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SMART STICK FOR VISUALLY IMPAIRED USING IOT

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ABSTRACT

The visually impaired community experiences significant difficulties in navigating through daily life due to the limitations of their vision. Traditional methods of navigation such as trained dogs and simple white sticks are not efficient in breaking the barrier of blindness and do not provide the necessary level of comfort and independence for individuals with visual impairments. To address this issue, a project has been developed with the main objective of creating a useful smart stick that empowers visually impaired individuals to live independently without relying on other animals or humans for assistance. The smart stick is equipped with sensors that detect fire/smoke, a GPS tracker, voice-oriented devices, pits detecting capabilities, and an Arduino microcontroller. By incorporating these advanced technologies into the smart stick, visually impaired individuals can navigate their surroundings with greater ease and safety. The smart stick not only detects potential hazards but also provides voice guidance and navigation assistance, allowing for a more comfortable and independent way of life. The roles of each are as follows: the voice-oriented devices give alert notification either reached destination or directions or location of a lost stick, the sensors detect the cigarettes smoke or fire and gives an alert notification, whenever there is an obstacle present in the walkway it vibrates. Pit detecting plays the important role as there are many pits across the paths which cannot be known to the blind, with the smart stick they can know that there is a pit, and it gives an alert about it with help of ultrasonic sensor. The proposed approach not only overcomes the disadvantages of the existing methods, but it is also optimal, cost efficient and easier to carry not only for the blind people but also for the elderly ones.

Index terms Arduino kit, ultrasonic sensor, GPS tracker, fire and smoke sensors.

INTRODUCTION

The visually impaired individuals face a great challenge in navigating unfamiliar environments due to their limited eyesight. In India, the latest survey reports that approximately 1.5 million people are visually challenged and find it difficult to perform their daily activities. This number is part of the 170 million

worldwide who are visually impaired, and the rate of individuals with visual impairments is increasing at a rate of 10% annually.

To address this issue, an alternative walking stick has been developed. This walking stick uses various components such as AT89S52, an ultrasonic sensor, a voice playback module, an LCD display, and a voltage regulator. The technologies incorporated in this walking stick aims to provide assistance and make navigation easier for visually impaired individuals. By utilizing this alternative walking stick, visually impaired individuals can navigate their surroundings with greater ease and independence. To aid visually impaired individuals in their navigation, the smart stick incorporates an ultrasonic sensor to detect obstacles in front of the user by measuring the distance between the obstacle and the stick. The voice playback module is also incorporated to assist the individual in reaching their destination through voice commands or a microphone. Moreover, the stick is also equipped with sensors that detect the presence of water, fire, and smoke. These sensors help to identify the depth of water, presence of fire, and presence of smoke, respectively, to alert the visually impaired individual of any potential hazards. By integrating these features, the smart stick provides a comprehensive solution to help visually impaired individuals navigate their surroundings with greater ease and safety. The stick's advanced capabilities enable individuals to feel more confident and independent as they go about their daily lives. Apart from sensors a GPS module is attached which is to track the location in case of emergency and can also be used to find the stick when it is lost.

LITERATURE SURVEY

In the first paper titled "Design and Implementation of an Intelligent Assistive System for Visually Impaired People for Aerial Obstacle Avoidance and Fall Detection," the authors suggest the development of a smart assistive system that includes wearable smart glasses and an intelligent walking stick to aid visually impaired individuals in avoiding aerial obstacles and detecting falls. The proposed system also features a mobile application and a cloud-based information management platform. By using the smart glasses and walking stick, visually impaired individuals can detect obstacles and falls on the road.

In the second paper titled "An Artificial Intelligence Edge Computing-Based Assistive System for Visually Impaired Pedestrian Safety at Zebra Crossings," the authors propose a wearable assistive system based on artificial intelligence (AI) edge computing techniques to help visually impaired individuals safely navigate zebra crossings. Upon reaching a zebra crossing, the system provides the user with real-time information about the traffic light signal and the current situation at the crossing. This system aims to increase pedestrian safety for visually impaired individuals at marked crosswalks.

METHODOLOGY

(i)Obstacle detection: The Ultrasonic sensor present here detects objects and triggers the Arduino controller. The vibrator alerts the person and voice command gives sound through the speaker. Ultrasonic sensors use sound waves (echolocation) to measure how far away you are from an object.

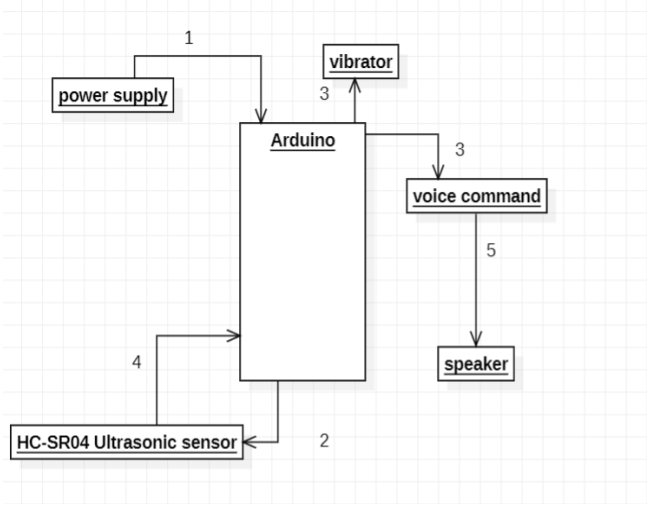


FIGURE 1: Obstacle detection

(ii)GPS tracking: GPS is a utility that provides users with PNT services, enabling them to determine their location, navigate through unfamiliar areas, and keep track of time. GSM, on the other hand, is an open and digital cellular technology used for mobile communication. The smart stick incorporates a GSM module that allows the user to send messages to a mobile device by pressing a switch, providing an added level of convenience for visually impaired individuals. By leveraging GPS and GSM technologies, visually impaired individuals can navigate their surroundings with greater ease and communicate with others more efficiently.

(iii)Water detection: A water sensor is located at the base or bottom of the stick. When the sensor reaches the max level of water level then it produces an electrical signal which triggers the Arduino controller. A voice instruction is given as water detected.

(iv)Fire detection: Fire sensor is a sensor designed to detect and respond to the presence of a flame or fire. It triggers the Arduino and give a voice command of fire detected. (v)Smoke detection: Smoke sensor is a sensor designed to detect and respond to the presence of a smoke from the fire. It triggers the Arduino and give a voice command of fire detected.

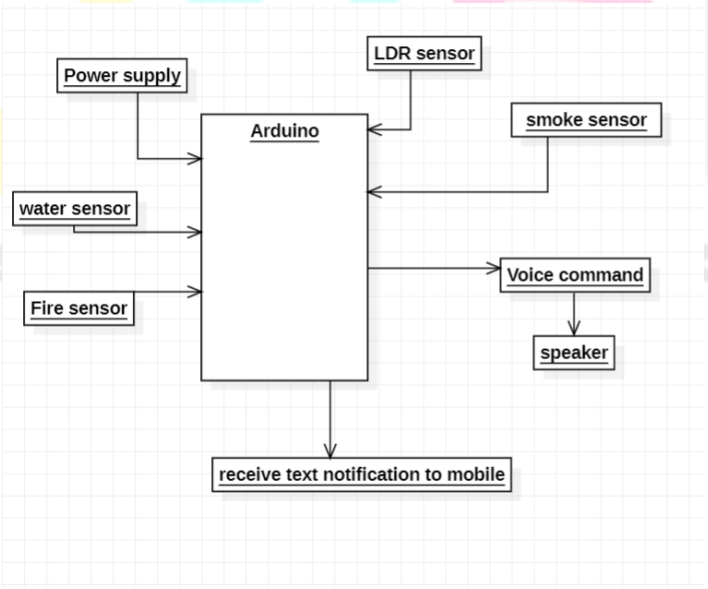


FIGURE 2: Water, Fire and Smoke detection

(vi)Finding stick if it is lost: In order to find the stick if it is lost by the blind person it makes use of the GPS module. When the stick is seemed to be lost then the person can send a text message to the GPS module (to the number in the GPS module) then the person will receive the location of the stick.

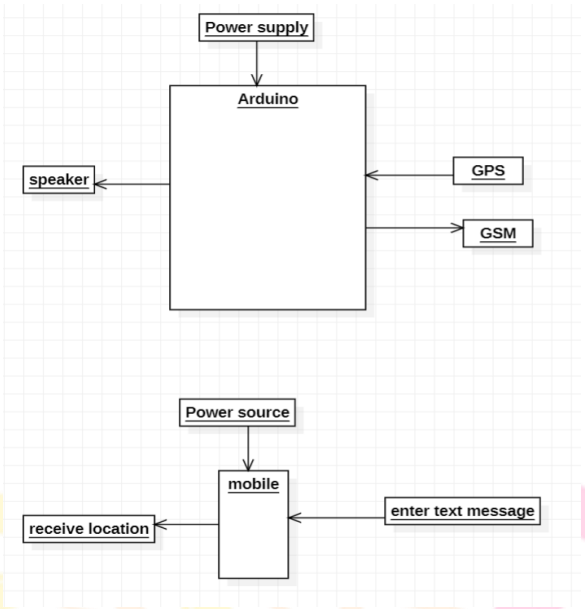


FIGURE 3: GPS module

IMPLEMENTATION

The proposed system consists of 6 modules. (i) water detection(ii) smoke detection(iii) fire detection(iv)obstacle detection(v)GPS tracking in case of emergency(vi)to find the stick if it is lost. The stick is attached with a water sensor which usually consists of anode and cathode. The presence of water has been confirmed only when both the nodes dip in the water and gives out voice output. The stick consists of a smoke sensor (MQ3) which detects uneven changes in the atmosphere suddenly by sensing small particles in the air and gives out voice output when smoke is detected. The stick is also attached with fire sensor (LM39) which detects the presence of fire and gives out voice output. The Stick is attached with GPS module (SIM800C) which is used to locate the position of the stick. In case of emergency stick consists of a button which immediately sends the location of the person with the stick to their family and friends via SMS message. Another module is finding the stick if it is lost by the blind person, it makes use of GSM module by sending a SMS message to the number in the GPS module then the location of stick can be known.

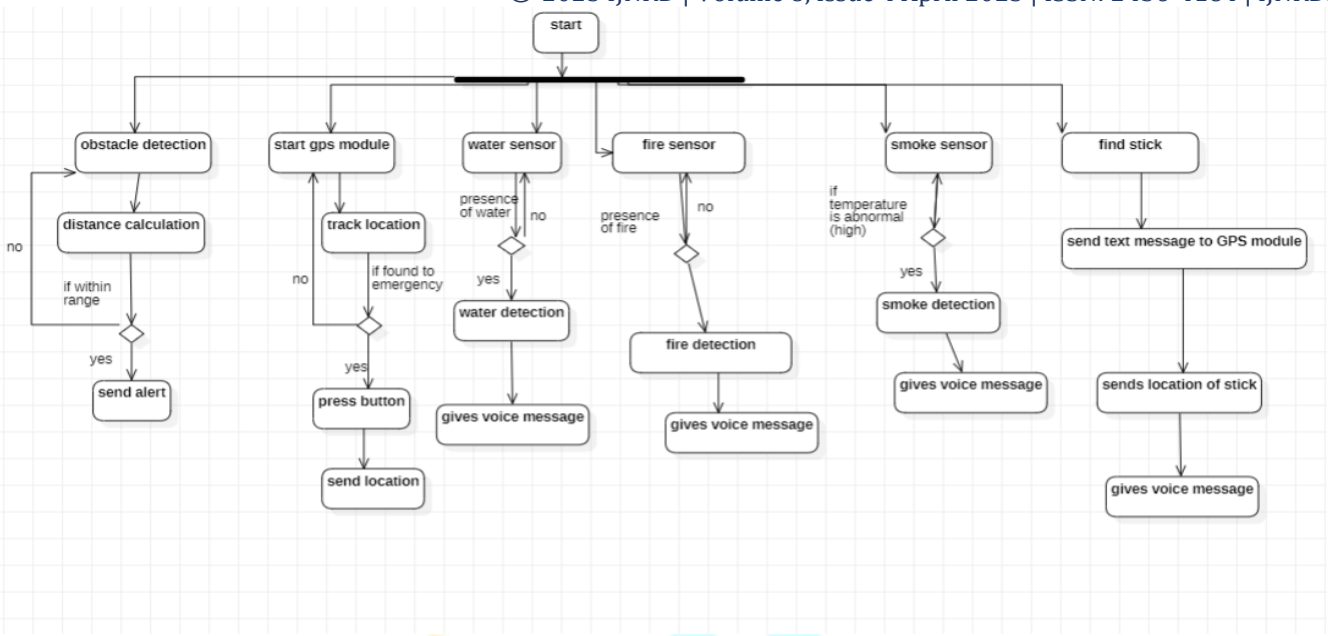
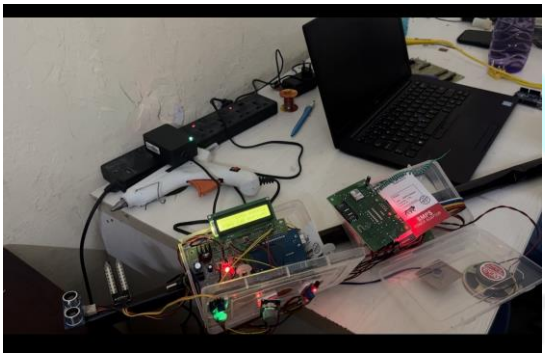


FIGURE 4:System flow

EXECUTION AND RESULTS

The modules discussed above are attached to Arduino microcontroller and given power source to it. Various voice commands are prompted out based on the obstacle identified. There exists serial communication in the system so that there would be no overlapping of the obstacles. The users even gets notified via SMS regarding the type of obstacle and the distance between stick and obstacle and even the latitude longitude of the stick's position.



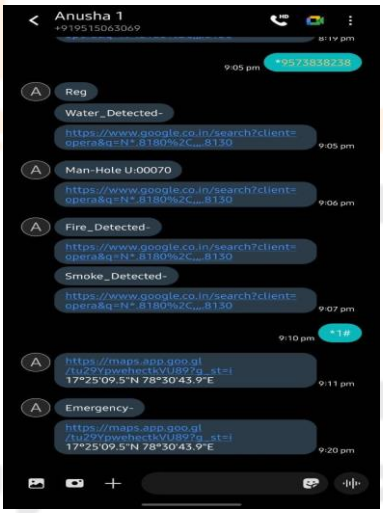


FIGURE 5: RESULTS AND OUTPUT

CONCLUSION AND FUTURE SCOPE

Blind individuals face challenges when it comes to navigating their surroundings, which can act as a significant barrier in their daily lives. As they are unable to see, they often rely on others for assistance in navigating their environment, whether it be a person or a guide dog. This dependence can limit their independence and affect their ability to move around freely. The dog cannot always be helpful as the voice does

not understand by us humans whereas people stay busy and don't give much of their time for navigation instead, they like person on their own, which makes blind people to face difficulty with walking or crossing paths. Many feel helpless in those situations and feel low. To overcome these issues, we are building a smart stick using IOT. This stick consists of 6 modules namely: Obstacle detection module; GPS tracking; Water, smoke, fire module; Detection of stick if lost . The sensor module is used to detect an obstacle present at distance of 50 radians using ultrasonic sensor. GPS sensor module consist of GPS and GSM which sends location of stick. The water module detects the presence of water, the fire module detects the presence of fire and the smoke module detects the presence of usual smoke present in the atmosphere respectively if present and gives a voice through speaker. The stick in room is found through sending a text message to the stick. Finally smart stick, which is used for the detection of obstacles, pits, manholes, tracking of stick if in case it is misplaced. As for every obstacle detection the person cannot identify what the stick is detecting so buzzer / speaker is fixed to distinguish.

To increase the scope of the project more sensors can be added as a LDR sensor. Rather using a speaker, a headset can be preferred because speaker may not be apt while using in traffic. Vibrator can also be used because it will be useful to the deaf people as well.

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