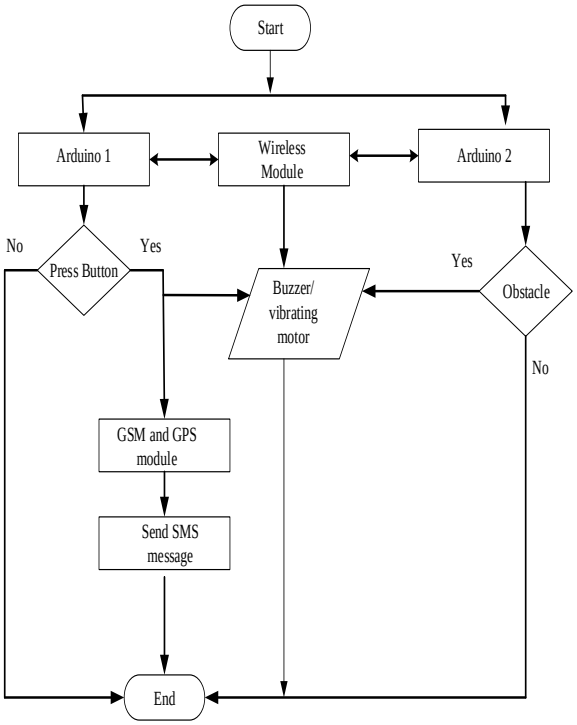

Fig. 7 Flow Chart of the Third eye for the Blind

"Third Eye for the Blind" is a device that can safety for the blind people life. The Ultrasonic sensor senses the obstacles in front of the user to avoid it. User can press the button on the watch to find his/her stick and to send his/her location to family member. The cane and watch are connected by wireless module (NRF24l01). The buzzer and vibrating motor will alarm when the sensor senses the obstacles. Then, if the user press button the buzzer and motor will ring.

B. Implementation System Design

Operation cane, we connect Arduino pin 2 to CE(, pin 4 to CSN, pin 13 to SCK, pin 11 to mosi, pin 12 to miso of the wireless module NRF24l01, pin 9 to TX, pin 10 to RX of the GSM sim900a and pin 6 to RX, pin 5 to TX of the Neo6 GPS, pin 7 to Trig, pin 8 to Echo of the Ultrasonic sensor. We give 5V from Arduino board to VCC pin of the Ultrasonic sensor and GPS. The GND pin of the Arduino is connected to GSM, GPS, wireless module NRF24l01, Buzzer, vibrating motor and Ultrasonic. And then, we connect 3.3V pin of Arduino to VCC pin of wireless module NRF24l01. The Arduino pin 3 is joined to both the positive pin of the buzzer and vibrating motor. The circuit diagram is shown in Figure. 8.

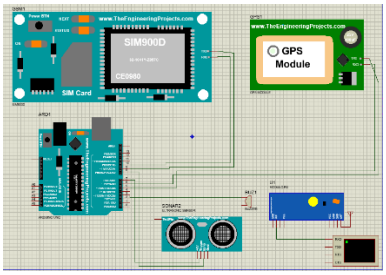

Fig. 8 Schematic capture of the stick

Operation Watch, we connect Arduino pin 9 to CE, pin 10 to CSN, pin 13 to SCK, pin 11 to mosi, pin 12 to miso of the wireless module NRF24l01. We give 5V to the Button from the Arduino and GND it. Arduino pin 3 to GND of the button. The circuit diagram is shown in Figure. 9.

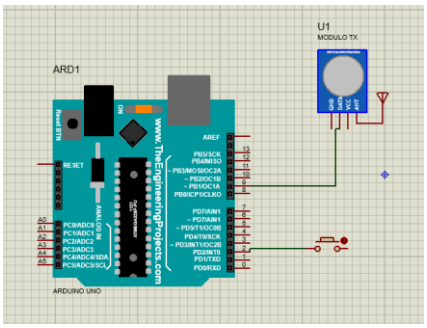

Fig. 9 Schematic capture of the watch

3) *Output of the Message*: The family member will get a message when the user presses the button on the watch. The Figure. 10 show below is the sample of the connected phone getting message.

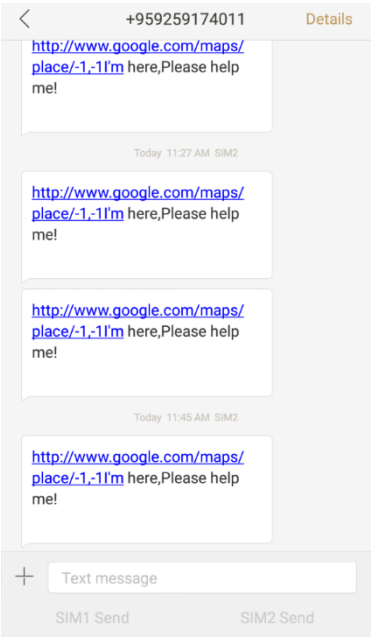

Fig. 10 Message in the connect phone screen

IV. CONCLUSIONS

This product proposed a new technology of smart cane and watch. Smart cane can give to blind people self-confident, safety and secure. This watch can not only give you a stylish view but also help you as a bodyguard. Family can know the location of blind people from GPS. This smart cane and watch aim to solve the problems faced by the blind people in their daily life. This IOT smart cane and watch can give ensure safety for the blind people. In addition, the GSM-GPS technology used in the system provides security during the blind lost his way. Overall, the use of technology provides much more benefits than the white cane, and has taken a great leap towards improving the lives of the visually impaired.

ACKNOWLEDGMENT

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