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Smart Radar Glasses

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Abstract: ***The aim of the project is to help differently able person, especially blind or visually impaired people, who are unable to recognize the object which is coming towards them. When a visually impaired person navigates into the heavy traffic area, it is difficult for them to cross the street. The outcome of the project is to give a signal to the visually impaired person, so that he/she can be able to keep themselves in a safe/static zone and is easy to use for the visually impaired person. In this project we use glass sensors having an accurate and precise sensor (VL53L1X) which is based on the LIDAR which will calculate the distance between objects or hurdles in front of blind person and respond. For response we have use a vibrating mini motor which will alert the blind person by giving vibrating alert. A vibration will be produced in accordance with the distance. Nearer the object, faster will be the vibration and far the object, slower will be the vibration. We have tried to make a user friendly and handy equipment by using a power supply of 3.7V battery, which is rechargeable, compact in size and easy to use by the user. An Arduino Nano is being used to reduce complexity of circuit and to produce the required output.***

Keywords : Glass sensors, Mini motor, Arduino Nano, LIDAR

I. INTRODUCTION

As we all know that now a day's people are very busy in their life. In this modern era, people who are disable, face so many problems and difficulty. We have come across an idea to reduce their hardships, specifically for blind and differently abled person. We are introducing smart glasses especially for blind person which will help them to navigate in day to day life like, getting across obstacles, determining person in front. The basic concept is based on sensor technology. Using these sensors, we are trying to alert the person about people around him and also about the fast-moving objects around them.

We are using a sensor which send a LASER [1] pulse (low power and in the Infrared spectrum so they are safe). The sensor calculates the total time taken by the Laser light to strike the object and reflect towards the sensor. Knowing the speed of the light, the distance of the object from the blind person can be calculated using the given basic formulae which is as follows,

Distance= Speed * Time/2

II. LITERATURE REVIEW

This basic concept is also used in SONAR system [2] in submarines and ships for finding obstacles in front of it or beneath the bottom of the ship. The sensor used in SONAR system is VL53L1X. It is a time of flight sensor (TOF) having a very narrow Field of view (programmable between 15-27 degrees) which means, they are very directional. This is important as it gives good resolution. Here he idea is that the user can move their head like a radar antenna. This along with the narrow field of view (FOV) allows the user to better discern objects at different distances.

III. PROPOSED WORK

In this work the key idea is to reduce the difficulty levels faced by blind people in today's day to day life. In this project, infrared light emitted from the sensor VL53L1X [3] will be focused on the object and then the signal is received back. The infrared light will travel with the speed of light and time could be determined by using the sensor. Therefore, distance of the object from the blind men could be calculated by the formula-

Distance= Speed * Time/2

The key components used in the proposed work are:

a. Sensor VL53L1X
b. Arduino Nano
c. Vibrating Mini Motor Disc
d. LiPo Battery

SENSOR VL53L1X- The VL53L1X is a hi-tech, TOF, laser-ranging sensor, attracting the ST Flight Sense product family. It is the speedy mini Time of Flight sensor in the market. Dissimilar to conventional IR sensors, the VL53L1X uses ST's latest generation Time of Flight technology which permits absolute distance measurement whatsoever the target color and reflectance.

Fig. 1. Sensor VL53L1X

ARDUINO NANO- The Arduino Nano [4] is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x).

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The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27).

The power source is automatically selected to the highest voltage source.

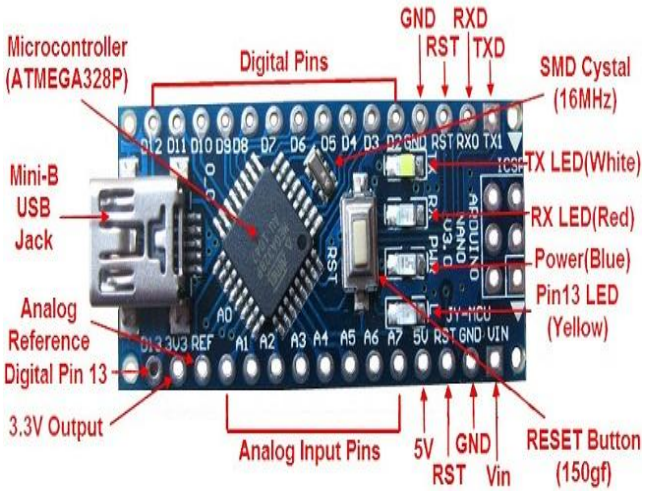

Fig. 2. ARDUINO NANO Pin diagram

VIBRATING MINI MOTOR DISC-These vibrating motors [5] are small discs, completely sealed up so they're easy to use and implant. Two wires are used to control/power the sense. Simply provide power from a battery or microcontroller pin (red is positive, blue is negative) and it will buzz away. Works from 2V up to 5V, higher voltages result in more current draw but also a stronger vibration. A typical image of Vibrating mini motor is shown in Fig. 3.

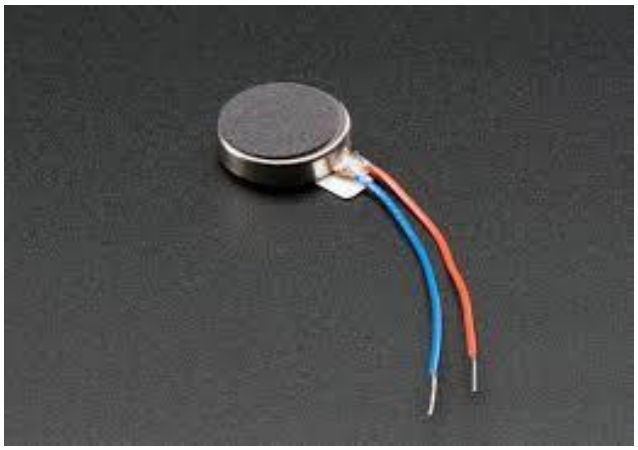

Fig. 3. Vibrating Mini Motor Disc

LiPo Battery (Lithium Polymer Battery)- Lithium ion polymer (also known as 'lipo' or 'lipoly') batteries [6] are tinny, light in weight and prevailing for long duration of time. The output ranges from 4.2V when completely charged to 3.7V. This battery has a capacity of 150mAh for a total of about 0.6 W. The batteries come pre-attached with a genuine 2-pin JST-PH connector as shown and include the necessary protection circuitry. The included protection circuitry keeps the battery voltage from going too high (over-charging) or low (over-use) which means that the battery will cut-out when completely dead at 3.0V. It will also protect against output shorts. An image of LiPO battery is as shown in Fig. 4.

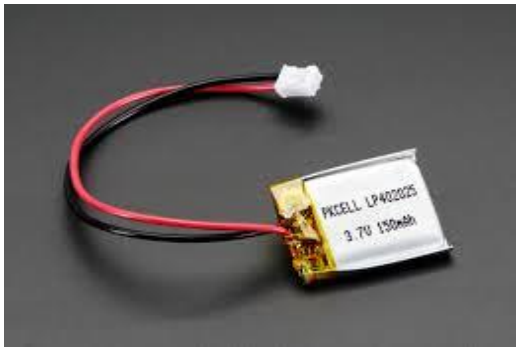

Fig. 4. LiPo Battery

Some other components used are-

- Zero size PCB (Printed Circuit Board)
- 10K ohm resistor
- NPN Transistor
- USB LiIon/LiPoly charger
- Hookup wires
- JST Right-Angle Connector

The block diagram is as shown in Fig. 5.

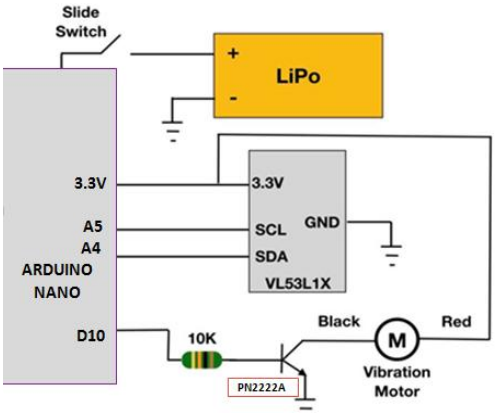

Fig. 5. Block diagram

IV. IMPLEMENTATION

Following steps are to be followed for the proposed work-

Step 1: We decided that we could design pair of glasses which could enable blind person to understand what is happening in the surrounding. An acrylic sheet was taken to provide base to our components and this sheet was designed in shape of spectacles using root cutting saw. Filing was done on the acrylic sheet to make its surface smooth. A view of glass is shown in Fig. 6.

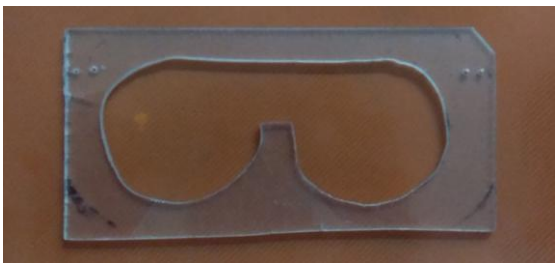

Fig. 6. Glass View

Step 2: We have taken a zero PCB which was made in the form rectangular shape using a cutter as shown in Fig.7 for the easy assembly of electronic components.

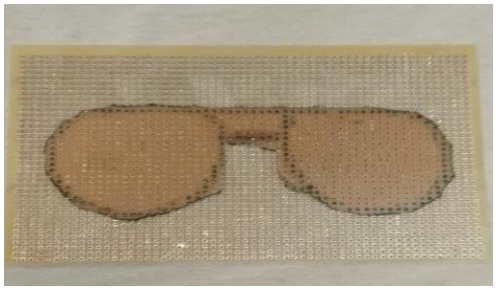

Fig. 7. Zero PCB

Step 3: We have used root cutting saw to cut out inside of the glass after that we have used a round file and flat file to smoothen the acrylic sheet as shown in Fig. 8

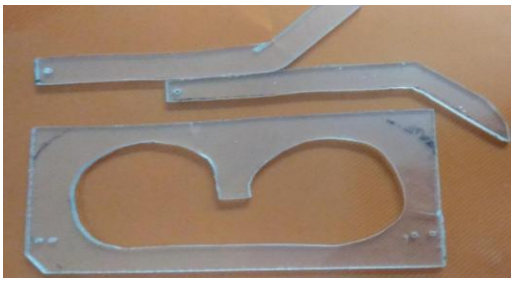

Fig. 8

Step 4: We have added the VL53L1X sensor to the Zero sized PCB board via soldering and after that we have connected the pins of sensor to pins of Arduino Nano respectively as shown in Fig. 9.

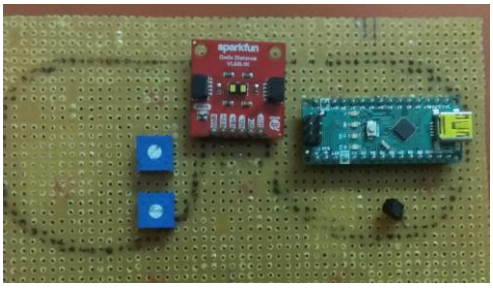

Fig. 9.

Step 5: We have tried to place the components by utilizing minimum wire lengths so that the signal loss can be minimized. So we arrived at the placement of various components that can be seen in the Fig. 10.

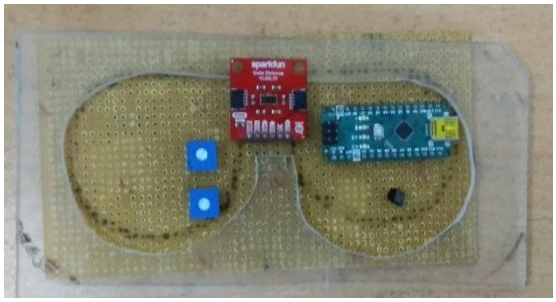

Fig. 10

Step 6: Finally, all the components are soldered to the board on the positions as shown in Fig. 11.

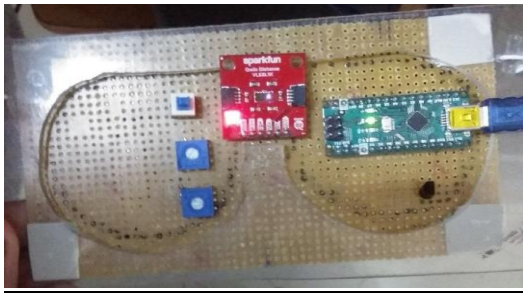

Fig. 11

V. RESULT

During our testing, we went to many villages and we checked our glasses for blind people and found that, if the obstacle is in the range of 400 cm then motor start vibrating according to the obstacle. If the obstacle is coming nearer, then the speed or vibration of the motor is increasing. We have also plotted a graph between obstacles and distance as shown in Fig. 12. In the graph, it is linearly increasing as the obstacle come nearer then the vibration of motor will increase.

Here,

C= Obstacles (x-axis)

q= Distance between Obstacles and Person (y-axis)

The red line in graph shows the vibration of Motor.

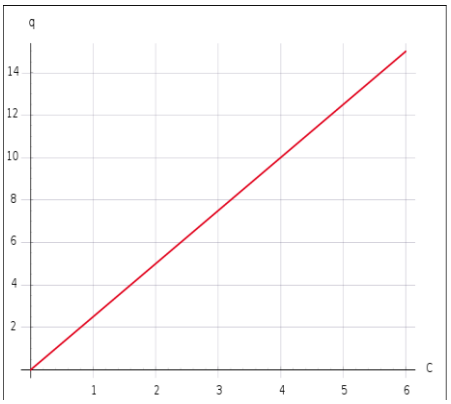

Fig. 12

VI. CONCLUSION AND FUTURE SCOPE

We have developed a project that will give a signal to the visually impaired person, so that they can keep themselves in a safe/static zone and is easy to use for the visually impaired person. In this project we use glass sensors having an accurate and precise sensor (VL53L1X) which is based on the LIDAR which will calculate the distance between objects or hurdles in front of blind person and respond. For response we have used a vibrating mini motor which will alert the blind person by giving vibrating alert. In future we can enhance it with the help of Artificial Intelligence, Raspberry Pi Camera and Machine Learning so that we can connect to the Google Maps.

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