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# Smart Walking System based on Artificial Intelligence

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***Abstract*: This paper shows the smart walking stick based on ultrasonic sensors and Arduino for outwardly debilitated individuals. There are roughly 37 million individuals over the globe who are visually impaired as indicated by the World Health Organization. Individuals with visual inabilities are regularly subjected to outer help which can be given by people, trained dogs, or electronic gadgets as supportive networks for basic assistance. Thus, this played as the motivation to develop a smart cane white stick to survive these restrictions which includes ultrasonic sensors at particular positions to the stick that gave data about nature to the client by initiating the signal sound and vibrations. We proposed minimal effort and light weight framework structured with micro controller that processes signal and alerts the visually impaired person over any obstacle, water or dark areas through beeping sounds or vibrations. The system comprises of obstacle and moisture detection sensors for process of receiving, processing and sending signals to the alarm system which finally alerts the user for prompt action. The system was designed, programmed using Java language and tried for exactness by the visually impaired. Our gadget can recognize obstacle inside the separation of around 2m from the client.**

***Keywords*: Artificial intelligence,Ultrasonic sensor, Arduino board,Microcontroller, Mobility aid, Visually Impaired Person,Alarm system**

## 1. Introduction

Visually impaired individuals are the general population who thinks that its hard to perceive the finest detail with solid eyes. The individuals who have the visual intensity of 6/60 or the flat scope of the visual field with the two eyes open have not exactly or equivalent to 20 degrees. These individuals are viewed as visually impaired. An overview by WHO (World Health Association) did in 2011 appraisals that on the planet, around 1% of the human population is outwardly disabled (around 70 million individuals) and among them, around 10% are completely visually impaired (around 7 million individuals) and 90% (around 63 million individuals) with low vision as per [1]. The major issue with visually impaired individuals is the means with which they explore their approach to wherever they need to go. Such individuals require help from others with great vision. As portrayed by WHO, 10% of the outwardly hindered have no practical vision at all to enable them to move around securely without help. This examination proposes another system for structuring a keen stick to help outwardly disabled individuals that will give them route. The traditional route helps for people with visual weaknesses are the strolling stick (additionally called white stick or stick) and guide mutts which are portrayed by the numerous defects. The most basic deficiencies of these guides include: fundamental abilities and preparing stage, scope of Movement, and exceptionally unimportant data conveyed been imparted.

Our methodology changed this stick with some hardware segments and sensors, the electronic helping gadgets are intended to explain such issues. The ultrasonic sensors, water sensor, signal, and RF transmitter/Receiver are utilized to record data about the nearness of deterrents out and about. Ultrasonic sensor have the ability to recognize any impediment inside the separate scope of 2cm-450cm. Along these lines at whatever point there is an obstruction in this range it will caution the client. Water sensor is utilized to distinguish if there is water in way of the client. Most visually impaired direction frameworks utilize ultrasound in light of the fact that of its insusceptibility to the ecological clamor. With the advances of present day innovation both in equipment and programming it has turned out to be simpler to give smart route framework to the outwardly impeded.

## 2. Literature review

In survey [1] the main problem for visually impaired person is to find the route whenever the person has to move for one place to another. To find navigation route is the main problem. To overcome this problem a smart white cane was develop in that ultrasonic sensors are used to detect the obstacle within 2cm to 450cm. In [2], the proposed technique is a straightforward strolling stick outfitted with sensors to give data about the earth. GPS innovation incorporated with pre-modified areas enables the client to pick the ideal course to be taken. In the framework, ultrasonic sensor, pit sensor, water sensor, GPS beneficiary, level converter, driver, vibrator, voice synthesizer, keypad, speaker or earphone, PIC16F877A micro-controller and battery were utilized. The proposed framework planned to give ease and effective route help for the visually impaired which gives a feeling of fake vision by giving data about the natural situation of articles around them while giving continuous help by means of GPS. The execution of the model created was assessed with four snag situation which are:

Concrete divider, Human body, Cardboard box, and Plastic. In [3] planned and actualized a Smart Stick for Obstacle Detection and Navigation. Their proposed framework used infrared, ultrasonic and water sensors. It likewise utilized GPS and GSM module. GPS to give situating and route to the stick. GSM module gives notices when the visually impaired individual is looked with dangers. The equipment executed on their proposed framework comprises of the Pair of ultrasonic sensors, Infrared sensor, Water sensor, GPS module, GSM/GPRS module, and Arduino Uno micro-controller board (AT-mega328P).The GPS module additionally follows the visually impaired individual through the information gathered by it. It alerts the visually impaired individual through sound whose force increments as the individual is near to the obstacles which help him to clear out of the obstruction. Additionally, when obstructions are identified, it gives alert messages through a Bluetooth headphone. In [4] Smart Walking Stick was developed which is an Electronic Approach to Assist Visually Disabled Persons. Their gadget is a micro controller based mechanized equipment that can help an ignorant concerning distinguish obstacles before him/her quickly. The effortlessness of the proposed structure makes it simple to use by any individual and in the meantime the expense of assembling such sticks is kept low. The power utilization of the proposed stick is low and can be worked effortlessly. The structure has an additional vibratory input instrument essential for making vibratory flag for different impair people to get exact data from the yield. In [5] the Voice Enabled Smart Walking Stick for Visually Impaired people was developed. Their proposed framework comprises of a basic strolling stick furnished with ultrasonic sensors to give data about the surroundings. GPS innovation is coordinated with prearranged areas to decide the ideal course that the visually impaired ought to explore. Likewise, a voice empowered hardware changing is given to help the visually impaired individual in private area. The proposed framework utilized two Ultrasonic locators which are Pit sensor and Water sensor; GPS beneficiary, GSM module, Voice synthesizer, AT-mega328/P micro-controller, transfer, speaker and battery. The main focus of this framework is that it helps the visually impaired individuals in both inside and outside, cheerful route. The data with respect to obstructions is given through voice alarms that destroy the issue of understanding vibration designs which was utilized in past frameworks. In [6] proposed Smart Cane which is a Sophisticated Walking Aid? Their proposed stick is intended to distinguish impediments which may assist the visually impaired with navigating cheerful. Their gadget is comprised of parts, for example, ATMega328PU micro-controller, 4 HC-SR04 Ultrasonic Sensor Modules, Sound IC-APR33a3, Vibration Motor, earphones and battery. Sound criticism. Their strategy alerts clients by pre-recorded sound messages with the help of vibrations. The framework gives ON/OFF switch, vibration input and the sound jack on the handle itself. The framework does not have a worldwide situating strategy to discover the situation of' the client utilizing the GPS and direction to their goal given to the client by voice route. The thought behind the plan of the stick was to keep it fundamentally comparative i.e. thin, lightweight and simple to deal with, yet give a functioning input to the client when the person is in danger or when there is obstacles. In [7] an Intelligent Walking Stick for the Blind was proposed. The proposed route gadget for the outwardly disabled around giving voice yield to route utilizing infrared sensors, RFID innovation, and android gadgets. The gadget has vicinity infrared sensors; RFID labels are introduced into open building and furthermore coordinated into visually impaired individual's strolling stick. The gadget is associated with an android telephone through Bluetooth. An android application is structured which gives voice route dependent on RF-ID label read and furthermore refreshes individual's area data on the server. The segments of the framework are: AT89C51 micro-controller, Bluetooth HC05, MAX232, ADC 0808 and IR sensors, RF-ID sensor, Android telephone, Server and Android application. The framework can be utilized both indoor and outside route. Their methodology can recognize obstructions and cautions the visually impaired individual through vibration alarm and discourse yield. The entire gadget is intended to be little and utilized related to the white stick.

## 3. Materials and methods

### *A. Proposed system*

Our proposed framework is comprised of the Ultrasonic sensor was interfaced to the micro-controller, codes were composed with the Arduino outline and the physical sensor was associated with the micro-controller. The Arduino UNO is a micro-controller board dependent on the AT-mega328p (data sheet). It has 14 advanced yields and information sources pins of which 6 can be utilized as PMW yields, 6 simple sources of info, a USB association, a power jack. The framework will enable the oblivious in regards to openly explore to their coveted goal. It is likewise easy to understand and simple. It is reasonable and accordingly can be mass created for utilization of the outwardly debilitated. The framework has the ability to distinguish snags that exist on the ground amid strolls indoor and outdoor route. A 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 micro-controller. After processing this data, the micro-controller activates the buzzer. The water sensor detect water on the ground, and battery is used to power the circuits.

### *B. Hardware*

The choice procedure of fitting sensor relies upon a few factors, for example, cost, air condition, kind of obstruction to be distinguished, recognition extend, and the coveted accuracy of estimations gathered data and its transmission recurrence. The flowchart of the proposed system is shown in Fig. 1.

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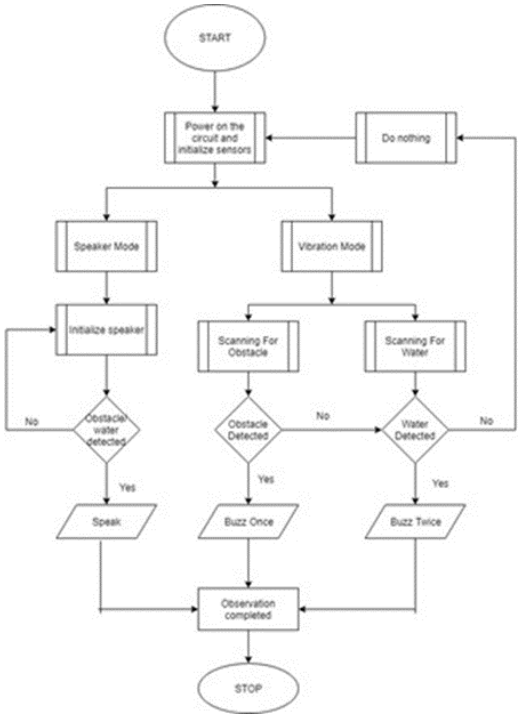


Fig. 1. Proposed system flowchart

## 4. Working

Arduino plays the role of micro-controller. The Arduino gets initialized by switching it on. In the event that the visually impaired person needs to go to a specific place he/she will initially choose the mode either the speaker mode or vibration mode. Ultrasonic sensors are being used for distance measurement and additionally for obstruction discovery. For the same, majorly 3 ultrasonic sensors are being utilized. These 3 sensors covers all 3headings (left, centre, right) of the individual. As indicated by the given figure, the separation between stick to street side (right half of the street) will be estimated by ultrasonic sensor 1, distance between stick to centre street will be estimated by ultrasonic sensor 2 and the distance between stick to street side (left half of the street) will be estimated by ultrasonic sensor 3. Wet sensor will identify the water or liquid substance. According to proposed framework, two modes are being utilizing that are vibrator mode and speaker mode. On the off chance that the encompassing volume is huge, disabled individual can utilize vibrator mode else he/she can utilize speaker mode with the goal that guidelines can get past through speaker. In the event that the individual picks the vibration mode, the impediment is identified with the ultrasonic sensor and the sensor will examine for an obstruction or it will filter if any water body is available or not, as an alert for the individual. At the point when the obstacle is detected then vibrator will vibrate once and in the event that water is recognized, the signal will vibrate twice. Presently on the off chance that the individual picks the speaker mode, with the assistance of speaker which obstacle is there is informed to the individual as an audio. Later the distance is calculated by the distance formula. The distance which is longest is chosen as the way for the individual to walk.

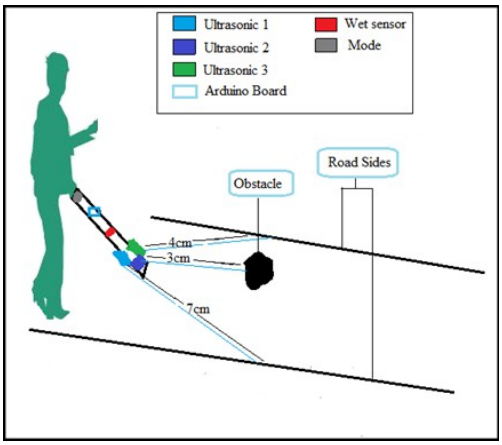


Fig. 2. System architecture

## 5. Results and discussion

This system basically performs two tasks i.e. distance measurement from stick to obstacle and obstacle detection. Obstacle detection identifies potholes and bumps on the ground in the user's route, guiding the user to avoid it.

### *A. Ultrasonic sensors*

The ultrasonic sensor creates high frequency sound waves and evaluates the echoes got back by the sensors. For the task of obstacle detection, the ultrasonic sensor mounted at the base of the stick sends ultrasonic waves towards the below ground and begins the clock. The clock is stopped when the waves reflected from the beginning are received. Utilizing the time required by the waves to return back to the sensor, the distance value between the stick and the ground is calculated in the Arduino board

### *B. Distance measurement*

Distance from stick to obstacle will calculated by distance formula and then after comparing distances the longest distance will choose for walk

Distance Formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

## 6. Conclusion

The Smart Stick goes about as an essential stage for the coming age of additionally supporting gadgets to the visually impaired to navigate safely both indoor and outdoor. It is effective and reasonable. It prompts great outcomes in recognizing the obstacles on the way of the user in the range of three meters. This framework offers a low-cost, reliable, portable, low power utilization and strong answer for route with clear short reaction time. A vibrator may likewise be included for usability and accommodation. In spite of the fact that the

framework is hard wired with sensors and different components, it's light in weight. Further aspects of this system can be improved via wireless connectivity between the sys- tem components, thus, increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. Later on, advance changes to upgrade the execution of the framework will be included. These include: A worldwide situating technique to discover the situation of' the user utilizing the GPS. The ultimate aim of the project is to develop a low cost and convenient embedded personal guidance system dedicated to visually impaired users.

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