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AUTONOMOUS INSTITUTION, AFFILIATED TO VTU BELGAUM, AND APPROVED BY AICTE*)*

A

PROJECT REPORT

ON

"SMART BLIND STICK"

PRESENTED BY

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ABSTRACT

This system is intended to provide object detection and real-time assistance for blind people via, Ultrasonic sensor. Whenever an obstacle is found in the path of blind person, it alerts him through a buzzer, led, vibration motor. There is a continuous on-going interaction between the microcontroller and these modules. The ultrasonic sensor continually senses the obstacles in the surrounding of the blind person.

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INTRODUCTION

Blindness is a state of lacking the visual perception due to physiological or neurological factors. The partial blindness represents the lack of integration in the growth of the optic nerve or visual centre of the eye, and total blindness is the full absence of the visual light perception. For most of us who are normal and healthy at least can reach the destination somehow but for some unfortunates like the blind location becomes an extremely tedious process. They will be in need of continuous help and companionship till they reach their desired destination.

There are approximately 36.9 million people in the world are blind in 2002 according to World Health Organization. Majority of them are using a conventional white cane to aid in navigation. The limitation in white cane is that the information's are gained by touching the objects by the tip of the cane. The traditional length of a white cane depends on the height of user and it extends from the floor to the person's sternum. So we'll design ultrasound sensor to detect all kinds of barriers whatever its shape or height and warn him with vibration. Blind people also face great problems in moving from place to another in the town and the only way for them is guide dogs which can be useful for about 5 – 6 years.

Security in travel is prime concern for everyone. There is a need of personal guide for visually impaired person. Accident (if occurs) or any emergency, spot can be detected. SMS can be received about the spot location which will be very helpful for the caretaker to reach to the blind person. We use an Ultra Sonic sensor HC SR04 which can detect obstacles within range of 3 meters.

The implemented system is cheap, fast, and easy to use and an innovative affordable solution to blind and visually impaired people in the world . The study hypothesizes that a smart cane that alerts visually-impaired people over obstacles in front could help them in walking with less accident.

The aim of the project is to address the development work of a cane that could communicate with the users through buzzer and vibration, which is named as a Smart Stick. The development work involves coding and physical installation. A series of tests have been carried out on the smart stick and the results are being discussed. This study found that the Smart Stick functions well as intended, in alerting users about the obstacles in front.

Visual impairment, also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems not fixable by usual means, such as glasses. Some also include those who have a decreased ability to see because they do not have access to glasses or contact lenses. Visual impairment is often defined as a best corrected visual acuity of worse than either 20/40 or 20/60. The term blindness is used for complete or nearly complete vision loss. Visual impairment may cause people difficulties with normal daily activities such as driving, reading, socializing, and walking.

The most common causes of visual impairment globally are uncorrected refractive errors (43%), cataracts (33%), and glaucoma (2%). Refractive errors include near Sighted, far sighted, presbyopia, and astigmatism. Cataracts are the most common cause of blindness. Other disorders that may cause visual problems include age related macular degeneration, diabetic retinopathy, corneal clouding, childhood blindness, and a number of infections. Visual impairment can also be caused by problems in the brain due to stroke, prematurity, or trauma among others. These cases are known as cortical visual impairment. Screening for vision problems in children may improve future vision and educational achievement. Screening adults without symptoms is of uncertain benefit. Diagnosis is by an eye exam.

The World Health Organization (WHO) estimates that 80% of visual impairment is either preventable or curable with treatment. This includes cataracts, the infections river blindness and trachoma, glaucoma, diabetic retinopathy, uncorrected refractive errors, and some cases of childhood blindness. Many people with significant visual impairment benefit from vision rehabilitation, changes in their environment, and assistive devices.

As of 2015 there were 940 million people with some degree of vision loss. 246 million had low vision and 39 million were blind. The majority of people with poor vision is in the developing world and is over the age of 50 years. Rates of visual impairment have decreased since the 1990s. Visual impairments have considerable economic costs both directly due to the cost of treatment and indirectly due to decreased ability to work.

Eye injuries, most often occurring in people under age of 30, are the leading cause of monocular blindness (vision loss in one eye) throughout the United States. Injuries and cataracts affect the eye itself, while abnormalities such as optic nerve hypoplasia affect the nerve bundle that sends signals from the eye to the back of the brain, which can lead to decreased visual acuity.

Cortical blindness results from injuries to the occipital lobe of the brain that prevent the brain from correctly receiving or interpreting signals from the optic nerve. Symptoms of cortical blindness vary greatly across individuals and may be more severe in periods of exhaustion or stress. It is common for people with cortical blindness to have poorer vision later in the day.

Blinding has been used as an act of vengeance and torture in some instances, to deprive a person of a major sense by which they can navigate or interact within the world, act fully independently, and be aware of events surrounding them. An example from the classical realm is Oedipus, who gouges out his own eyes after realizing that he fulfilled the awful prophecy spoken of him. Having crushed the Bulgarians, the Byzantine Emperor Basil II blinded as many as 15,000 prisoners taken in the battle, before releasing them. Contemporary examples include the addition of methods such as acid throwing as a form of disfigurement.

Figure 1 Ultrasonic waves and identifying object

OBJECTIVE

I. To develop prototype hardware for modern blind stick

II. To help the blind people navigate the route at their best

III. To reduce the risk of injuries and lost for the visually impaired person

IV. To creating suitable software for the visually impaired person

PROBLEM STATEMENT

I. Blind people can't easily recognize obstacles or stairs while using normal blind stick

II. No safety features on the normal blind stick

III. Can't locate the location of the normal blind stick user when they are having an emergency problem or lost in a public area

SCOPE OF PROJECT

Currently, we can see blind people is scared to walk at the busy road because they can't navigate freely .With this fear, blind people can't live their life freely. They also a human, they need to live as a normal person. The main problem is , they can't navigate and detect an Obstacle with the faster way . With their normal blind stick, they must use the stick to navigate on the road slowly. Usually, visually impaired person difficult to identify a hole on the road. Beside that the normal blind stick doesn't have safety features. For example, at night, car driver or motorcycle can't see them at the road. This is a big dangerous for them.

Block DIAGRAM and Description

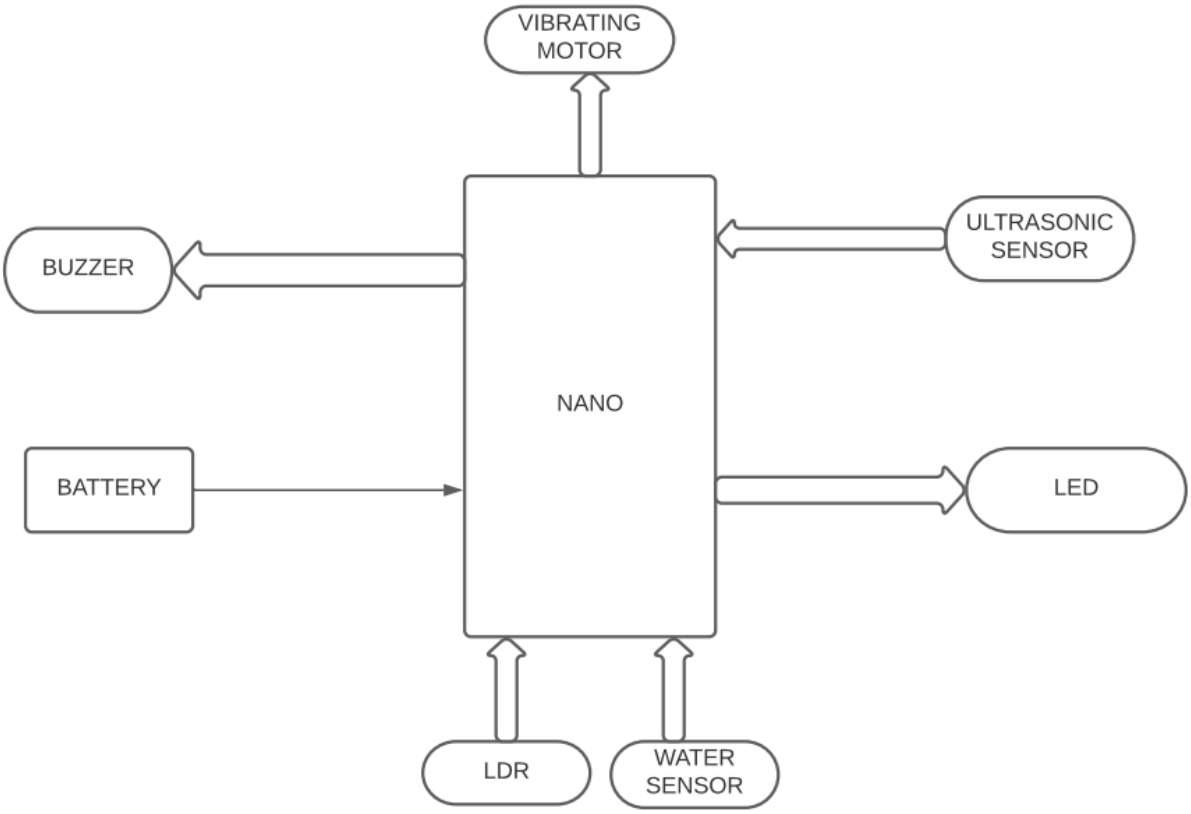

Figure 2 Overall view of Block diagram

The above figure shows the Arduino NANO microcontroller is connected to the 9V battery, buzzer, LED, Ultrasonic sensor, Vibrating motor, Water sensor and LDR sensor. The connection was made by using the connecting wires.

The hardware requirements

- Arduino NAN0
- Ultrasonic Sensor (HC-SR04)
- LDR Sensor
- Water sensor
- Battery(9V)
- Buzzer
- LED
- Vibrating motor
- Connecting Wires

The software requirements

- Arduino IDE

1. ARDUINO NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on

the ATmega328P released in 2008. It offers the same connectivity and specs of

the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30

male I/O headers, in a DIP30-like configuration, which can be programmed using

the Arduino Software integrated development environment (IDE), which is common to all

Arduino boards and running both online and offline. The board can be powered through

a type-B micro-USB cable or from a 9 V battery

• In 2019, Arduino released the Arduino Nano Every, a pin-equivalent evolution of the

Nano. It features a more powerful ATmega4809 processor and twice the RAM.

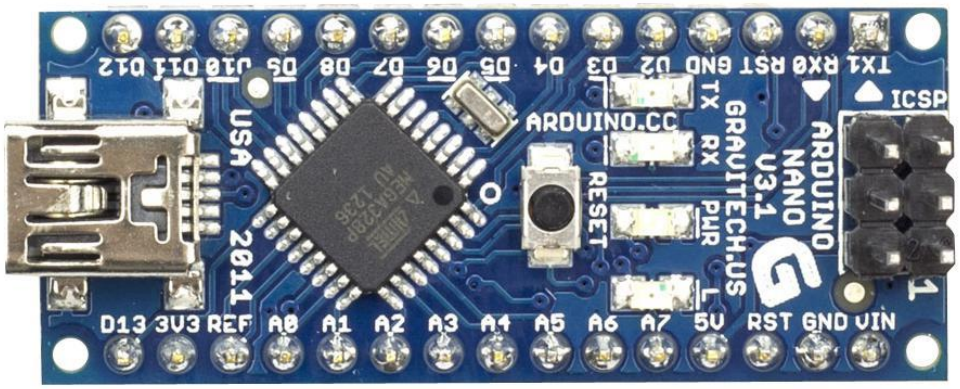

Figure 3 Arduino NANO

2. Ultrasonic Sensor

Ultrasonic sensors are used in pair as transceivers. One device which emits sound waves is called as transmitter and other who receives echo is known as receiver. These sensors work on a principle similar to radar or sonar which detects the object with the help of echoes from sound waves. This detects the object and alarm to warn the blind people.

Pin Function

TRIG: Trigger Pulse Input
ECHO: Echo Pulse Output
GND: Ground
VCC: 5V Supply

Working Voltage	DC5V
Working Current	16Ma
Working Frequency	40Hz
Max Range	700cm, Ensured stable signal within 5m, gradually faded signal outside 5m till disappearing at 7m position.
Min Range	2cm
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	46x20.5x15 mm

Table no 1

Figure 4 Ultrasonic Sensor

3. LDR Sensor

In order to detect the intensity of light or darkness, we use a sensor called an LDR (light dependent resistor). The LDR is a special type of resistor that allows higher voltages to pass through it (low resistance) whenever there is a high intensity of light, and passes a low voltage (high resistance) whenever it is dark. It is connected to the Arduino and in darkness it makes alarm to help the blind to know the day and night.

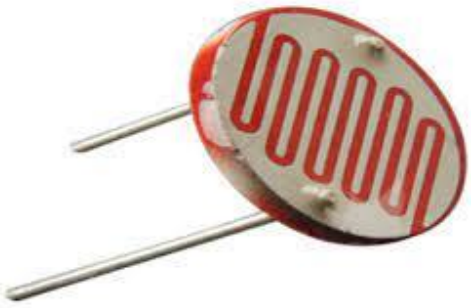

Figure 5 LDR SENSOR

4. Water Sensor

A rain sensor is one kind of low-cost electronic sensor which is used to detect the rainfall or water drops. It works as a switch. Normally the switch is open condition. This sensor is consists of mainly two parts, one is sensing pad and another one is the sensor module. When rainfall or water drops fall on the sensing pad surface, then the switch will be closed. The sensor module reads data from the sensor pad and processes the data and converts it into a digital/analog output. So, the sensor can provide both types of output Digital output (DO) and Analog output (AO).

Figure 6 Water Sensor

6. BATTERY

The 9V battery works well in the Arduino kit and simply connect to the + terminal of battery to DC connector positive and the - end to the ground

Figure 8 Battery

7. BUZZER

The buzzer is connected to the Arduino by using the connector wires and it is used to make alarm to warn the blind people.

Specifications

- Buzzer Type: Piezoelectric
- Sound Pressure Level 95 dB
- Operating Voltage: 3 - 24V
- Max Current Rating 20mA
- Frequency 3900±500

Figure 9 Buzzer

8. LED

The LED is connected to the Arduino by using the jumper wires and it is used to make alarm to warn the people.

Specifications

- Body Material: Aluminum
- Power Type: Battery
- Lighting Type: LED
- Color Specification: One Color
- Lighting Color: White
- Input Voltage: 4V

Figure 10 LED

9. VIBRATING MOTOR

The Vibrating motor is connected to the Arduino by using the jumper wires and it is used to make vibrations to warn the blind people.

Specifications

- No-load speed @ 3V:12500 rpm
- No-load current @ 3V:65 mA3
- Stall current @ 3V:100 mA
- Voltage: 3V

Figure 11 Vibrating motor

CIRCUIT DIAGRAM

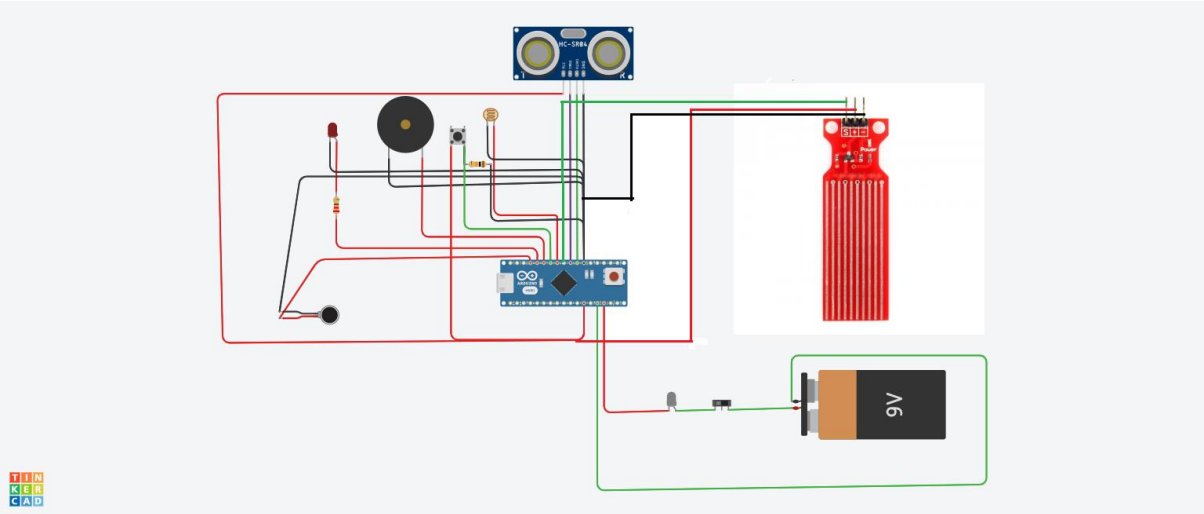

Figure 12 Circuit diagram

WORKING

An Arduino NANO is used to control all the sensors. The complete board is powered by a 9V battery Arduino has an inbuilt 5V voltage regulator so we also have the options to power it using a 6V or 12V supply. The Ultrasonic sensor is powered by 5V and the trigger and Echo pin is connected to Arduino NANO pin 2 and 3 respectively. The LDR is connected to form a Potential divider and the difference in voltage is read by Arduino NANO pin D5. Pin D3 is used to read the signal from water sensor. The output of the board is given by the Buzzer**,** Led, Vibrating Motor which is connected to pin 7, pin 8, pin 9 respectively so that it can guide the user using different tones and vibration. PUSH BUTTON is only used for emergency situation where buzzer beeps and LED flashes which is connected to the pin6 . Also, a toggle switch is used to save the power when the device is not in use or when the impaired person has support of others to guide him/her.. The brain of the circuit is Arduino NANO. The Ultrasonic sensor "HC-SR04" are used for obstacle detection using ultrasonic waves. These sensors require a power supply of 3.3V each to operate up to a distance of 3 m and can detect obstacles within an average angle of 25 degrees in the sphere.

The Arduino is programmed in such a way that on switching 'ON' the Arduino, it sends a LOW to HIGH signal on the TRIG pin of all the Ultrasonic sensors. This ultrasonic sensor will send an Ultrasonic wave using the ultrasonic transmitter of the sensor. This ultrasonic waves travel through air and on colliding with an obstacle, get reflected back. Programming is done in such a manner, that when this obstacle is in the range of 30 cm of the sensor, the Arduino will play the buzzer with different delay (1000ms) and led flashes for obstacles located on the sides, and no delay for the straight ones. When the obstacle is in the range of 20 cm of the sensor, the Arduino will play the buzzer with different delay (500ms) To further enhance its performance, if the obstacle is too close (less than 10 cm from sensor) then the vibrating motor is also activated .The sensor would give an electrical response at the ECHO pin of the sensor. This response is the time taken by the wave for a round journey from sensors to obstacle and back to the sensors. For our calculation, we need only the one-way distance.

This can be calculated by Arduino using the following formula:

$$Distance = \frac{\frac{Duration}{2}}{29.1}$$

Here, Duration=Echo output and since we need only one-way distance, hence we divide this duration by factor of 2.

Here the constant 29.1 is derived as follows:

- The speed of sound is 343.5 m/s or 0.0345 cm/microseconds.
- 1/0.0345 cm/microseconds is 29.1 microseconds/cm.
- Dividing the Duration (ms) by 29.1 (microseconds/cm) gives us the distance in (cm).

To distinguish between the directions of obstacle location, the following mechanism is followed:

- For Left and Right side direction locations, the delay is 1000 ms, for 30cms and 500 ms for 20cms and 50ms for less than 10cms.
- For Forward direction location, the delay is zero.

An additional provision of a motor that vibrates the stick is planted into the assembly for very near obstacles. Experimentation study shows the optimum distance post assembly, to be 10cm.

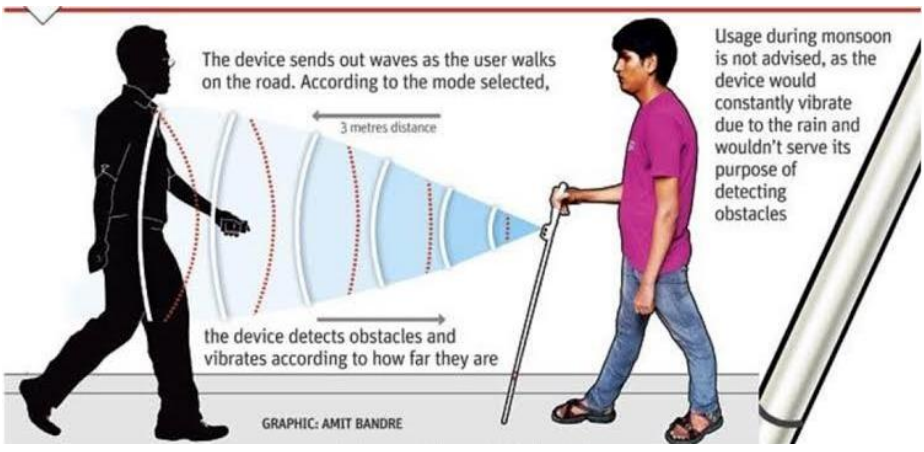

Figure 13 Working of smart blind stick

The water sensor works on the resistance principle. This sensor module permits to gauge moisture through analog output pins & it gives a digital output while moisture threshold

surpasses. This sensor includes four pins which include the following. Pin1 (VCC): It is a 5V DC pin, Pin2 (GND): it is a GND (ground) pin, Pin3 (DO): It is a low/ high output pin, Pin4 (AO): It is an analog output pin. A rain sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed. Programming is done in such a manner, that whenever it detects water the Arduino will play the buzzer with different delay (200ms) even then the vibrating motor is also activated. The change in resistance of LDR detect by a circuit. Which turn ON the buzzer and vibrating motor with different delay (500ms) When light is not falling on LDR and turn OFF when light falling on LDR which helps the blind person to find out whether it is day or night. When the sensor detects an obstacle, Arduino will play the buzzer with different delay (200ms) even then the vibrating motor is also activated. Giving a low-level output signal in the OUT pin.

RESULT

The system continually monitors its surroundings by detecting obstacles in its path and giving the microcontroller updates for every specified interval of time. The distance detected from the obstacle to the system is displayed in the serial monitor of the Arduino IDE software using the ultrasonic sensor. The expected output for the ultrasonic sensor functioning is as shown in table.

D in cms	Buzzer	Led	Vibrating motor
0	OFF	OFF	OFF
0-80	ON	OFF	ON
80-100	ON	OFF	OFF
100-1200	ON	ON	OFF

Table no 2

Prototype

Figure 15 Prototype design of project

ADVANTAGES

- System unable blind people to lead routine life.
- The proposed system is an effective solution to millions of blind people worldwide.
- System enables the blind people to move with same ease and confidence as sighted people.
- Helps blind people for obstacle detection
- Simple to use and low cost
- Can detect transparent obstacle
- Can indicate whether it is day or night
- Can detect water if present

OPERATIONAL PROCEDURE

1. Make sure the stick have been put the enough power supply
2. Is easier to use the stick at the crowd place
3. Make sure the led turn red to make sure the system is ready
4. Smart Blind Stick buzzer will sound when the system is started
5. Smart blind stick will sound, vibrate and led starts blinking when its detect a hole
6. The LED will be on when at the dark place

TURNING OFF THE MODERN BLIND STICK

7. To turn off the modern blind stick, just pull of the power supply
8. Put it at the safe place to avoid any accident

CONCLUSION

In the end of our project, we can conclude that our project can reduce the number of risk and injuries for the visually impaired person when walking at public. Now a days, even at young age experience the visually impairment. This thing cannot be taken as lightly as they know how much risk it could be. If the number of risk and injuries increasing rapidly, the kid or the person will lose their spirit to walk independently. The Smart Blind Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads to good results in detecting the obstacles on the path of the user in a range of three meters. Though the system is hard-wired with sensors and other components, it is light in weight. Further aspects of this system can be improved via wireless connectivity between the system components thus, increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. The proposed model can be extended in terms of providing Voice intimations regarding the information of the obstacle in front of the blind person. Using latest android applications which feature text-to-speech conversion mechanisms can be used so that the system can have a connected interaction with both the ultrasonic sensor and the android application to keep signaling this in his path.

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