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# A Smart Wearable Obstacle Detection and Warning System for the Visually Impaired

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***Abstract:*** ***A pragmatic approach for aiding the Visually Impaired as a wearable, smart device that is meant to help people with a visual disability and navigate their way while causing minimum hindrance to daily activities. The device uses sensors to detect presence and proximity of objects, obstacles and humans around the wearer. Through appropriate feedback mechanisms, it also gives out indication of any obstacle or step in the path that the person is walking through. This paper aims to make the solution scalable, safe, economical, power-efficient and easy to use. In addition to all this, the well-being of the wearer can be ensured by notifying the nearby healthcare in case of a mishap. The microcontroller board is worn like a device. This will be equipped with ultrasonic sensors, consisting of a GSM module. Using the sensor, a visually impaired person can detect the objects around them and can travel easily. When the sensor detects any object it will notify the user by a voice playback module. Thus this is an automated device. Hence, this device will be of great use for the visually impaired people and help them travel to different places without any hassles.***

***Keywords: Visually Impaired, Obstacle Detection, Easy navigation for the visually impaired, Smart Jacket, Voice playback module, Panic button.***

## I. INTRODUCTION

This paper is based on a system concept to provide a smart electronic aid for the visually impaired people. Apart from the conventional navigation systems, blind aid systems can be used with depth measuring circuitry which will be helpful to measure the depth in case of dealing with the stairs or pits on the jacket. A voice playback circuitry is present to alert the person of the obstacle. These different units are implemented in the design of a "smart jacket". The Visually Impaired people are constantly dependent on an assistive device [1], [3], [4] like white cane, guide dogs or other individual to navigate. The problem increases when moving from one location to another and thus we propose an aid for the Visually Impaired people which will not only help them move freely indoors [2], [5] but also help them carry out daily chores with ease without depending on other individual. This aid is used to help them move as confidently as sighted people. The prototype model has an accuracy of 98% for obstacle within 200cm. The smart jacket requires low power, hence can be used for real time navigation for visually impaired people. Panic button is integrated on the jacket where if the visually impaired person senses an unsafe environment, by the press of the switch, a message (SMS) of their location is sent to their care taker or their registered emergency contact.

## II. NEED FOR THE SYSTEM

This paper aims to help the visually impaired people to be fully independent and navigate safely without any help or assistance. Since it is a wearable technology i.e. in the form of a jacket, it is pragmatic, hassle free and it gives them leverage. It also aims at detecting obstacles such as stone, pit, steps and notifies through voice assistance mechanism conveying the type of obstacle to alert the visually impaired people and help them. It also aims at developing a Panic button where if the visually impaired people sense any kind of threat or menaces, by the press of the button a message (SMS) is sent to their care taker or their emergency contact.

## III. BLOCK DIAGRAM

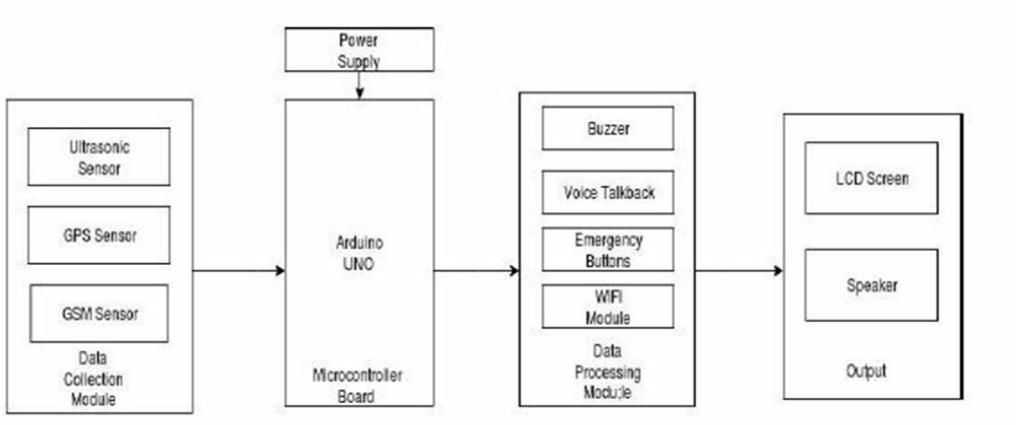


Fig 1: Block Design of Components with Arduino

The proposed system makes use of ultrasonic sensors to continuously send digital signals to the microcontroller. From the duration of transmitting and receiving pulses, distance is getting calculated and if an obstacle is detected within a particular range, it gives a voice alert to the visually impaired person. The range of the ultrasonic sensor is between 2cm to 200cm. The ultrasonic sensor has ultrasonic waves which have a frequency above normal human hearing i.e. 20 KHz and the range of human hearing is between 20Hz to 20 KHz. The system uses Arduino Uno as a microcontroller board supported by ATmega328. The system consists of distress or a panic switches which is used to trigger the microcontroller to send the Emergency message and location to the family members, caretaker or relatives via GSM. The system also consists of voice playback kit APR33A3 which is used play an alert message if there is any obstacle.

The functions of the following components are:

*1)* Ultrasonic sensor is used for obstacle avoidance.
*2)* The Voice playback module alerts the person when an obstacle is encountered which helps in alerting the visually impaired person and allows enough time to change their path.
*3)* Water sensor is used to detect the presence of water and provide an alert in time to change path so as to avoid slipping.
*4)* GSM Module along with a distress button is used by the visually impaired person to alert their emergency contact or caretaker about their location, if they feel unsafe.
*5)* Voice playback kit and is used as an output device.

## IV. CIRCUIT DIAGRAM

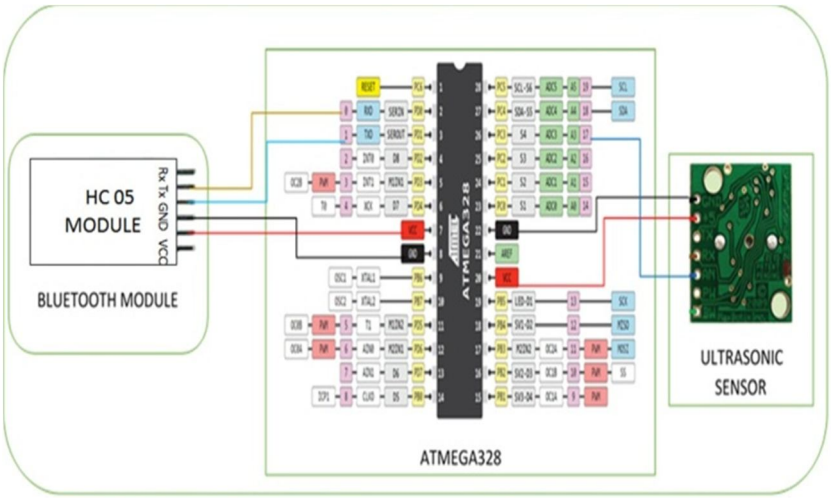


Fig 2: Circuit Diagram of ATMEGA328 with Ultrasonic sensor and Bluetooth module

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## V. COMPONENT REQUIREMENT

### *A. Arduino Uno IDE*

Arduino Uno is a microcontroller board is used which is an open-source electronics platform. Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. IDE software is mainly developed to program Arduino. Programming language C is used in IDE.

### *B. Ultrasonic Sensors*

Ultrasonic sensors generate high frequency sound waves and operate by transmitting an ultrasonic pulse of sound waves and then obtaining and processing the properties of the reflected echo pulse. Basically, sensor works by sending an ultrasonic pulse and computing the time it takes to receive the echo. The output from the sensor is in the form of a variable-width pulse. Here we use three ultrasonic sensors to detect obstacles in front, left and right side of the person wearing the jacket. These sensors collect the real-time data and send it to the microcontroller for processing.

### *C. APR33A3 Voice Playback Kit*

A voice playback (APR33A3) Module is a single chip, High Quality Audio/Voice Recording & Playback Solution, Operating at Range: 3V ~ 6.5V DC. It has a playback capability for 8 to 20 seconds.

### *D. GSM Module*

SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS. Low cost and quad band frequency support make this module perfect solution for any project that require long range connectivity.

### *E. Switch*

A switch serves as a controller, enabling networked devices to talk/communicate to each other efficiently. Through information sharing and resource allocation, switches save business's money and increase employee productivity.

### *F. Accelerometer Sensor*

An accelerometer is an electronic sensor that measures the acceleration forces acting on an object, in order to determine the object's position in space and monitor the object's movement giving feedback all along.

## VI. WORKING

The proposed system uses Arduino Uno microcontroller as its main processing unit. The entire circuitry connected together as a unit is placed in and around the jacket. The ultrasonic sensors and the switches are placed on the jacket according to the visually impaired person's physique in all the directions. This helps in detecting obstacle in all three directions i.e. in the front, left and right. Voice playback module is used to give alert when obstacle is found in the proximity of wearer. The system is purposefully retrofitted in a jacket, to ensure maximum comfort and ease of operation. Once the jacket is worn by user, system essentially keeps user's hands unengaged, as hands are significant for a visually impaired person for tactile sensing. If the obstacle is approaching the person, then a voice alert is given stating the direction from which it's approaching via the speaker giving the user enough time to change their path direction. GSM module is used which is connected to an accelerometer sensor which is intern connected to the switches. By pushing the first switch, an alert along with the location is sent to the family member or the caretaker in case the visually impaired person feels unsafe in the environment they're in. To avoid sending a false message, a second switch is given and should be pressed to prevent it. Water sensor is used to detect the presence of water and it provides an alert in time to change path so as to avoid slipping.

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## VII. FLOW CHART OF THE WORKING SYSTEM

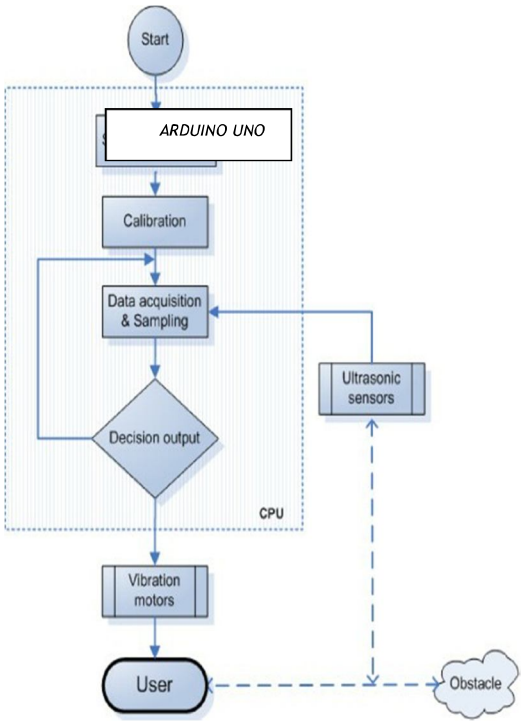



Fig 3: Flow diagram of the system

## VIII. RESULTS

The jacket made into a prototype can be used to guide the visually impaired. It majorly uses ultrasonic sensors to detect the obstacles on the front, left and right side of the wearer. It has voice payback kit incorporated into itself that gives different sounds from different sensors making navigation very easy. Initially, the prototype is examined by placing an obstacle in front of the jacket and measuring output response on serial monitor. The voice commands are played on the voice playback kit based on the direction of the sensor. If the obstacle is on the right, the right sensor senses it and an audio saying that the "Obstacle on the right" (as shown in fig.4) is heard from the speaker that is embedded on the jacket. The obstacles on the other sides are sensed and stated the same way (as shown in fig.5 and fig.6), thus making it easy for the user to change the direction of their path. The experimental results reported that system has excellent detection performance of 98% for obstacle with in 200cm. Fig.7 shows the message received by emergency contact of the visually impaired person. When the panic button is pressed, a message is sent along with the location.

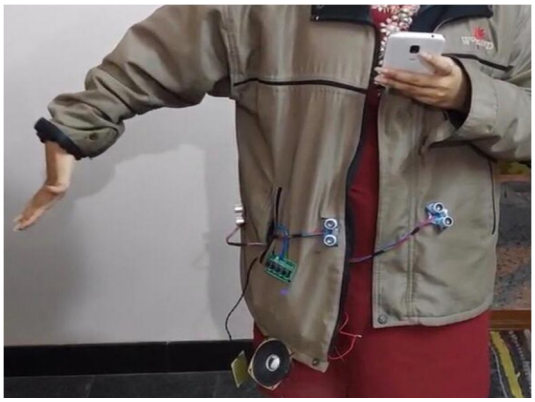


Fig 4: Obstacle detection on the right side

Fig 5: Obstacle detection in the front

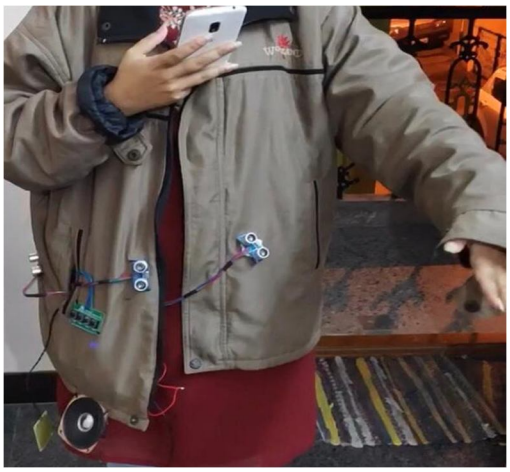


Fig 6: Obstacle detection on the left side

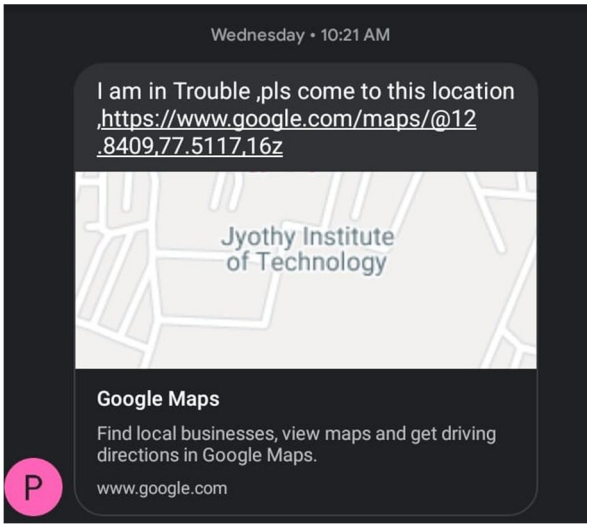


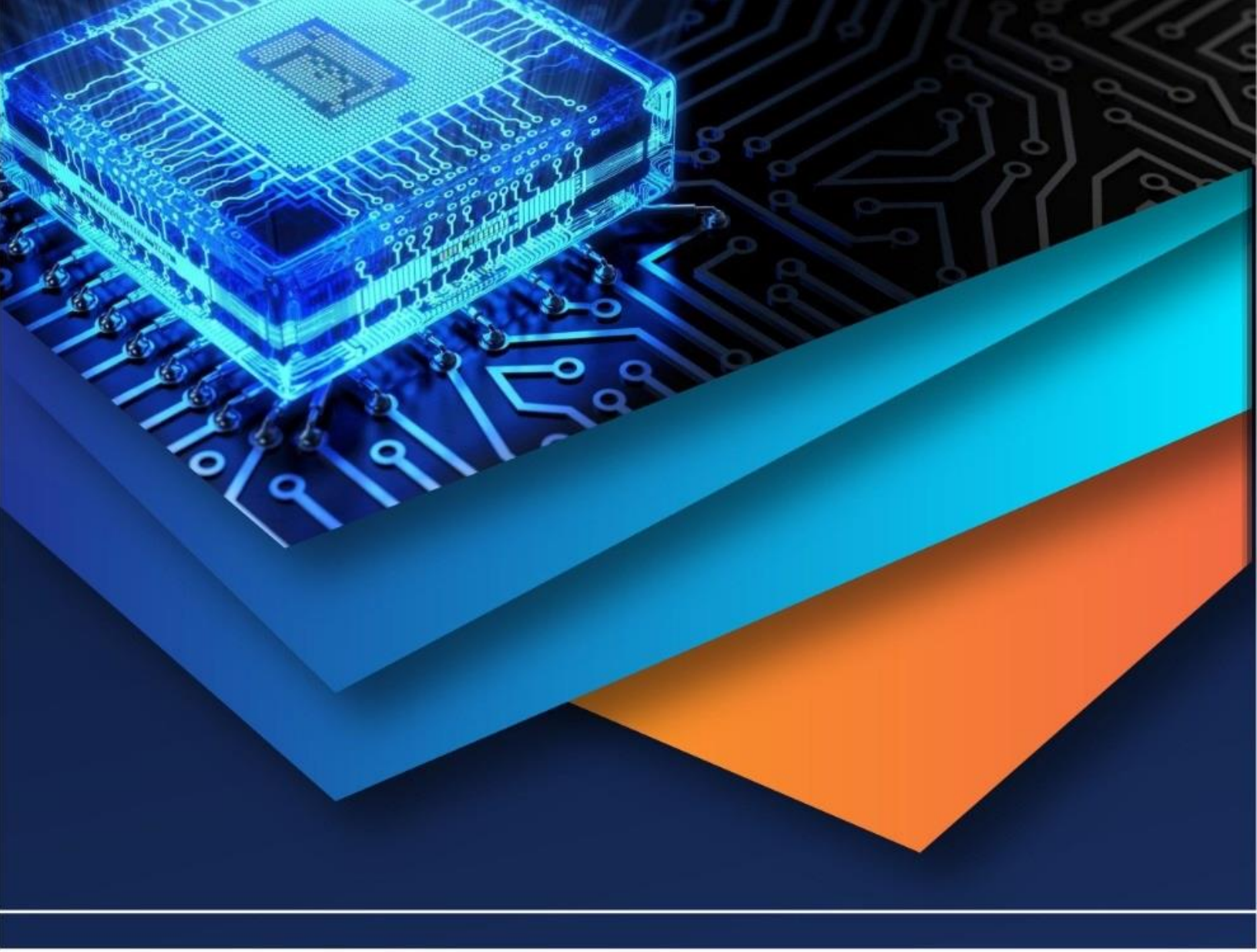

Fig 7: Message received by emergency contact

## IX. CONCLUSION

This paper proposes the design of an aid to help the visually impaired people commute easily from one location to another without any hindrance. The prototype is a simple, cost-effective and a lucrative guidance system that can be used easily by a visually impaired person. With all the aforementioned attributes, one can expect a visually impaired person to move freely without depending on another individual to carry out their everyday chores and activities.

## REFERENCES

[1] Islam, M. M., Sadi, M. S. , Zamli, K. Z., & Ahmed, M. M. (2019). Developing walking assistants for visually impaired people: A review IEEE Sensors Journal, 19(8), 2814-2828.
[2] J. Bai, S. Lian, Z. Liu, K. Wang and D. Liu, & quot; Smart guiding glasses for visually impaired people in indoor environment,& quot; in IEEE Transactions on Consumer Electronics, vol. 63, no. 3, pp. 258-266, August 2017.
[3] J. Bai, S. Lian, Z. Liu, K. Wang and D. Liu, " Virtual-Blind-Road Following-Based Wearable Navigation Device for Blind People,& quot; in IEEE Transactions on Consumer Electronics, vol. 64, no. 1, pp. 136-143, Feb. 2018.
[4] L. Chen, J. Su, M. Chen, W. Chang, C. Yang and C. Sie, & quot; An Implementation of an Intelligent Assistance System for Visually Impaired/Blind People,& quot; 2019 IEEE Consumer Electronics (ICCE), Las Vegas, NV, USA, 2019, pp. 1-2.
[5] C. Lee, P. Chondro, S. Ruan, O. Christen and E. Naroska, & quot; Improving Mobility for the Visually Impaired: A Wearable Indoor Positioning System Based on Visual Markers,& quot; in IEEE Consumer Electronics Magazine, vol. 7, no. 3, pp. 12-20, May 2018.



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