Team: Drishti

Project: aid for the visually impaired

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INTRO...

As the name suggests, our project is an aid for visually impaired. It detects obstacles around the user and gives the directions to user through earphones. It has an additional help button. Whenever the user needs help, he can alert the people by pressing a button, which triggers the buzzer and the LEDs.

ANSWERING THE 'WHY?'

India is home to the largest population of visually impaired people. Out of the 37 million blind people in the world, India has 15 million – 26% of which (3 million approximately) are children. Our project, if implemented in the right way could make the life of this neglected population a lot easier.

(Statistics taken from TOI)

THEORY …. CONCEPTS…..

Take help from the following links for clearing your concepts….

1. HC SR04 Ultrasonic sensor MANUAL: www.accudiy.com/download/HC-SR04_Manual.pdf
2. HC SR04 simple APPLICATION : howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/
3. Watch this for more conceptual clearity about HC SR04 https://www.youtube.com/watch?v=ZejQOX69K5M
4. Arduino mega 2560 manual www.microelectronicos.com/datasheets/ArduinoMega2560.pdf

5) An insight to arduino and related programming https://stab-iitb.org/electronics-club/tutorials/arduino/

6) Have a look at what micro-sd-card-BREAKOUT-board is:
https://learn.adafruit.com/adafruit-micro-sd-breakout-board-card-tutorial/intro

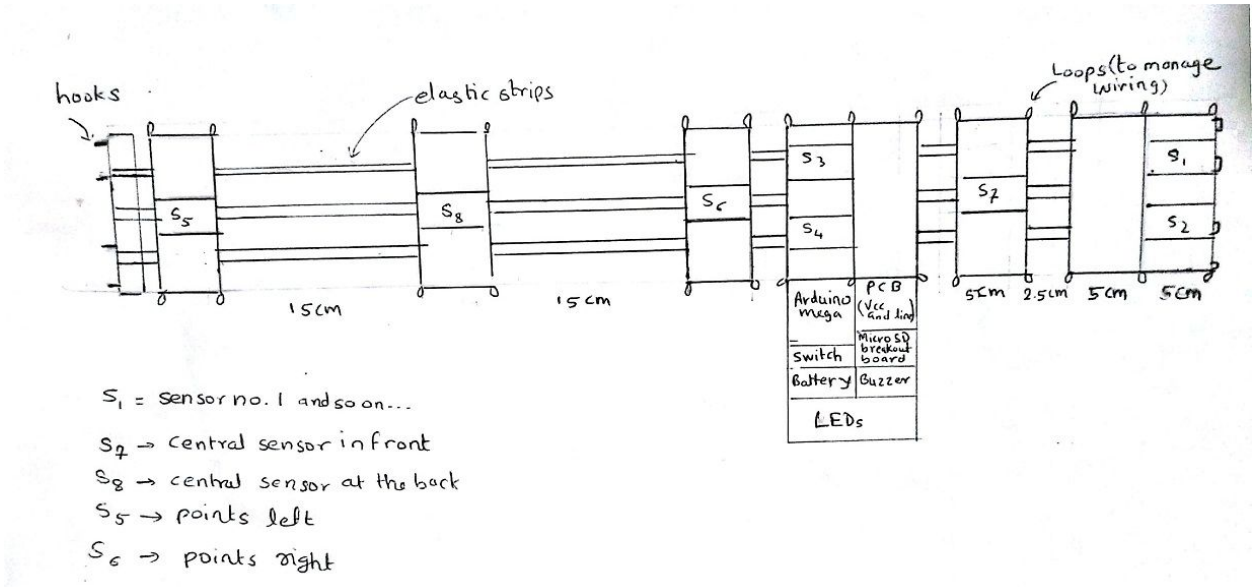
7) Get yourself introduced to tmrpcm thing
diyhacking.com/arduino-audio-player/

WORKING(OVERVIEW)

Ultrasonic sensor modules with little bit of arduino programing is used for obstacle detection.
Arduino MEGA is used as a control unit- and controls all the hardware.
Audio messages to be played are stored in microSD card.
MicroSD card is connected the to Arduino using the microSD card breakout board.
According to the inputs received from all the sensors, the information is processed by the main program and the corresponding audio command is played in the earphones.

PROJECT DETAILS

Belt Design



Sensors are mounted on wooden blocks

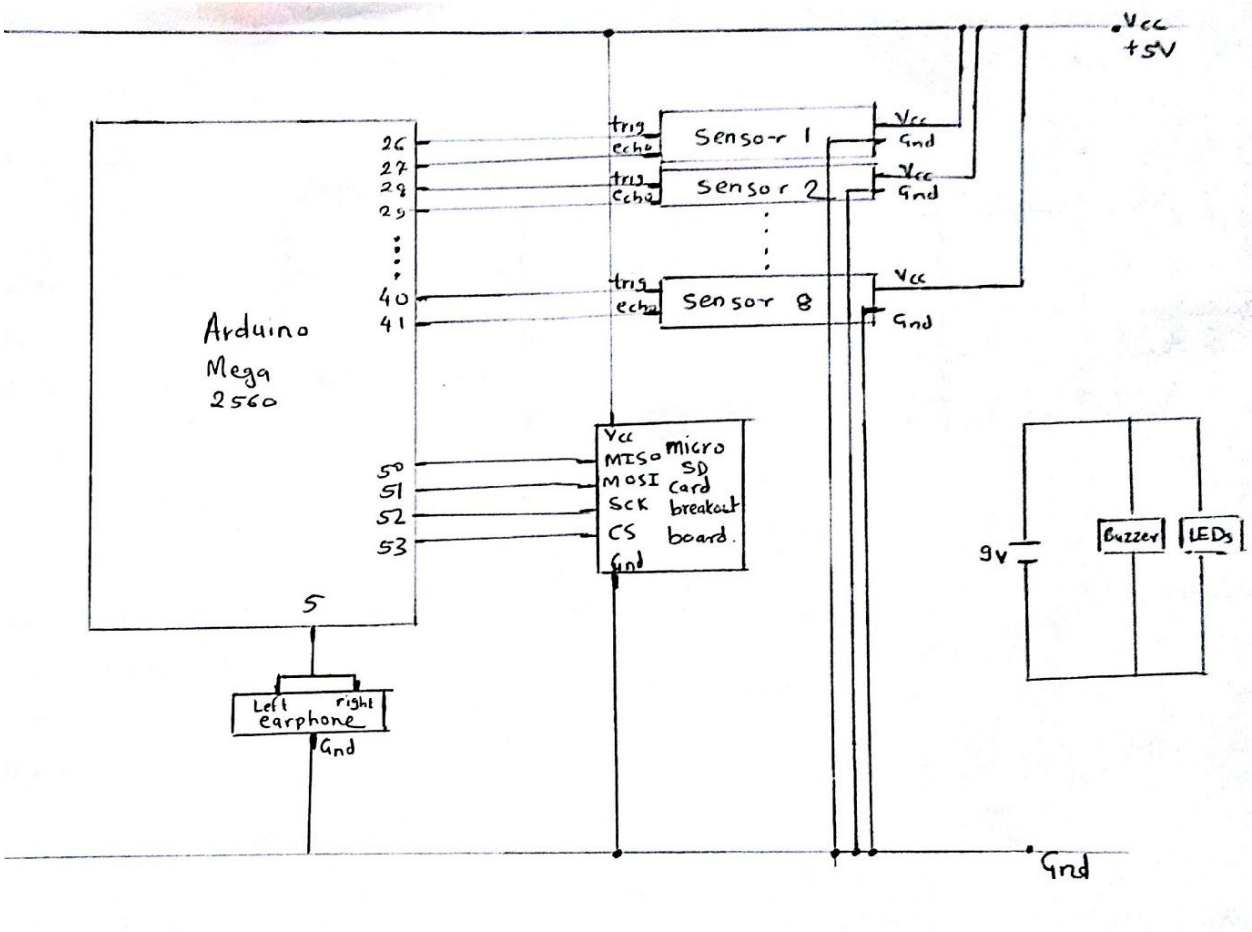
(5cm*2cm*1.5cm)

Wooden blocks on which S1, S2, S3, S4 are mounted are cut to make the sensors point at some angle instead of making them point straight.

S1, S3 deviate upward by 10 degrees, whereas S2, S4 downward by15 degree.

In addition, they all deviate by 10 degrees with respect to vertical (S1, S2 to the left, S3, S4 to the right)

Circuit diagram



PROGRAMMING LOGIC:

*obstacle detected by a sensor means distance reported by the sensor is between 10 cm and 150 cm.

*Function with Boolean return type (get_status)is going to be there(telling whether the obstacle is detected). precisely, it will use get_distance function

*Between two trigger pulses of nearby sensors, we are going to ensure separation of 50 ms. (to avoid interference of two sensors)

Obtain status in following order-

1

4

Wait (means wait for 50 ms before next status call; if wait is not written, still, wait for 2 us.)

2

3

5

6

7

8

We store these statuses in an array current status1,

We again call another set of statuses(in same order as above) and store them in another array current status2 for minimising errors.

*Nos. indicate sensor no. from the diagram.

Cases:

Sensor no. Giving low outputs	Msg to the user
7	No msg(saying keep walking)
1,2 (note- comma means and)	Left(approx 45 degrees)walk for a second and again head in original direction
3,4	Right(approx 45)....
5	Left(90) walk for a second and.....

6	right(90) walk...
8	Turn 180 and walk
Else	Stand wherever u are

Note: sensor is said to give low output iff both statuses status 1 and status 2 for that sensor are low.

INSTRUCTION MANUAL

User just needs to wear the belt and switch on the power button to start the sensors and arduino.

There is a help button available- which the user can press, if he/she wants to alert the people, in case he/she needs help.

COMPONENTS (with Cost)

1. HC SR04 sensor module(8 * Rs.125)

2. Micro SD card Breakout Board(1* Rs.200)
3. Arduino mega 2560(1* Rs.800)
4. Perforated circuit board(PCB) (1* Rs.20)
5. Jumper wires(Rs.300)
6. Earphones(1*Rs.100)
7. Battery(1* Rs.20)
8. Buzzer(1* Rs.15)
9. LEDs(Rs.100)

(cloth, wood and elastic for mechanical design of belt)(approx. Rs.500)

TOTAL: Rs. 3050.

(But we had to spend approx. Rs.4500 due to wastage on account of experimenting.)

MANAGEMENT AND PLANNING….

By First Review Meet

Learning Arduino Programming and basics of Arduino and Electronics.
Basic Planning of the entire project.

By Second Review Meet

Single component testing.
Writing codes for test programs.
Writing the main program.

By Third Review Meet

Preparing the basic design of the prototype.
Preparing the basic model and making improvements in the programs as and when required.

By Final Review Meet(Final Demonstration)

Improvements in the model.
Testing, debugging.
Final demo.
Documentation.

BUGS… & THEIR ANTIDOTES…..

1. Status and distance reported by program using data from sensor were not synchronous. There was fault in the program that we had called get_distance function twice in the definition of get_status program. We sorted that out by storing distance given by get_distance function in a variable “Distance” and used this Distance variable twice in the definition of get_status.

2. Distance reported by sensors were not matching our observations. This was another programming error. We sorted this out by writing program on similar lines for two sensors and tested it while debugging.
3. Wires were forming a loop on belt and it was so complicated in the basic prototype that we couldn't package it in such away that we can wear it. ……then we designed wiring(with a colour code) and all circuit components' packaging efficiently so as make the package look simplified and user friendly.
4. In addition to that, We replaced thermocol pieces by wood to make the package more durable.

LIMITATIONS

1. Durability limitation because of mechanical design of belt
2. While using ultrasonic sensors, we found that they fail to give reliable results when the obstacles are at distance greater than 60 cm (thought datasheet guarantees 400cm). Better sensors might give better results.

3. In high traffic condition, this would not be of much help, because it will detect obstacles from all sides and give output “stand wherever you are”. User will just be able to ask for help using our help button

IMPROVEMENTS

1) Using rechargeable batteries.
2) Include the programming such that if an object comes with a certain speed towards the user, the user is notified….
3) The material of the belt must be light-weight, water-proof and heat-tolerant.
4) Traffic mode
5) Usage of cameras instead of HC SR04…. This improves durability as well as adds new features like image recognition.
6) Adding a bluetooth module to the package so that it will beep when we press a certain button, making it easier to find when lost.

REFERENCES

See the links we have provided under theory and concepts, we referred to them

Special thanks to Meet Udeshi, Ajinkya Gorad , Yash Bhagat for their valuable help and guidance.

GITHUB LINKS OF CODES:

1) Complete final program for 12 sensors:
https://github.com/mona1997/12-sensors-main-program/blob/master/complete_final_program.ino

2) Test programs:

a) 12 sensors test program
https://github.com/mona1997/12-sensors-main-program/blob/master/_12_sensor_test_program.ino

b) Audio sensor test program
https://github.com/mona1997/12-sensors-main-program/blob/master/audio_sensor_test_prog.ino

c) Single senor test program
https://github.com/mona1997/12-sensors-main-program/blob/master/single_sensor_testing.ino

d) Testing audio
https://github.com/mona1997/12-sensors-main-program/blob/master/testing_audio.ino

e) Testing loopholes final program
https://github.com/mona1997/12-sensors-main-program/blob/master/testing_loopholes_final_program.ino

OUR TEAM (Contact Us)

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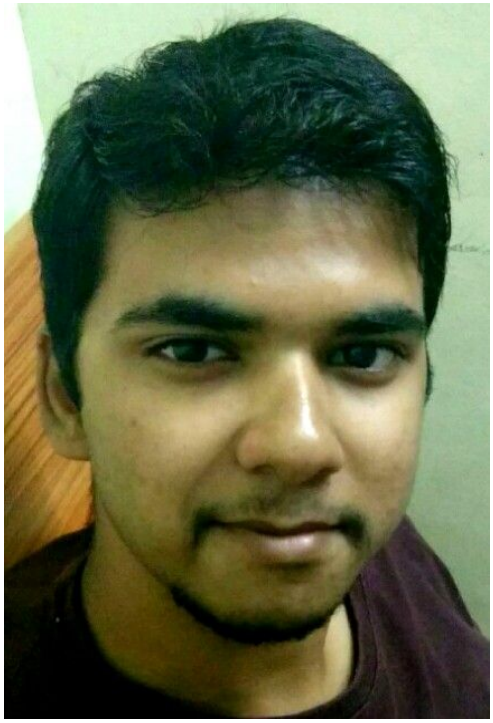

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