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Project Title : SMART CANE FOR VISUALLY DISABLED

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TITLE: SMART CANE FOR VISUALLY DISABLED

ABSTRACT

Visual defects are the most prevalent diseases among people. The estimated number of visually impaired people in the world is 285 million and number of blinds is 39 million. Among the 39 million blinds, 15 million are from India. People with visual disabilities are often dependent on external assistance for decision making which prevents them from travelling independently. To aid the visually impaired people smart cane is used.

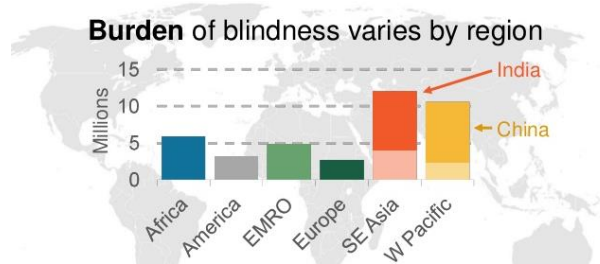


Fig : Chart showing the percent of blind people across the globe

This innovative cane is integrated with ultrasonic sensor in order to detect the obstacles that come in their way and alerts a buzzer if it is with in the minimum threshold distance. If not, it neglects. The cane also has light and water sensing units. The light sensing unit detects whether it is a bright or dark area and beeps the person accordingly, which prevents him entering the restricted areas. Water sensing unit detects the water ahead, and beeps. Each buzzer beep is of different frequency so that the user can distinguish the alerts. Thus, the proposed stick allows improved navigation using obstacle, water and darkness detection.

Keywords: Microcontroller, Ultrasonic sensor, LDR, Buzzer, conducting wires.

LITERATURE SURVEY

G. Gayathri, M. Vishnupriya, R. Nandhini and M. Banupriya “**Smart Walking Stick for Visually Impaired.**” International Journal of Engineering and Computer Science, vol. 3, number 3, pp. 4057-4061, 2014.

- Normal walking canes are mechanical devices to detect only static objects.
- This paper gives the obstacle detection and pit detection when the ultrasonic sensor and pit sensor (IR) are connected to the PIC microcontroller.
- It also has a GPS integrated module that stores a set of destinations into the memory and is programmed to find an optimal route for easy navigation.
- All these are considered as an embedded system which is integrated with various sensors with the microcontroller.
- Generally, a microcontroller is a chip that consists of various input and output devices like RAM, memory etc.
- The main purpose of using microcontrollers for all these systems is that it stores the programs and runs them uniquely.
- The obstacle detection which is possible through the ultrasonic sensor detects the obstacles within a range which is limited.
- The ultrasonic sensor principle is similar to the radar principle.
- It interprets the attributes of the object that is opposite through the echoes of the sound waves and sends this information to the sensor.
- This sensor calculates the time interval between the waves which further calculates the distance and sends back to the microcontroller.
- The uneven surfaces or pits are detected through simple tactile force with the help of an infrared sensor.
- This paper is not embedded with water detection.
- The software used to develop code for PIC microcontroller is MPLAB.
- It is an Integrated Development Environment (IDE) that is specially designed for microchip technologies.

- It is windows-based software.
- The main purpose of using this software is because of easy understanding.
- The Global Positioning System(GPS) gives the alerts to the user when desired location is reached which is functioned earlier.
- Any data that is generated either through sensors or through the GPS module is stored within the microcontroller.
- This microcontroller functions according to that type.
- There are some suggested improvements described in the paper such as increasing the range of ultrasonic sensor, synchronization with the external memory.
- As there are many software applications available, there may be a chance of developing a device that is not fixed
- only to limited number of distinctions or a particular destination given by the user through voice system which
- is not present in pre-program.

R. Radhika, P.G. Pai, S. Rakshitha and R. Srinath “**Implementation of Smart Stick for Obstacle Detection and Navigation.**” International Journal of Latest Research in Engineering and Technology, vol. 2, number 5, pp. 45-50, 2016.

- This paper refers to the obstacle detection with the help of ultrasonic sensor and IR sensor.
- Ultrasonic sensor detects obstacles within the range of 3m.
- IR sensor detects small objects at a range of 50cm, angle +/-45 degrees upwards and downwards.
- Arduino microcontroller is used in this paper.
- Laser sensors can also be used for obstacle detection but it is costlier.
- GPS module is used for positioning and navigatio

G. Prasanthi and P. Tejaswitha “**Sensor Assisted Stick for the Blind People.**” Transactions on Engineering and Sciences, vol. 3, number 1, pp. 12-16, 2015.



- In this paper the cane with multiple sensors are used to detect the obstacle for collision avoidance in all directions.
- The sensor is placed at the bottom tip of cane which is used to detect pits.
- The sensors are integrated to voice record and play chip which respond for different sensors to give voice message if obstacle is found.
- This cane helps blind and visually impaired people to reach their destination.
- The main component used in this system is infrared sensor.
- Basic components used are microcontroller sensor, power supply, servomotor, buzzer, voice record and play back device, speaker.
- Two distance measuring sensors are connected to i/p of microcontroller, the buzzer and servo motor are connected to o/p terminals.
- Initially all the sensors and motors are switched off then the servomotor starts rotating upward and downward since the distance sensor is mounted on the servomotor.
- If obstacle is found within threshold limit the buzzer beeps and also gives voice message.



TOOLS

HARDWARE

- Arduino Mega 2560 Microcontroller
- Ultrasonic Sensor HC - SR04
- Light Dependent Resistor
- Conducting Wires
- Buzzer
- Breadboard
- Battery 9v

SOFTWARE

- Arduino Compiler.
- Embedded C Programming.

DESIGN

Smart cane basically works on the microcontroller i.e., Arduino mega 2560. This Microcontroller is used for IoT based applications. It has 54 digital Input-Output pins and 16 analog input pins. Smart cane has the sensing unit with ultrasonic sensor, light dependent resistor (LDR) and water sensing unit.

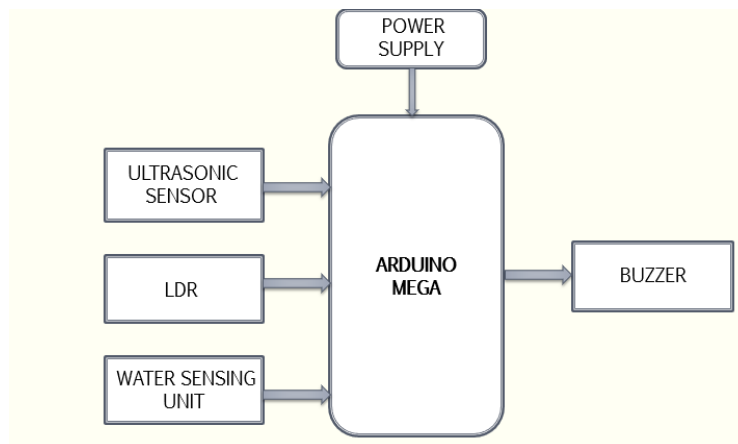


Fig: Architecture of smart cane.

All the sensors are connected to the Arduino board. These give the respective inputs to Arduino. Buzzer is connected to Arduino as output. The whole unit is supplied with the power using battery of 9 volts. Ultrasonic sensors detect the obstacles in three directions front, left and right. This can be done by placing three sensors in three directions. When sensors detect any obstacles within the distance of 2 meters in any of the three directions in the path of the user, buzzer gives a beep sound. Each buzzer beep is differentiated with varying time delays. LDR detects the dark environments and gives input to Arduino then the buzzer is activated. Water sensing unit is also connected as input to Arduino. When water is detected in the path of the user, buzzer is activated.

METHODOLOGY

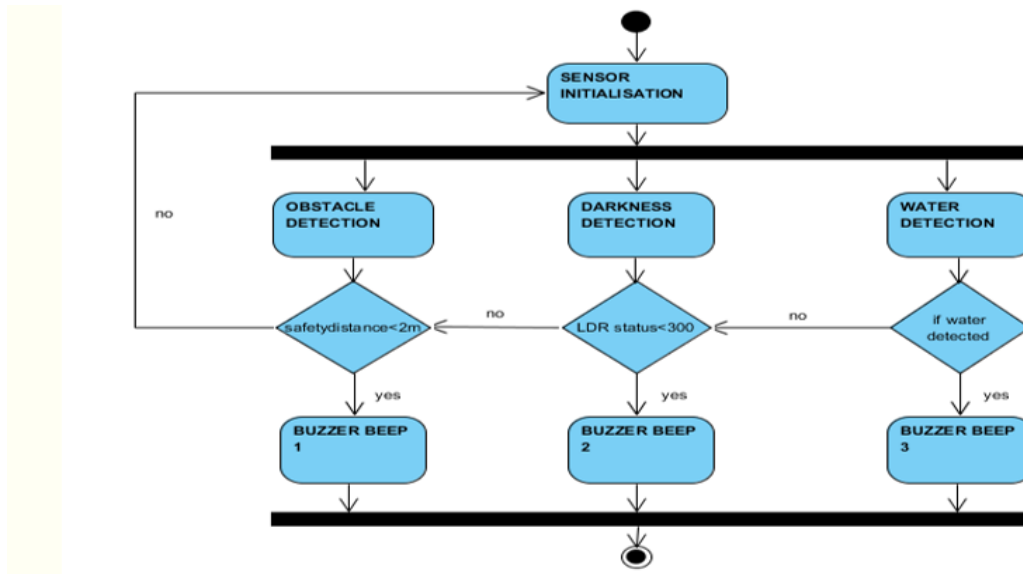


Fig : Working of smart cane.

IMPLEMENTATION

Obstacle Detection

Ultrasonic sensor is used for obstacle detection in this smart cane. The sensor has two openings on its front, one transmits ultrasonic waves and the other receives them. This is the working principle of the ultrasonic sensor and used to calculate distance.

$$\text{Distance} = (\text{Time} * \text{Speed of Sound}) / 2$$

This sensor has four pins namely Vcc, trig, echo, GND. These pins have to be connected to the microcontroller. A Buzzer is also connected to the board which is the source of output. Code written in the Arduino compiler environment is interfaced with the microcontroller. When the sensor detects an obstacle within the distance of 2 meters, the buzzer gets activated.

Algorithm

1. Start
2. Initialise pin numbers.
3. Set the pin modes(input/output)
4. Calculate duration using pulseIn()
5. Calculate distance using formula $\text{Distance} = (\text{duration} * \text{Speed of Sound}) / 2$
6. If Distance less than 2 meters then 6.1. Activates buzzer using tone()
7. Else 7.1. Do nothing.
8. End.

Darkness Detection

Light Dependent Resistor (LDR) is used to detect darkness. Resistance of LDR increases or decreases depending on the light intensity. LDR has lower resistance in the absence of light which is the working principle. It has two pins, one is connected to analog input of microcontroller. When there is a dark environment the resistance of LDR increases thus activates the buzzer

Algorithm

1. Start
2. Initialise pin numbers.
3. Set the pin modes(input/output)
4. Read ldrstatus value from LDR
5. If ldrstatus less than 3005.1. Activates buzzer using tone()
6. Else 6.1. Do nothing
7. End.

Water Detection

A simple water sensing unit is set up using the principle of conduction of electricity in water. For this purpose, two silk wires are used. When these wires come in contact with water start conducting electricity thereby activating the buzzer.



Algorithm

1. Start
2. Initialise pin numbers.
3. Set the pin modes(input/output)
4. Read status value using digitalRead()
5. If status = HIGH 5.1. Activates buzzer using tone()
6. Else 6.1. Do nothing
7. End.

Coding is done in Embedded C language. This language is used for programming Microcontroller applications. Arduino compiler is the Integrated Development Environment where the codes are written using the built-in libraries. All the three codes are combined into a single one and that code is uploaded to the Microcontroller with the upload option provided in the IDE.



EXPECTED OUTCOME

- Detects the obstacles in the three directions of the person within the range of 2 meters and beeps.
- Detects the dark environment and gives a buzzer sound.
- Detects the presence of water and buzzes the sound.
- The whole setup will be implemented within 2000 rupees.



CONCLUSION

- The proposed smart cane allows improved navigation using obstacle, water and darkness detection.
- Due to its low cost it can be used by many visually disabled people.

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