

An Artificial Eye for Blind

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A blind person always remain dependent on assistant to move from one place to another. If they move by themselves they can harm themselves because they are not able to identify the obstacle in their path. To make them independent a smart stick is proposed in this paper. This stick makes the blind person independent. A smart stick consists of different sensors to identify the obstacle. A speaker and buzzer to give the output in recorded voice after sensing the obstacle. In addition smart stick also consists of GPS and GSM module to navigate the path. The GPS module also plays a major role as it provides safe and precise navigation to the users. It also help relatives to track the blind person. The paper describes the different component and working of smart stick. The Smart Blind Stick automatically detects the obstacle in front of the person by use of sensors present in the systems, it also incorporates moisture detection at its bottom in order to detect the moisture of the soil or ground so that the person will be aware if it's feasible to walk on that particular ground.

Keywords: Smart Stick, GPS and GSM module, Arduino Uno, Speaker, obstacle.

1 Introduction

The people who can't see small detail by their eyes are called Visually impaired people. "Those who have the visual acuity of 6/60 or the horizontal extent of the visual field with both eyes open less than or equal to 20 degrees, these people are considered blind" as stated in [1]. The blind person also known as visually impaired persons find difficulty in movement and travelling. Due to this difficulty they are not social and less explored to world.

As stated in [2] almost 10% of blind community has no visual eyesight so they cannot move independently. Blind people are part of a community but their mobility in the world and social life is limited. Due to pollution and other impurity in food items it is expected that visually impaired people will grow in the future. To make them independent it is very essential to develop the smart stick by using the latest technology. So many sticks are available in the market but they are not that much effective. As the technology develops normal sticks are converted into smart sticks. Smart sticks are compact in size, easy to use and low cost with many other features.

In [3 and 4] the author has uses IR sensor, water sensor and ultrasound sensor to locate the obstacle. A buzzer is used to alert the blind person however location of blind person cannot be detected. In [5] camera with storage system is used in stick to captures the images based on images the obstacle is detected. However the use of camera and storage system makes stick very expensive. So its use is limited to only rich persons. Further in [6 and 7] Raspberry Pi is used with an ultrasonic sensor and camera to detect the object. A very complicated embedded system is used to store and detect the images. This stick is also very expensive and not used by general people. The ultrasound sensor with belt is used in [8]. The belt is embedded in stick with buzzer which vibrates after detecting the obstacle. In this stick system is developed to calculate distance between stick and obstacle and after calculation distance is sent as an audio message by speaker.

After the development of GPS and GSM module it is used in stick to trace the location of blind person. The memory chip with GPS module is used to save different locations. The blind person can easily trace the location via voice signal. To send message to relatives in case of emergency or any other issue GSM modem is used. In [9] author presented a review on smart stick used by blind persons to detect obstacle using artificial intelligence.

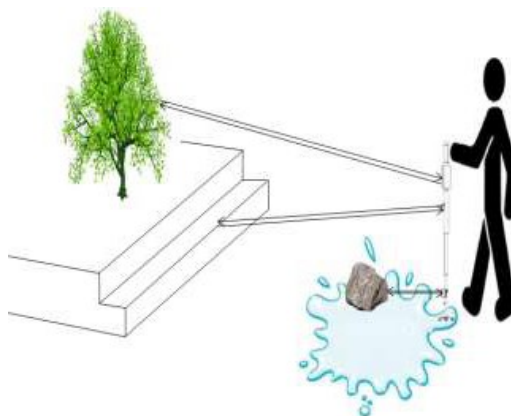


Fig1.: Smart stick detects obstacles in front of the blind

Figure 1 represents how the smart stick helps blind person to detect water, stone, stairs and tree. Due to which the person walk easily without any assistant and also does not harm them shelves.

2 SMART BLIND STICK COMPONENTS

In this section different important components used in making smart blind stick are described in detail. Figure2 show the block diagram of proposed blind stick.

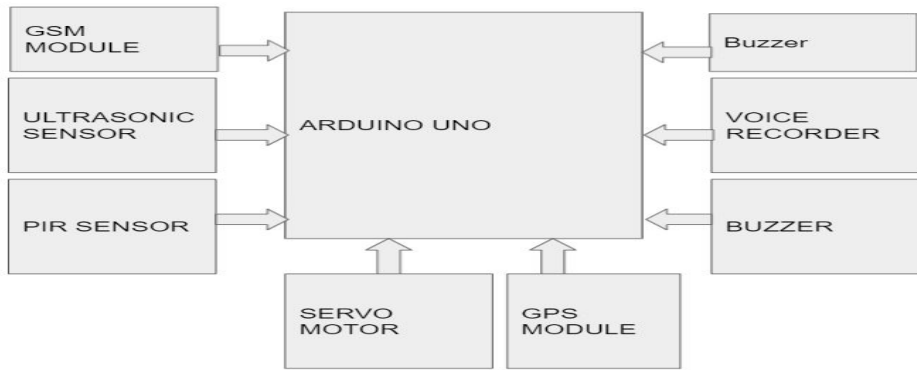


Fig 2.: Block diagram of proposed Blind Stick

ARDUINO UNO: Arduino Uno is worked on principle of AVR microcontroller called Atmega328. The controller have 2KB SRAM, 32KB of flash memory, 1KB of EEPROM. In Arduino Board 14 digital with 6 analog pins are used for external connection of any kind of circuit as shown in fig.3. The pins are sampled by ON-chip ADC. The board requires only 5 V supply to turn on through USB port however it can be connected upto 12 V supply as per the requirement of the project. The Arduino Uno-based stick inform blind people about any obstacles by Audio Jack Headphones which is installed on the stick [10-12].



Fig. 3: Arduino UNO

BUZZER: A buzzer is a transducer which converts electrical signal into mechanical signal. A buzzer will operate in audio range of 20Hz to 20kHz frequency as shown in fig.4. The use of buzzer is to warn the persons regarding any obstacle in path.

SERVO MOTOR: Servo motor may be a mechanism { positioner | actuator} or linear actuator. The servo motor shown in fig.5 permits for precise management of angular or linear position, velocity, and acceleration.



Fig. 4: Buzzer



Fig. 5: Servo Motor

PIR SENSOR: PIR sensor detect any human or animal movement in set range by detecting different infrared radiation emitted from human or animal body. The PIR sensors as shown in fig.6 does not emit any energy but it receives energy from body as a passive element. The sensor has three pins. Pin 1 is connected to 5V DC supply. Pin 2 is the output pin used to detect IR signal with amplifier. Pin 3 is connected with ground.

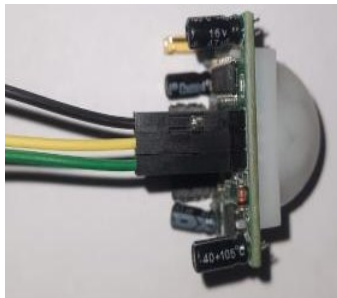


Fig. 6: . PIR Sensor

Ultrasonic Sensor: The ultrasonic sensor shown in fig.7 is a type of transducer with transmitter and receiver. This sensor is used to detect an object with wavelength ranging from 20kHz to 20MHz [11]. The sensor transmitted a sound pulse at the speed of 340m/s which bounces off an object and reflected back in the finder range. This sensor is very robust, flexible connected in air in stick to detect non-contact object. This sensor performance is not affected by any environment condition.



Fig. 7: Ultrasonic Sensor

VOICE RECOGNITION MODULE (ISD1820) :ISD1820 is a small Voice Recorder and Playback module that can do the multi-segment recording. This Voice Recorder/Playback module is designed with embedded-Flash memory, which can hold data for up to 100 years and erase. For announcing the warning alarm in case of obstacle detection recorded multiple messages are saved. In this device microphone is used as input and speaker is the output. In this proposed blind stick model seven messages are recorded shown in fig.8.



Fig. 8: Voice Recognition Module

GSM and GPS module: To trace the location of blind person GPS module is used. If the relative person wants to trace the location of blind person, with the help of GSM and GPS module attached to stick they can easily identify. If the blind person wants to make contact to their relative the GSM module help to contact to the emergency number stored in the microcontroller.

3. WORKING OF SMART STICK

Arduino Uno is the heart of this project which connects other component such as GSM module, ultrasonic sensor, PIR sensor, buzzer, voice recorder, servo motor and GPS module. The Ultrasonic sensor used in this project have 4 pins first is Vcc, second is Trig (Signal Output pin), third is Echo(Signal Input Pin) and the last one is GND. The Ultrasonic Sensor whenever receives a signal through Trig pin output is sent to the Arduino giving command to blow the buzzer which send the command to Servo motor to rotate. The PIR sensor used here can detect human being (even a warm body or object with some temperature) passes through the stick. It can easily detects the infrared radiation emitted by a hot body motion. Thus, the infrared radiation detected by the sensor generates an electrical signal that can be used to activate an alert system or buzzer. In this model as shown in fig.9 the buzzer system is replaced with Voice Recording Module which receives the signal and when given input to Arduino when PIR sensor detects the motion and the voice recording module get activated. The GPS and GSM here is used to track the visually impaired person by their relatives or by visually impaired to understand the locations by listening.

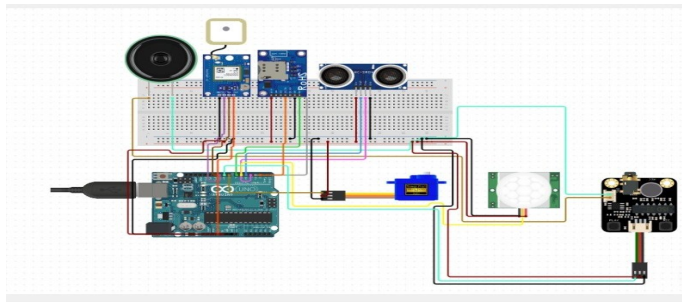


Fig. 9: Circuit model of Smart Stick

The model of smart stick consist of GSM module, vibrator, GPS module, switches and sensors. If any sensor detect obstacle the vibrator vibrate which is placed at the top of the stick. If the blind person wants to send or know the current location he can use the button of GSM. To sense the water, obstacle, any heat body ultrasonic sensor and infrared sensor are placed at stick. To know the directions GPS module help. Figure 10 show the blind stick model.

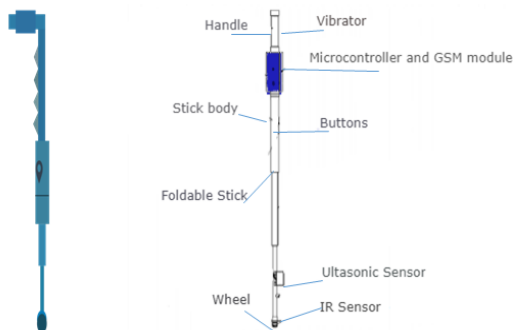


Fig. 10: Smart Stick Model

3 CONCLUSION

In this model a smart stick is designed to detect obstacles in path of blind person. This smart stick is very compact, easy to use and cost effective. The smart stick can sense obstacle up to 70 centimeters. away and receive feedback in the form of sound and vibration. In this stick an additional feature of GSM and GPS module is also added to track the location of blind person. If the blind person wants to make contact to their relative the GSM module help to contact to the emergency number stored in the microcontroller. In this proposed blind stick model seven messages are recorded. This model provides a means of active interaction and navigation between the system and the blind person. Its features like interaction or commands over voice, precise navigation, and reliable obstacle detections make its future scope huge. With the advancement in technology and our dependency on it, this project would be proved to be high in demand in the recent future. The test results prove that this system is more reliable than any other existing system, however, some more improvements can make it even more faithful and accurate.

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