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SMART STICK FOR BLIND

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ABSTRACT
The Blindness is frequently used to describe severe visual impairments with or without residual vision. The main problem with blind people is that they can go anywhere or just stick to their defined area. There is a blind man after every 1350 people in the world according medical studies. So, it is worth if we solve this problem. Through this project we are going to solve the problem of blind people by making them able to detect the environment through various sensors. In this "Blind Stick "helps blind people to move everywhere. There are various features included in this project which are as follows: Detects object in front(Ultra-sonic sensor),Water or Mud sensor(Aluminum contact sensor),Day night detection (LDR),Wireless module (RF 433mhz),Sound record and playback module(APR 33A3). The project has huge potential if we talk about future. It can be used in every hospital globally. Because in the world there is a blind man after every 1350 people on a average so if we talk about future our project has a huge scope in terms of usage.

1. Introduction

Visually impaired people are the person who finds it difficult to recognize the smallest detail with healthy eyes. Those who have the visual acuteness of 6/60 or the horizontal range of the visual field with both eyes open have less than or equal to 20 degrees. These people are regarded as blind. A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision.

The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. This study proposes a new technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional and archaic navigation aids for persons with visual impairments are the walking cane (also called white

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cane or stick) and guide dogs which are characterized by a many imperfections. The most critical shortcomings of these aids include: essential skills and training phase, range of motion, and very insignificant information communicated been communicated. Our approach modified this cane with some electronics components and sensors, the electronic aiding devices are designed to solve such issues.

The ultrasonic sensors, water sensor, buzzer, and RF transmitter/Receiver are used to record information about the presence of obstacles on the road. Ultrasonic sensor have the capacity to detect any obstacle within the distance range of 2cm-450cm. Therefore whenever there is an obstacle in this range it will alert the user. Water sensor is used to detect if there is water in path of the user.

Most blind guidance systems use ultrasound because of its immunity to the environmental noise. With the rapid advances of modern technology both in hardware and software it has become easier to provide intelligent navigation system to the visually impaired. Recently, much research effort have been focused on the design of Electronic Travel Aids (ETA) to aid the successful and free navigation of the blind. Also, high-end technological solutions have been introduced recently to help blind persons navigate independently. Another reason why ultrasonic is prevalent is that the technology is reasonably cheap. Moreover, ultrasound emitters and detectors are portable components that can be carried without the need for complex circuit. RF module will help the person to find the stick wherever it is placed. Whenever the user wants to locate it, such a person will press a button on remote control and buzzer will ring, then the person can get the idea of where the stick is placed.

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision. The conventional and oldest mobility aids for persons with visual impairments are characterized with many limitations. Some inventions also require a separate power supply or navigator which makes the user carry it in a bag every time they travel outdoor. These bulky designs will definitely make the user to be exhausted. The objectives of this research work include: to design an assistive technology for visually impaired people that can detect obstacles and provides alternative routes for the blind; to alarm the user through vibration to determine the obstacles direction sources; and to help the user find his stick when he International Journal of Engineering Science and Computing, August 2018, cannot remember where is was kept. Several attempts have been made to design guard or obstacle avoidance devices for the blind using components with limited number of applications. This section will discuss some of these

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attempts and their shortcomings.

2. Overview

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.98 percent of all microprocessors are manufactured as components of embedded systems. with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available.

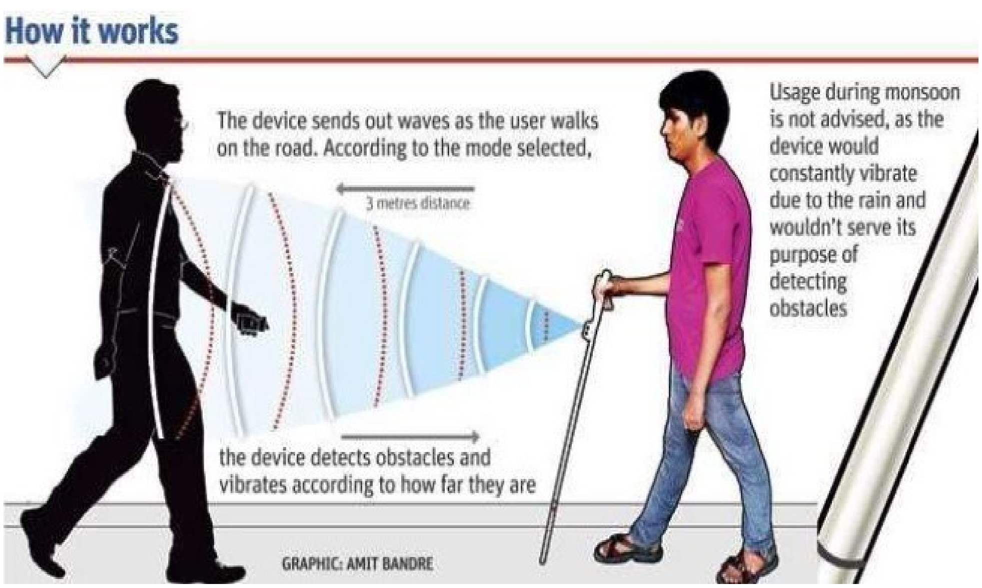

Figure 2.1 Working of Blind Stick

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For example, intelligent techniques can be designed to manage power consumption of embedded systems. Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more-complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. A common standard class of dedicatedprocessors is the digital signal processor (DSP).Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass- produced, benefiting from economies of scale.

3. SYSTEM DESIGN

This section deals with the theory of some of the components used as well as the design and implementation of an intelligent walking stick for the blind. The ultrasonic sensor transmitter generates signals and transmits them in a particular direction which will then be reflected back when they are approaching any obstacle(s), then the ultrasonic sensor receiver receives it and sends it to the microcontroller which will trigger/switch ON the Buzzer.

Our proposed system is made up of the Ultrasonic sensor was interfaced to the microcontroller, codes were written with the Arduino sketch and the physical sensor was connected to the microcontroller. The Arduino UNO is a microcontroller board based on the ATmega328p (datasheet). It has 14 digital outputs and inputs pins of which 6 can be used as PMW outputs, 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP reset button. The Moisture sensor consists of two wire probes which rely on the specificresistance of water to sense its presence when there is a contact. The RF transmitter was interfaced with the microcontroller as codes were written with Arduino sketch and the RF receiver was connected to the microcontroller. The LCD was interfaced with the microcontroller connected to pin and all codes written with the Arduino sketch. The system will allow the blind to freely navigate to their desired destination. It is also user friendly and easy. It is affordable and therefore can be mass produced for use of the visually impaired. Thesystem have the capacity to detect obstacles that exist on the ground during walks indoor and outdoor navigation. The smart stick, as shown in figure 2, is basically an embedded system integrating the following: pair of ultrasonic sensors to detect obstacles in front of the blind from ground level height to head level height in the range of 400 cm a head. Ultrasonic sensors and water sensors take real time data and send it to the microcontroller. After processing this data, the microcontroller activates the buzzer. The water sensor detects water

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on the ground, and battery is used to power the circuits.

3.1 Sensors

The selection process of appropriate sensor depends on several factors such as, cost, atmospheric condition, kind of obstacle to be detected, detection range, and the desired precision of measurements collected information and its transmission frequency.

We used a combination of 2 types of sensors infrared and ultrasonic for the following reasons:

1. Infrared sensor recognize small obstacle but with less accuracy than laser sensors. However using laser sensor is costly which contradicts our aim in obtaining affordable aiding devices. They perform almost the same within 2 meter.
2. Ultrasonic sensor work well for close obstacles unlike laser one, when an object is so close the laser sensor (less than 15 cm) can't get an accurate reading. Moreover, it should be noted that radar sensors can easily detect near and far obstacles with equal perform once, but their medium accuracy doesn't allow them detecting small obstacles.

Infrared sensor chosen has a detection range distance that goes from 20 to 200 cm, a resolution of 0.5 cm, a frequency of 26.3 Hz and an analogical output that goes from 0 to 5 V. Ultrasonic sensor used 40 kHz transmission signal. The 40 kHz frequency is produced by a transmission sensor of two-centimeter diameter; it can generate 2.4644 beams of narrowness. This is a reasonable size to be installed in the stick. We use the infrared sensor to detect upward and downward stairs because the sensor spot is roughly 6 cm. This feature enables the user to identify precisely, any kind of stairs in front of him. We use a pair of ultrasonic sensor. An upper one at a height 90 cm to detect upper obstacles and another sensor at a height 30 cm to detect lowobstacles.

Detection using ultrasonic sensor is based on two factors:

- Time of flight (TOF), the amount of delay between the emission of a sound and the arrival of an echo depending on the distance of an obstacle, which is directly proportional to the distance.
- Beam size: Obstacle size is depending on amount of reflected wave. Obstacles whose dimensions are larger than the beam size, all of the sound waves will be reflected to receiver. If the obstacle size small as compared to the beam size, the part of the ultrasonic sound wave will be reflected to the receiver and the rest will be lost.

The speed at which sound travels depends on the medium it passes through. Broadly, the speed of sound is proportional to the square root of the ratio between the stiffness of the

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medium and its density. The speed of sound also changes with the atmospheric conditions. All obstacles reflect some part of the wave through. The amplitude of the wave reflected is relatively proportional to how much available surface there is on the obstacle, concerning coherent reflection. Also, surfacearea, shape and orientation, are major factors contributing to the strength of the reflected signal.

3.2 Block Diagram

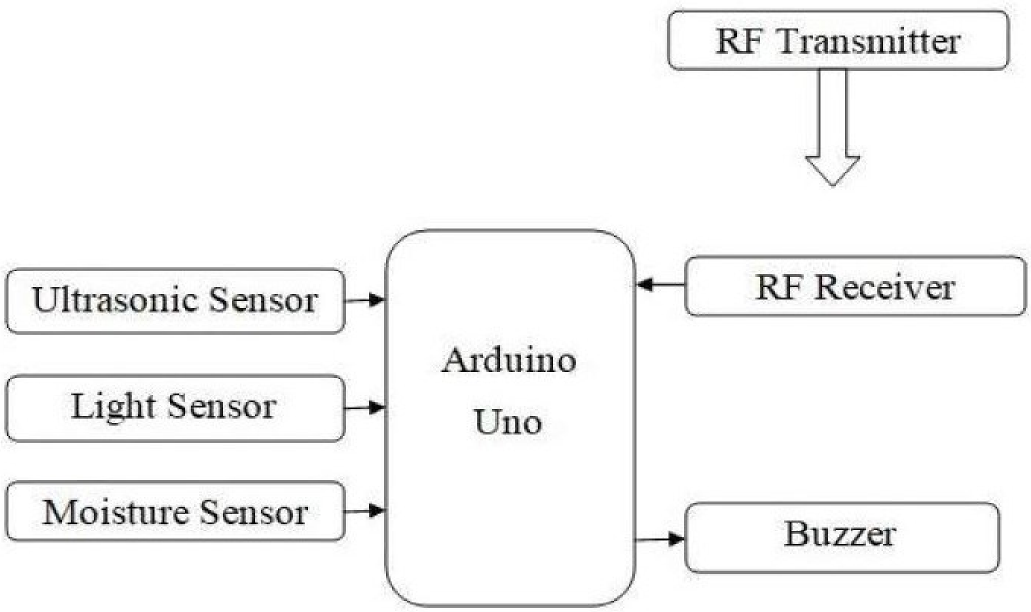

Figure 3.2.1 Block diagram of smart blind stick

We have many reasons to design smart stick for blind; firstly, the blind to feel free, isn't surrounded by wires as in belt and its content. Secondly, is easy to use because it is familiar and affordable. Thirdly, to be able to detect obstacles that exist on the ground (this is not available in glasses), which he walks indoor and outdoor is faced by obstacles such as stairs, puddles and sidewalks. This " Blind Stick "helps blind people to move everywhere. There are various features included in this project which are as follows: Detects object in front(Ultra- sonic sensor),Water or Mud sensor(Aluminum contact sensor),Day night detection (LDR).

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3.3 Circuit Diagram

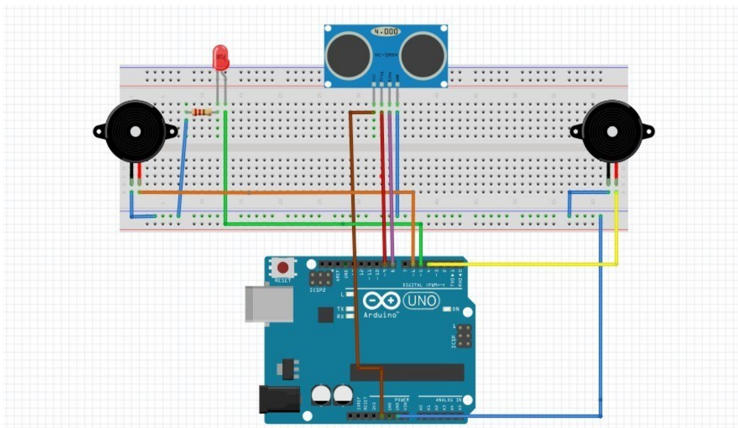

Figure 3.3.1 Circuit Diagram

This circuit diagram shows how ultrasonic sensor is connected to arduino UNO and how buzzers are connected. These all are connected through breadboard.

4. IMPLEMENTATION

Implementation is the realization of an application, or execution of a plan, idea,model, design, specification, standard, algorithm, or policy and it is a process of having the systems personnel check out and put new equipment's into use, train users, install new application and construct any files of data needed to use it. Another factor to be considered in the implementation phase in the acquisition of the hardware and software. Once the software is developed for the system and testing is carried out, it is the process of making the newly designed system fully operational and consistent in performance.

Microcontroller

Arduino Uno R3 Microcontroller .

Arduino can control the environment by receiving input signals (Digital/Analog) and can effects its surroundings by controlling lights, relays and other devices. The microcontroller on the board is programmed using Arduino software.

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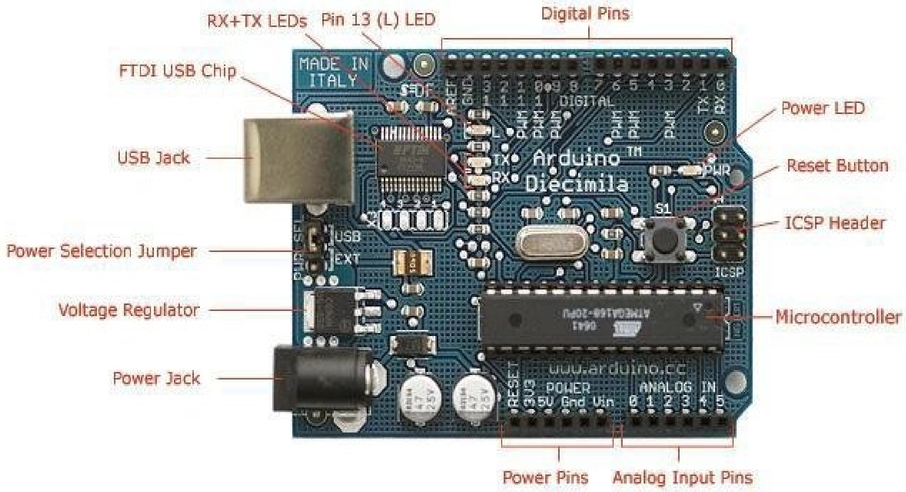

Figure 4.1 Arduino UNO R3 Mircrontroller

Ultrasonic Transducer

Generating, detecting & processing ultrasonic signals.

Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. Ultrasonic Ranging Module HC – SR04.

Features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

- Using IO trigger for at least 10us high level signal,
- The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- F the signal back, through high level , time of high output IO duration is the time fromsending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2,

Figure 4.2 Ultrasonic HC-SR04

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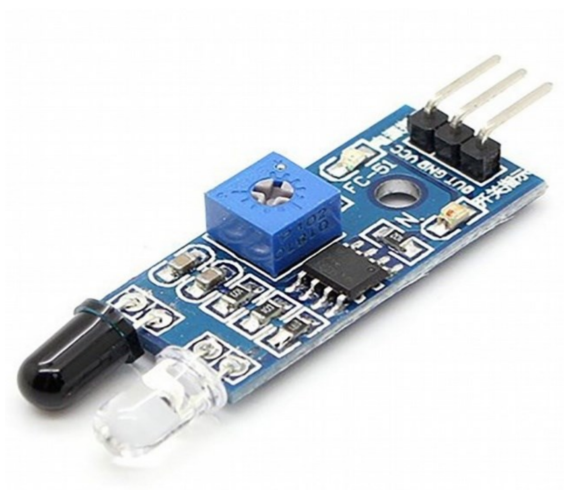
The Flow chart of obstacle detector using ultrasonic sensor in Figure4 which is having two parts, first part deals with the obstacle detection while the second part deals with distance measurement, and alerting the users depending on distance of the obstacle to avoid collusion. Depending on the distance of the obstacle from the person four zones are formed: far zone, near zone, close zone and danger zone. If the detected object is at 4 meter or more then it comes under far (safe) zone. If the object is found at 2 meter or more then it comes under nearzone, if the object is found at 1 meter or more then it comes under close zone, and if the object is detected at less than 1 meter then it comes under danger zone. A voice instruction along with vibrating alert and a buzzer voice will be send to user at every zone to alarm him and let people around that blind person to help him.

IR sensor

To detect small obstacles: pit, staircase, or stone, as it located at the lower side of the stick. After detecting the small obstacles on ground, IR sensor will send the signal to the Arduino, as result it will send a voice instruction for small obstacle available. And at the same time it



will enable the buzzer for informing the blind person about presence of obstacles on ground.

Figure 4.3 Obstacle detecting sensor module

Water Senor

A water sensor is located at the base of the stick to have precaution against the wet surface which it can causing slipping on the floor and thus can hurt. When the water sensor comes in contact of the wet surface, it produces an electrical signal which trigger

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the Arduinocontroller. A voice instruction for wet surface is produced and also a buzzer is enabled for alarming against a wet floor.

Figure 4.4 Water Sensor

LDR Sensor

Light Dependent Resistor, changes its resistances due to change of the light intensity. During night, LDR will have high resistance and no current pass through it but through a LED connected parallel to it which illuminates and acts as a Flashlight, which can be easily noticed by others. It alerts people about the presence of blind person to let him to pass the way

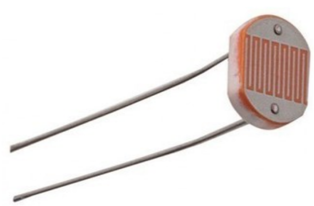

Figure 4.5 LDR sensor.

Alarm Unit- Buzzer

A transducer (converts electrical energy into mechanical energy) that typically operates A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to warn the blind person against obstacle by generating sound proportional to distance from obstacle

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5. RESULTS

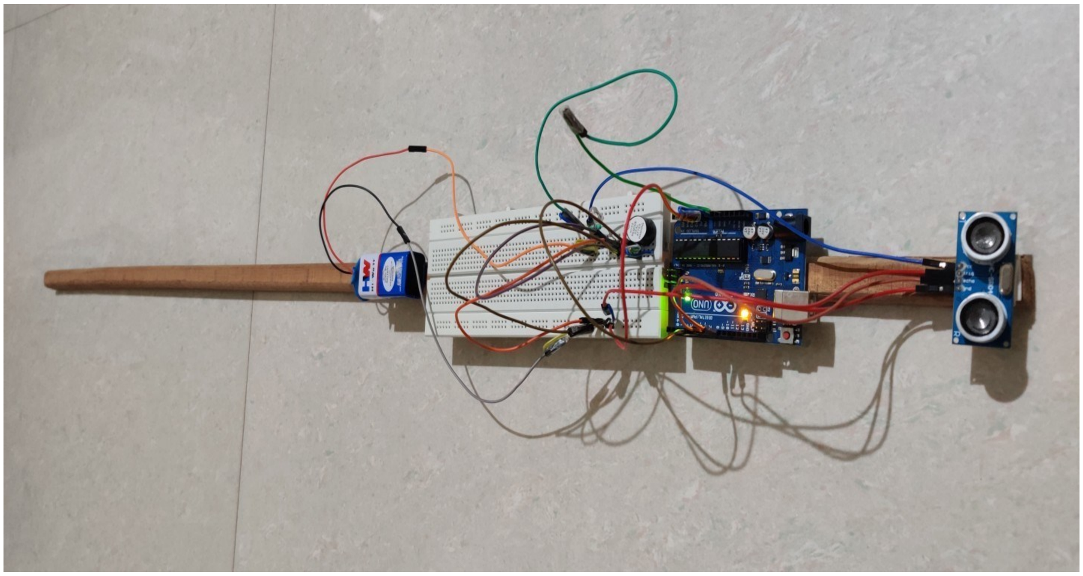
Figure 5.1 Circuit Connection.

The above image shows how components are connected to each other through common connection to arduino IDE.

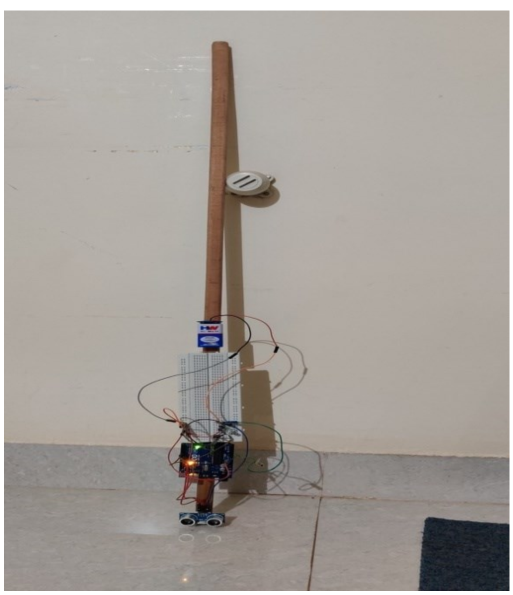
Figure 5.2 Front view of smart blind stick

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6. CONCLUSION

With the proposed architecture, if constructed with at most accuracy, the blind people will able to move from one place to another without others help, which leads to increase autonomy for the blind. The developed smart stick that is incorporated with multiple sensors will help in navigating the way while walking and keep alarming the person if any sign of danger or inconvenience is detected. The developed prototype gives good results in detecting obstacles paced at distance infront of the user; it will be real boon for the blind. At the same time global positioning system (GPS) can be linked with the voice stick for navigation, so that person can know his current position and distance from the destination which will be informed to users through voice instructions

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