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Smart Stick for Hurdle Detection and Location Tracking for Blinds

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ABSTRACT

Vision is a beautiful gift to the human being by the god. The proportion of visually impaired and blind people in the world has been increased very largely. In this paper, we are introducing a smart stick system for assisting the blind people. The smart stick comes as a solution to enable visually impaired people to find difficulties in detecting obstacles and dangers in front of the blind people during walking and to identify the world around. The system consists of various sensors along with the Arduino Uno microcontroller and the GPS-GSM.

Keywords: Smart stick, Ardunino Uno, GSM, and GPS

I. INTRODUCTION

Visually impaired persons have difficulty to interact and feel their environment. They have little contact with surrounding. Physical movement is a challenge for visually impaired persons, because it can become tricky to distinguish where he is, and how to get where he wants to go from one place to another. So the main problem with blind people is mobility. This paper proposes a tool for visually impaired people that will provide them navigation. Long white cane is a traditional mobility tool used to detect obstacles in the path of a blind person. We are modifying this cane with some electronics components and sensors so that this traditional cane can become smart cane. Our project aims to design and implement an intelligent and cheap stick with sensors like ultrasonic sensor, water sensor and flame sensor with Global Positioning System (GPS) and Global System for Mobile Communication (GSM) for the visually impaired people, which will detect the obstacle and hurdle in the path and also determine the position and location through GPS.

II. DESIGN AND METHODOLOGY

A. Existing Methodology

It is difficult for blinds to move or live without help. So, they usually use white cane for guide them during moving. Although it might be helpful, it doesn't guarantee saving blind people from risks. These traditional ways can be used for low level obstacles detection only. Blind Aid Stick has been a popular project with constant enhancements and modifications. Currently the commercially available of blind stick are not that popular due to high cost and lack of accuracy.

B. Proposed Solution

Our works aims at providing the help for blinds with the third type of aid. The blind stick is integrated with ultrasonic sensor along with flame and water sensor. The proposed system detects obstacles in his path ahead using ultrasonic waves on sensing obstacles passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close to the microcontroller sends a signal to sound a buzzer and produces appropriate alerts to save the person from hitting obstacles. The ultrasonic sensor is used in this project for detecting

obstacles because it is light weight, user friendly, easy to use, flexible and less expensive. We have also included flame sensor to detect the obstacle in the form of heat and then microcontroller alerts about it through buzzer. The blind people can also face problems of water in their path; this can be detected by water sensor and alerted by buzzer. Location tracking is the major point in our project. We are providing the android application to track the location which provides the current location of blind person to the receiver through the application via message passing system.

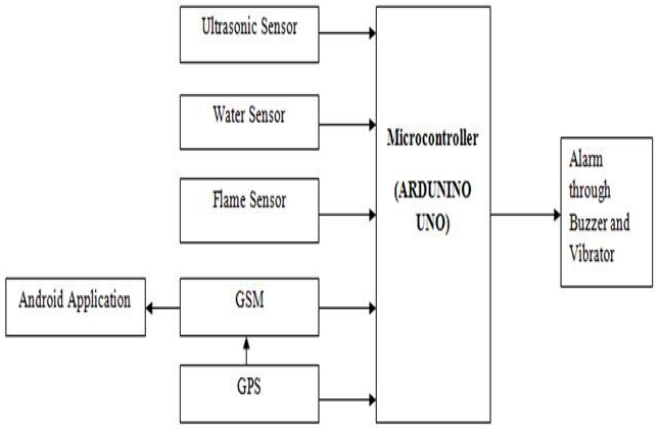

Figure 1, Block Diagram of Smart stick

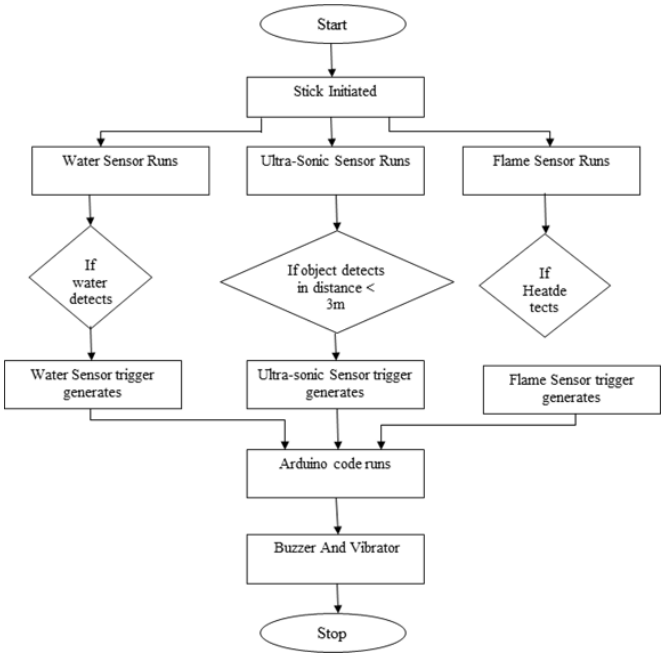

Figure 2, flowchart for smart stick

III. BASIC COMPONENTS

A. Arduino Uno Controller:

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

B. Ultrasonic Sensor:

This ultrasonic sensor module can be used for measuring distance, object sensor, motion sensors etc. High sensitive module can be used with microcontroller to integrate with motion circuits to make robotic projects and other distance, position & motion sensitive products. The module sends eight 40Khz square wave pulses and automatically detects whether it receives the returning signal. If there is a signal returning, a high level pulse is sent on the echo pin. The length of this pulse is the time it took the signal from first triggering to the return echo.

Distance = (speed of sound × time taken) / 2

C. Water Sensor

Water sensor brick is designed for water detection, which can be widely used in sensing rainfall, water level, and even liquid leakage. Connecting a water sensor to an Arduino is a great way to detect a leak, spill, flood, rain, etc. It can be used to detect the presence, the level, the volume and/or the absence of water. While this could be used to remind you to water your plants, there is a better Grove sensor for that. The sensor has an array of exposed traces, which read LOW when water is detected.

D. Flame Sensor:

The flame sensor is used to detect fire or flames. The module makes use of Fire sensor and comparator to detect fire up to a range of 1 meter. Here is an ultra-sensitive fire sensor that activates an alarm when it detects fire. In extremely hazardous environments, flame sensors work to minimize the risk associated with fire.

E. GPS (Global Positioning Systems)

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites.

F. GSM(Global System for Mobiles)

GSM (Global System for Mobile communication) is a digital mobile telephony system.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.

IV. IMPLEMENTATION

A. Working Of Hardware And Designed Application

Working of hardware:

1. Start
2. Initialize the Arduino microprocessor
3. Configure all sensors as an input to arduino
4. Send init commands to GSM and GPS
5. Check input from sensors
    a. If water sensor set i.e. flag=1 then,
        Buzzer starts
        goto step 5
    b. If flame sensor set i.e. flag=1 then,
        Buzzer starts
        goto step 5
    c. If ultrasonic sensor set i.e. flag=1, then
        Vibrator starts
        goto step 5
6. Check for input from switch
    If switch=1
        then goto step 7
    Else
        goto step 5
7. Send data to GSM and initialize the message sending mode
8. Send data to GPS as an input
9. Get location from GPS
10. Save location in input memory
11. Send location details to GSM
12. Return

Software working

1. Start
2. Set application input data
3. Receive message from registered mobile number in GSM module
4. Get location mentioned in message
5. Open location in application designed of location tracing
6. Track specified location in map window provided by application
7. return

B. Circuit diagram of the hardware system

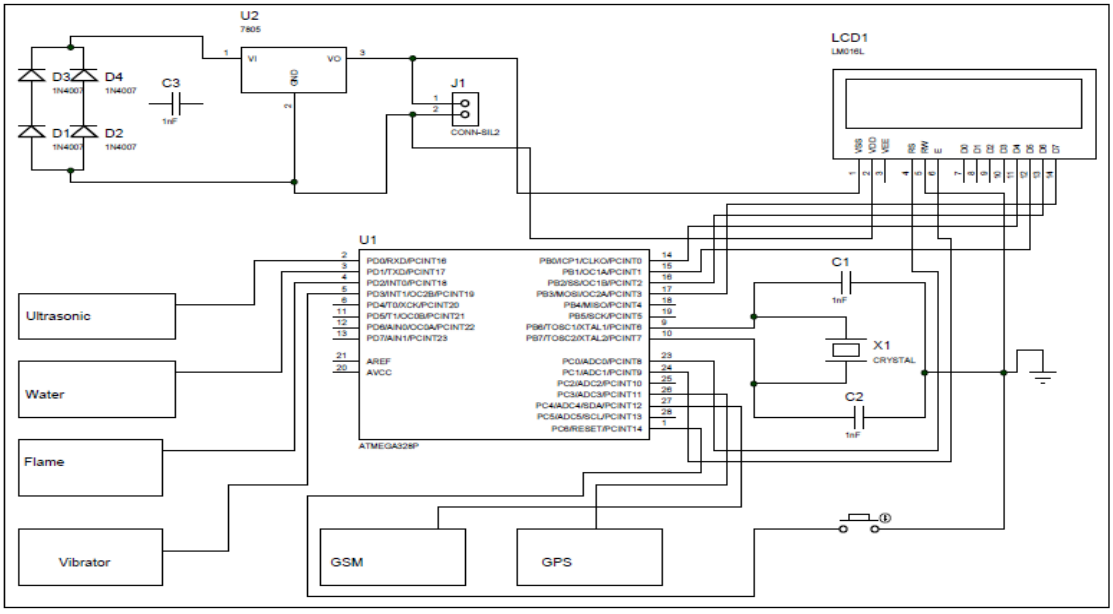

Figure 3. Circuit diagram of smart stick

V. RESULT AND ANALYSIS

There were few details that had been obtained when analyzing the sensors as listed below**:**

A. Result analysis of Ultrasonic Sensor:

Table 1

Sr. No	Ultrasonic Sensor Test Result	
	Distance(Meters)	Vibrator
1	0.305	ON
2	0.456	ON
3	1.215	ON
4	1.289	ON
5	2.067	ON
6	2.890	ON
7	3.567	OFF
8	3.996	OFF
9	4.123	OFF

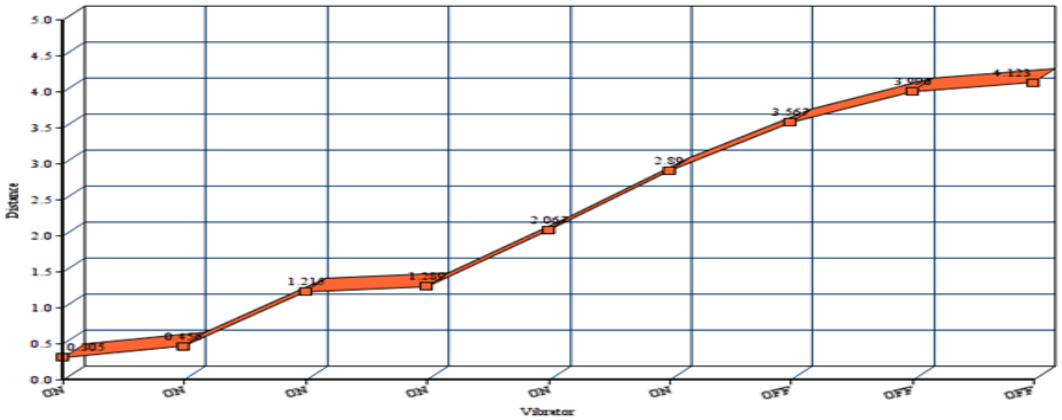

Figure 4. Result for Ultrasonic Sensor

B. Result analysis of water sensor:

The water sensor senses the presence of water in the path and passes the signal to controller which gives alert through buzzer.

C. Result analysis of Flame sensor:

A flame sensor detects the presence of fire or flame. The buzzer gets ON when the obstacle is in the form of fire or heat under the distance of 1 meter.

VI. CONCLUSION

This paper presents the concept of Smart Stick for Blind People. This concept includes the detection of obstacles while blind people moves from one place to another place. The stick is generated using many sensors like Ultrasonic, Flame sensor and Water sensor. When the blind person moves from one place to another place with the help of sensors the message is passed to the blind person through the Arduino UNO in the form of different types of beep and vibrations. Because of this stick blind people can move easily from one place to another without help of others and it also increase the autonomy for the blinds.

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