iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4403

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

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 Nano microcontroller and the GPS-GSM.***
Microcontroller receives the sensor signals and process them to short pulses to the Arduino pins where buzzers is connected, which gets start if the obstacle is found in the way. GPS and GSM technology helps in tracking the device. The aim of this research is to provide a good understanding to make a suitable system in the future. It can be made available to all segments of the society and families who need them.
Keywords: Smart stick, Arduino Nano, Global System for Mobile Communications (GSM), Global Positioning System (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. [1] The aim to design and implement the intelligent and cheap stick with sensors like ultrasonic sensor, flame sensor and water 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 will also determine the position and location through GPS-GPS system.

II. LITERATURE SURVEY

A smart stick for blind people is a popular projectwhich has contiguous improvement and modification. The basic tool for blind person is a white cane, which is innovated for help them to balance while walking and detect the obstacles by tapping the stick on the ground surface. But this requires lot of practice for getting the directions only by using that white cane. The born blind people somehow be comfortable with it, but the people who lost their eyes in life happened accidents can't live well with that. So they need more reliable and secure solution for this purpose other than that white cane.
Now a day's many smart sticks consisting different sensors are available in market which detects the obstacle in the path of that blind person and alerts them about that obstacle. This smart stick provides many advantages to the blind persons for reaching till their destination without facing any major problem and moreover this also helps them in doing their daily based work more efficiently and conveniently. Currently available blind sticks aren't that much popular because of their high cost and inappropriate /lack of accuracy. The blind people require much more reliable, low cost and accurate stick which helps them during their movements and alerts them about the hindrances in path. So it is needed to develop a more reliable and low cost smart. Stick for the people who cannot afford the high cost and high technology based sticks. Several attempts have been made for designing the guard/ obstacle/ hindrances avoiding devices for the blind by using components with limited number of applications. The section discussed below lists the some of these attempts and their shortcomings.

1) *Paper [1] Title:* Pothole detection for visually impaired- Over the years, researchers and companies have invented plenty of devices to help people with visual impairments avoid objects such as a desk or chair. Many of these gadgets used ultrasonic sensors for detecting such hazards and moreover this uses..a..camera..that..captures..image..@15..frames persecond and based on the concept of image processing the pothole is detected. Problem with this system was that it uses the camera which is

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expensive, and hence overall cost of the stick increases. Also a lot of images per second increases the overhead and storage requirement. [2]

2) *Paper [2] Title:* Smart Walking Stick for Blind describes about a Stick which use Raspberry Pi-10 and an ultrasonic sensor to detect objects and intruder, the system also has a camera embedded with it, and based on the images captured the objects are detected. [3]
3) *Paper [3] Title:* A wearable ultrasonic obstacle sensor for visually impaired .This system uses a couple of ultrasound sensor on either side over the strap of the goggles .This project can detect the intruder in front of the blind person who is wearing the goggles .This system is not robust as the sensor embedded with the goggles makes it heavier and also it cannot detect complex objects such as water, vehicle etc. [4]
4) *Paper [4] Title:* Voice operated outdoor navigation system for visually impaired persons done by Somnath and Ravi. The system uses the ARM processor which has more memory space, but this system cannot operate indoors because there will be no signal for the GPS system. [5]
5) *Paper [5] Title:* A multidimensional walking aid for visually impaired using ultrasonic sensors network with voice guidance .The proposed method implemented a network of ultrasonic sensors capable of detecting the direction and position of obstacle(s) .The performance of his proposed stick in detecting obstacles is low, that is, 1 meter maximum range of detection. [6]

III. METHODOLOGY

The aim is to provide the help for blinds with thethird type of aid. The Blind stick is integrated with ultrasonic sensor along with water/ moisture and flame sensor.

The proposed system detects the upcoming obstacles in the path of blind person using ultrasonic waves. 0n sensing the obstacles it passes this data to the Arduino. The Arduino then processes this data and calculates whether the obstacle is close enough. If the obstacle is not that much close the circuit does nothing.

If the obstacle is close to the Arduino , it sends the sound signal to the attached buzzer and produce an appropriate alert sound for the purpose of saving the blind person from hitting by/the obstacles. The purpose of the ultrasonic sensor used in this is for detecting the obstacles because of its light weight, user friendly behavior ,easy to use and understand, flexible and less expensive.

The system also includes Global Positioning System (GPS) and Global System for Mobile Communication (GSM) for helping the visually impaired blind peoples, which will detect their position and location.

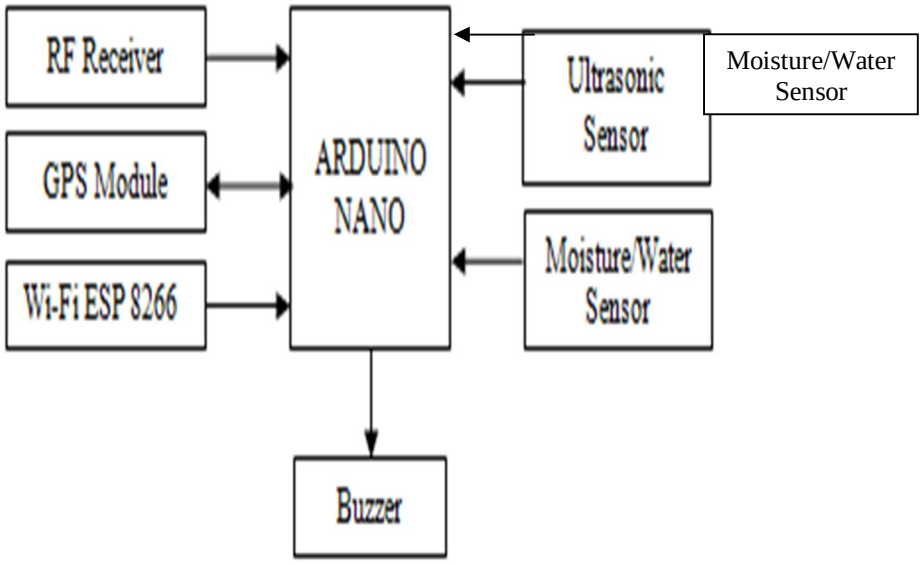


Fig.1 Block Diagram of the System

The above mentioned units are responsible for giving the information to the user about the closest object in five different directions. Based on these data obtained from the sensors (Ultrasonic, water and flame), user can decide what to do to keep the system safe from the collision.

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IV. TOOLS AND TECHNOLOGY

A. Arduino Nano Microcontroller

Arduino Nano is a microcontroller which can control the environment by receiving the input signals whether Digital or Analog and can effects its surroundings by controlling them in the form of lights, relays and other devices. The microcontroller on the board which is programmed using Arduino software (IDE).

B. Ultrasonic Sensors

Generating, detecting & processing ultrasonic signals Ultrasonic sensor is produce the sound waves above the frequency of human hearing and can be used in a different variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement .Ultrasonic sensor module HC - SR04 provides 2cm - 400cm non-contact measurement facility, the ranging accuracy can reach to 3mm.

The basic principle of work:

1) Using IO trigger for at least 10us high level signal.
2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.[7]

C. Moisture Sensor

A moisture sensor is located at the base or bottomof the stick to have precaution against the wet/ watery surface which can cause slipping on/over the floor and thus can hurt badly. When the water/ moisture sensor comes in contact with the wet surface, it produces an electrical signal which triggers the Arduino controller. A voice instruction for wet surface is produced and also the buzzer is enabled for alarming against the wet floor.

D. GPS and GSM System

When GSM modem receives a message the microcontroller will process the message with the keyword gets saved in it. Afterwards, it will get the location of the stick from the GPS modem and transmit the saved location in GSM modem in order to respond to the sender. In case of an emergency, the user of the blind stick can press the emergency button then the microcontroller accesses the location from the GPS modem and then transmit the location to the GSM modem which Will have the SMS sending facility and will send the messages to the all saved numbers in the microcontroller. The GPS will update the location of the stick and automatically save the location in the microcontroller. EEPROM memory. If the microcontroller receives the word “set codeword” from the GSM modem, the microcontroller will track the last saved location from the EPROM and transmit it to the GSM modem which will send an SMS message that will state the location for the person to the required. Additionally if the emergency button is pressed the directly the microcontroller will transmit the last location saved in the EEPROM to the GSM modem to send it to all desired saved number in the microcontroller.

E. E. Buzzer

A transducer (converts electrical energy into mechanical energy) that typically operates. A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to warn the blind person against obstacle by generating sound proportional to distance from obstacle.

F. Wi-Fi ESP 8266

ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems or to function as a standalone application, with the lowest cost, and minimal space requirement. ESP8266EX offers complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload. Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. In has integrated cache to increase the performance of the system in such applications.

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V. IMPLEMENTATION RESULTS AND DISCUSSION

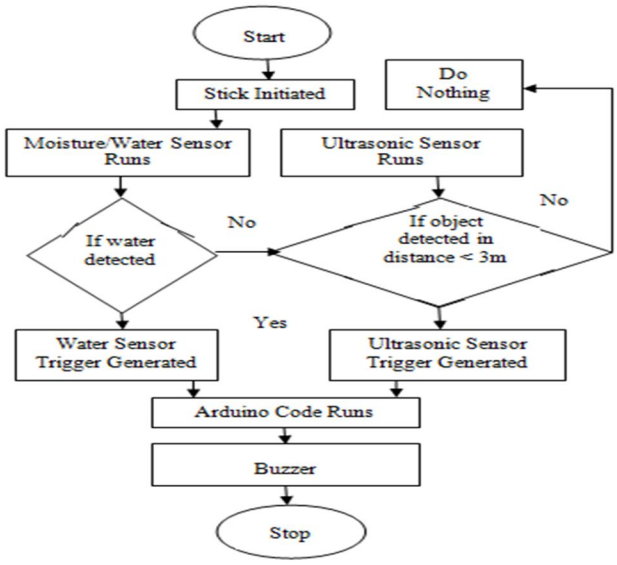


Fig.2 Flow Chart of the Hardware Communication [8]

The system has been performed on the Arduino Nano board. Wi-Fi module is used to transmit data between microcontroller and laptop. Data obtained from sensors is sent to Windows from application for further processing. Several simulations were carried out to ascertain the efficiency of proposed technique.

After it was obtained that all hardware devices were working perfectly, the testing of them began. Test and reliability check was conducted using each components of the smart stick to validate their efficiency and know if the are working according to specification before soldering.

VI. FUTURE SCOPES

The technologies behind blind sticks are upgrading day by day. And our model ensures one thing that is making the task of moving of a blind person easy and comfortable. The stick is also very light and handy to carry. And the components or parts that we used in the stick are also easily available and less in cost. And besides all that the manufacturing cost is also quite low, that makes the stick affordable for people of all class and age. In future, if further improvement and investment is carried out with the stick then it will be an even more effective device for the future world. Some of the techniques in which this device can be modified are given below:

A. Arduino can be replaced by upgraded Microcontroller or chip.
B. It can be further enhanced by using VLSI technology to design the PCB unit. This can make the system even more compact.
C. More sensors can be used for further application.
D. Image processing can be used for knowing about the volume of obstacles and object patterns.
E. High range ultrasonic sensor can be used. [9]

VII. CONCLUSION

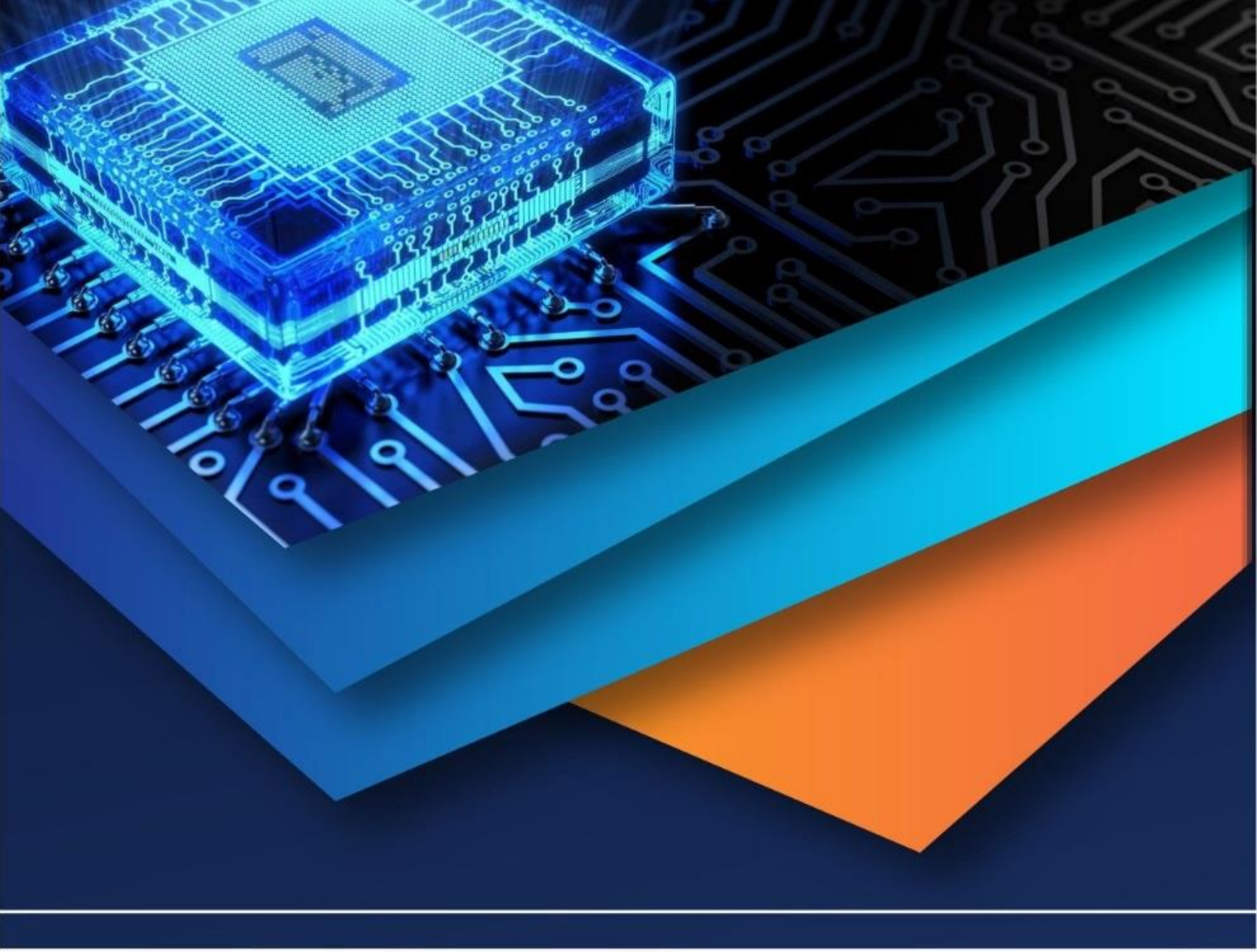
All the studies which had been reviewed show that, there are a number of techniques for making an ultrasonic blind stick for blind people. The aim of this paper is to get familiar with the work done in making walking stick smarter and more helpful. The literatures related to this topic were reviewed and analyzed. As technology improves these smart sticks need to be modified. The simulation results are expected for the ultrasonic sensors and water sensor in one microcontroller. A global positioning method to find the position of' the user using the GPS, and GSM modules to communicate the location to a relative or care giver. In the future, further modifications to enhance the performance of the system can be added. A vibrator may also be added for ease of use and convenience. Voice playback module to assist blind person to reach the destination through the command or microphone could also be installed. So in this paper wide survey of the work related to this project is done and we have shortlisted some useful aspects of this project, this will also help to decide designing approach.

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