



“Dark Light” for blind/visually impaired people using Global Positioning system and Arduino

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Abstract:

This paper presents the Dark light project designed for visually impaired people using GPS and Arduino. Approximately, 285 million people are visually impaired and 39 million are blind according to World Health Organization. People who are visually impaired should depend on technological devices. Thus this project aims to develop ‘Dark Light’ for visually impaired to connect them to real time environment. This contains Ultrasonic sensor connected with Arduino and it send the audio information to the people using headphones to convey the distance measured for an obstacle present in front of the people. It can be tracked and Google Assistant will Guide the visually impaired people to move exact location. The device can measure up to a distance of about 2m.

Keywords:

Dark light, Blind vision, Third eye, Arduino for blind

Introduction:

According to World Health Organization report, there are 2.2 billion people have vision impairment or blindness. Vision impairment is classified into mild, moderate, severe and blindness. Mild impairment represents the acuity worse than 6/12, moderate represents acuity worse than 6/18, severe distance vision impairment represents the acuity worse than 6/60 where blindness represents acuity worse than 3/60. Overall there are 123.7 million affected by refractive error problem. There are 65.2 million people suffered with cataract, 6.9 million people affected by glaucoma,

corneal opacities with 4.2 million people, 3 million people suffered diabetic retinopathy and about 2 million suffered with trachoma (WHO, 2013).

After the technological advancements in the last 3 decades, the conventional navigation aids are replaced with walking aid that has ultrasonic sensors, buzzers, RF transmitter and receiver. It has the capability to detect the obstacle at a particular range and can guide the blind with cost effective performance and robustness. 83% of information are received from the human through eye sight. Enormous attempts have been made to guard the blind people to avoid obstacles. Gayathri et al., 2014 proposes a smart walking stick for blind. GPS programmed location sharing along with optimal route can also be integrated. Nowadays Internet Of Things plays major role in wearable sensor applications (Duraishamy Sathya & Pugalendhi Ganesh Kumar, 2017). Dodds et al. (1984) applied the sonic method to guide visually challenged people. Navigation belt was designed by Shoal et al. (1994) for indoor navigation. Smart stick was introduced and designed by Innet and Ritnoom, 2008 using infrared sensors. Na (2006) designed the interactive guide system for personal use restricted to indoor applications as it cannot detect the obstacles. Multitasking stick is designed to guide the visually disable people using micro controller (Kuranov and V. Pisarevsky, 2002)

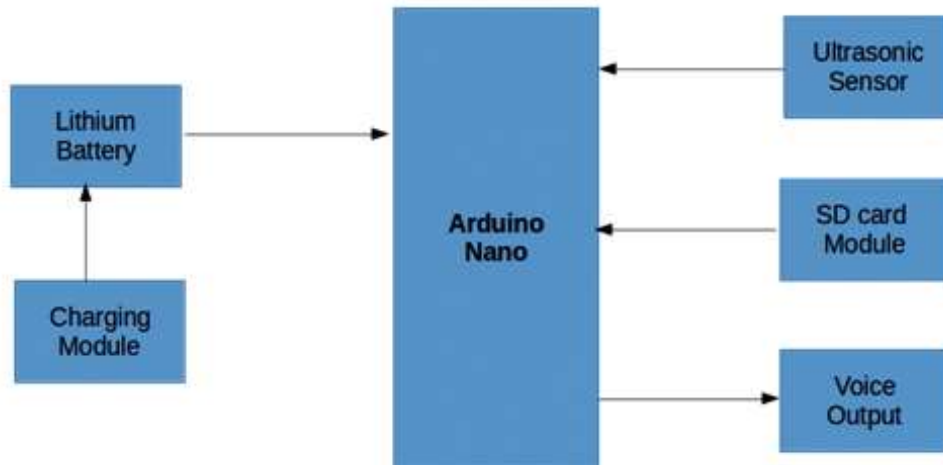
Methodology

Materials and Methods

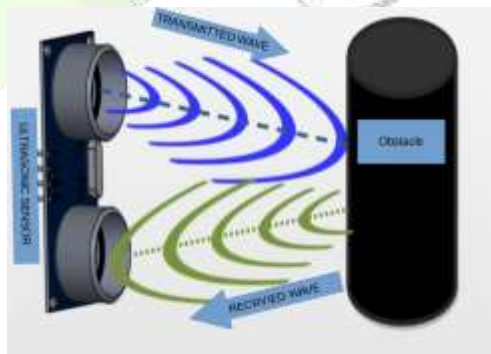
This section deals with the components involved in this project used for dark light. The ultrasonic transmitter and receiver reflected from a particular obstacle and it trigger the microcontroller to alert the user through audio information.

Ultrasonic sensor interfaced with the microcontroller send the signal to the headphones and will alert the user by providing the distance between the obstacle and the people. Arduino Nano microcontroller is used to receive signals from ultrasonic sensor and will alert the user through the preprogrammed audio output preferably stored in SD card module in the native language of the user. Arduino Nano has 14 digital outputs and input pin with 16 MHZ Quartz crystal, USB connection and a power Jack.

Apart from using the conventional buzzer at output, this microcontroller will send audio signal mentioning the distance between the obstacle and the user.

Hardware:

A Dark Light is made up of Arduino Nano, Ultrasonic sensor, an SD card module. Most of the coding system is designed in the Arduino. the core part of the system is microcontroller Arduino nano. Arduino IDE software and C programming language are used to run the whole system of the Dark Light.HC-SR04 ultrasonic sensor is used because it is not affected by colour or transparency objects. The transmitter emits 8 bursts of a directional 40kHz ultrasonic wave when triggered and starts a timer. Ultrasonic pulses travel outward until they encounter an object, it causes the wave to be reflected back the unit.

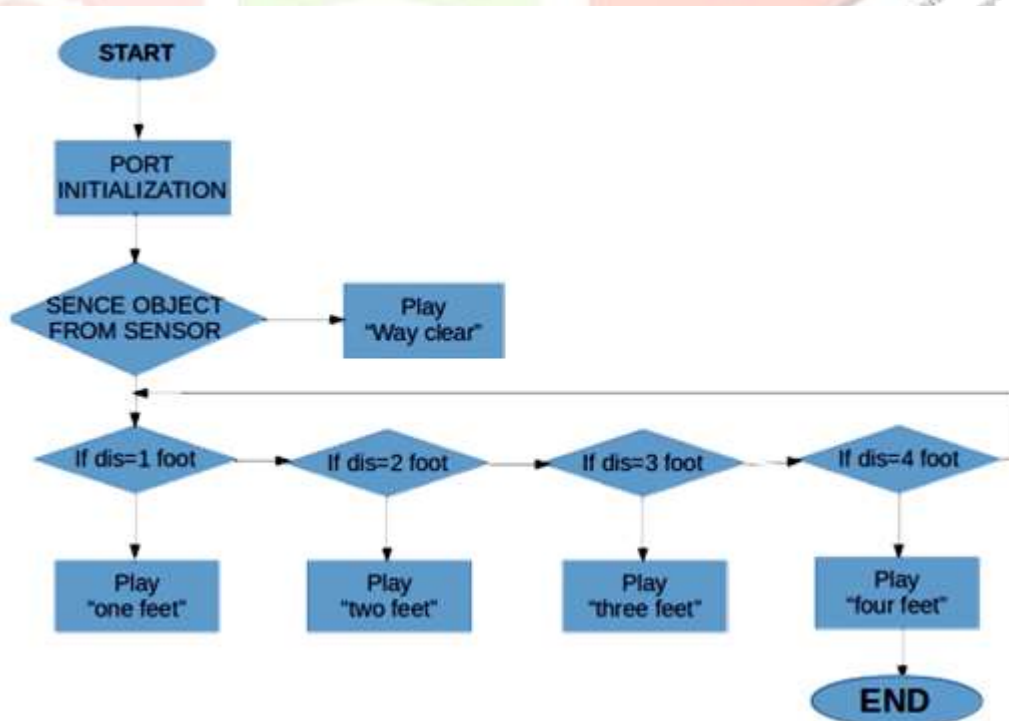


The ultrasonic receiver would detect the reflected wave and stop timer. After calculating the distance, the information will send to the Arduino and then, the headset produces the voice. In this system, the distance is measured between the object and the Dark Light kit, the information is sent from the sensor to the Arduino board. The operation of the Dark Light system is composed of an ultrasonic sensor, an Arduino Nano. The ultrasonic sensor senses the

directional distance and sends distance data to Arduino Nano. The Arduino Nano has calculated the receive distance for the safe zone of the blind walker. In this system, the ultrasonic sensor used to read the distance information. Here, the user has used the HC-SR04 ultrasonic sensor because it is not affected by color or transparency objects. The transmitter emits 8 bands of directional 40kHz ultrasonic wave when triggered and starts the timer. The variety of the reflectivity of the object, the environmental temperature and the operation duration are easily to detect the distance. When the object is discovered in front of the ultrasonic sensor the voice will start with a delay of 1s.

SYSTEM OPERATION:

First, power is supplied to Arduino Nano by a lithium battery. And ports are initialized. And then the ultrasonic sensor has sensed the object between 30cm to 50cm it will play audio the audio is one foot. If object between 55cm to 85cm it will play audio, the audio is two feet. If object between 90cm to 115cm it will play audio, the audio is three feet. if object between 120cm to 150cm it will play audio the audio is four feet. if object between 155cm to 180cm it will play audio the audio is five feet. otherwise play audio is road clear. the voice will start with delay 1s.



SYSTEM DESIGN:

A Dark Light is made up of Arduino nano, ultrasonic sensor, SD card Module and Lithium battery and charger. The core part of the control system is the Arduino nano. Most of the coding system is designed in the Arduino based on the ATMEGA. C programming language and Arduino IDE software are used to run the whole system of a Dark Light.



DISCUSSIONS:

The user gets the benefits for this system. This system is an automatic system that uses an ultrasonic sensor to be detecting obstacles, by an Arduino Nano. Adding security features for the disabled. Facilitate people with disabilities to move freely. This system will operate to help all of the blind people in the world to make them easier to walk everywhere they want. This system was done to help the blind to move in front very well. That can detect objects or obstacles in front of users and feeds warning back, in the forms of voice messages. This system is to people with disabilities that are blind to facilitate the movement and increase safety.

CONCLUSION:

The system is a new concept of Dark Light for blind people. The advantage of the system lies in the fact that it can prove to be a very low-cost solution to millions of blind person worldwide. The main purpose of this study is to produce a prototype that can detect objects or obstacles in front of users and feeds warning back, in the forms of voice messages to users. ultrasonic sensors and Arduino function for detection and distance and obstacles in front of. The Dark Light is successfully designed consistent with all the objectives achieved. One of the most important difficulties

faced by the visually challenged person is constraints in independent mobility and navigation. They primarily the white stick as mobility aid allowing them to detect close by obstacles on the ground. The detection of objects above knee height is almost impossible and is a major hindrance for them. Developments in embedded systems have opened up a vast area of research and development for affordable and portable assistive devices for the physically challenged. This system aimed at the design and implementation of a detachable unit which acts augment the functionality of the existing cane, to allow knee-above obstacle detection. This unit consists of an ultrasonic sensor and controlled by Arduino Nano. A crucial design optimization goal has cost the unit has been developed as a low-cost device which is affordable by the poor in developing countries.

The electrical circuit design was assembled with power supply source, UV sensor, Audio Jack, Siren, Vibrator are connected. The measurement cycle starts with microcontroller transfer signal at the rate of $10\mu\text{s}$ pulse. In case of the obstacle no signal will be generated. The ultrasonic sensor used for this purpose can able to detect upto 2m.

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