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SMART BLIND STICK WITH GPS AND GSM BASED TRACKING WITH VOICE OUTPUT ON OBSTACLE DETECTION

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Abstract -*Today, many blind individuals struggle with daily tasks and face risks when traveling. Ensuring their safety and security is crucial. This innovative project features a blind stick with useful sensors like ultrasonic and moisture sensors, a fall detection system, and a person detection feature.*

The ultrasonic sensor detects barriers using sound waves, relaying this data to a microcontroller. Upon sensing a nearby obstacle, a buzzer notifies the user. If a person or their cane falls, the fall detection system, utilizing an accelerometer, triggers a voice-based alert. A moisture sensor at the tip of the cane alerts the user to damp or perilous areas. Additionally, a panic switch may be incorporated for emergencies, activating a buzzer to alert nearby individuals. For live tracking, GSM and GPS modules are integrated. During emergencies, the device transmits the user's location to a registered mobile number via a Google Maps link. Fundamentally, this initiative seeks to improve the safety and autonomy of visually impaired individuals by furnishing a reliable and adaptable tool for navigating their surroundings effectively.

***Key Words*: ultrasonic sensors, moisture sensors, voice-based alert, GSM module, GPS module .**

1.INTRODUCTION

A visually impaired cane is a cutting-edge device designed for individuals with visual disabilities to enhance navigation. The envisioned, sophisticated cane empowers visually impaired individuals to navigate effortlessly using state-of-the-art technology. Our proposed project begins by employing an ultrasonic sensor to identify obstacles without physical contact, utilizing ultrasonic waves. Upon detection of obstacles, the sensor relays this specific information to the microcontroller. Subsequently, following data analysis by the microcontroller, it evaluates the closeness of the obstacle. If the obstacle is distant, the circuit remains inactive. However, if it's in close proximity, the microcontroller initiates a signal to activate a buzzer.

This system is equipped with fall detection system. This system is designed using an accelerometer. If Person or His / Her stick fall down and Voice based Audio output will be generated for requesting of Help from nearby people. A moisture sensor is connected at the end of the stick, to alert the user that he is moving towards Drain or Water contained area. This system is programmed using an Arduino IDE-based compiler and an onboard-based USB programmer. Embedded C language is used to code this hardware unit. A combination of Analog and digital pins is used to interface the sensor and output devices.

The emergency button also integrates with the system; this button can also be linked to the glove. In the event of any crisis, the user can activate this button, and the GPS coordinates of the user are transmitted to their family members. The power supply configuration of the system includes a 12V Battery, Voltage Stabilizers, Filter Capacitors, and Charging Circuit. A 12V Output from a 7812 Voltage stabilizer and a 5V Output from Voltage stabilizers are utilized to energize the Microcontroller, Accelerometer, and Ultrasonic Sensor. Filter capacitors are employed to eliminate fluctuations from DC Voltage. A charging Circuit, alongside a 12V adapter, is utilized to recharge the 12V battery.

2. Literature Survey

G. Gayathri, M. Vishnupriya, R. Nandhini, and M. Banupriya et al. among others, propose a study aimed at assisting visually challenged individuals in walking more confidently The study introduces a novel concept: the smart walking stick, crafted to warn visually impaired individuals of obstacles, pits, and water along their path, consequently mitigating the likelihood of accidents. This innovative solution holds significant promise as a navigational aid for the visually impaired community.

The smart walking stick comprises a simple design equipped with various sensors to provide real-time environmental information. Integrated GPS technology, along with pre-programmed locations, assists in determining the most suitable route to take. Users can select their desired destination from a predefined list stored in the device's memory, enabling the stick to guide them in the correct path. Components utilized in this system include ultrasonic sensors, pit sensors, water sensors, GPS receivers, level converters, drivers, vibrators, voice synthesizers, keypads, speakers or headphones, PIC controllers, and batteries. The overarching objective of

this device is to offer a convenient and safe solution for visually impaired individuals to navigate through their daily lives [1].

R. Radhika, P.G. Pai, S. Rakshitha, R. Srinath et al. A smart stick has been developed to aid visually impaired individuals in detecting obstacles, employing a combination of infrared, ultrasonic, and water sensors. This technological advancement offers enhanced assistance to the visually impaired community in navigating their surroundings safely. These sensors enable the detection of obstacles within a range of approximately 3 meters. Additionally, a GPS module is incorporated to provide positioning and navigation assistance to the stick. By utilizing the GPS module, blind individuals can navigate to their destination safely. During navigation, the GPS receiver continuously updates the location of the person, allowing for real-time tracking for safety purposes. Furthermore, the blind person can send emergency messages or make emergency calls to their guardian using a GSM module in case of risk or threat. This feature ensures that notifications are sent to the guardian when the blind person encounters potential dangers [2].

Jismi Johnson, Nikhil Rajan P, Nivya M Thomas, Rakendh C S, Sijo TcVarghese et al. smart stick system designed to assist blind individuals. This innovative solution aims to address the challenges faced by visually impaired individuals in detecting obstacles and dangers while walking, as well as understanding their surroundings. The system functions as an artificial vision and alarm unit, enhancing safety and mobility for the user. Comprising three sensors - ultrasonic, water, and heat flame - along with a microcontroller (Arduino Uno R3), the system receives sensor signals and processes them into short pulses directed to the Arduino pins connected to buzzers and LED bulbs. The project's objective is to offer an affordable and lightweight smart stick solution suitable for a wide range of visually impaired individuals and their families, ensuring accessibility across various segments of society [3].G. Prashanthi, P. Tejaswitha, et al. the issue of blind individuals' dependency on assistants for mobility in their paper. They propose a solution in the form of a smart stick to empower blind individuals and enhance their independence. This smart stick is equipped with various sensors to detect obstacles and features a speaker and buzzer to provide feedback in recorded voice upon sensing obstacles. Additionally, the smart stick integrates GPS and GSM modules for navigation assistance, ensuring safe and accurate guidance for users. The GPS module also used to track the blind person by their relatives. This paper elaborates on the components and functionality of the smart stick. It describes how the Smart Blind Stick automatically detects obstacles using sensors and incorporates moisture detection at its base to assess ground conditions, thereby providing crucial information to the user about the feasibility of walking on a particular surface [4].

Agrawal, M.P, Gupta, A.R, et al. They highlight how blindness can strip away the visual splendor of the world, leaving individuals grappling with numerous difficulties in their daily lives. Transportation poses a significant hurdle, whether it's crossing roads or navigating public spaces, often requiring reliance on human assistance. The absence of such assistance can leave them feeling helpless, further diminishing their confidence. Traditionally, visually impaired individuals have used conventional cane sticks to navigate by physically detecting obstacles, a method prone to accidents and hazards. In response to this need, the team proposes a technologically driven solution: the "Smart Stick." This device employs sensors to detect obstacles within its range, providing real-time guidance to the user. Data retrieved by the microcontroller is translated into vibrations, alerting the user to obstacles in their path. The Smart Stick offers an efficient and innovative approach to assist visually impaired individuals, potentially revolutionizing their mobility and safety [5].

Dey, N., Paul, A., Ghosh, P., Mukherjee, C., De, R., Dey, S.et al. design and implementation of an ultrasonic sensor-based walking stick for visually impaired individuals. The system utilizes the HC-SR04 ultrasonic sensor module to detect obstacles in the path of the user, with a buzzer incorporated to alert the person accordingly. Implementation is achieved through the PIC microcontroller 16F877A. This walking stick offers a safe navigation solution for blind individuals, capable of detecting obstacles within a range of 5 to 35 cm [6].

Ravikumar Racha Ganesh, Kunchala Madhu Moku Sai Kumar Reddy, P. N. Pranay, et al. the limitations of conventional blind walking sticks, which only detect obstacles upon physical contact. In response, they propose an advanced blind stick system capable of sensing objects before contact. This system includes features to detect water in front of the user, enhancing safety and awareness. Utilizing an Arduino-based circuit, the system integrates an ultrasonic sensor to detect objects within a certain range, emitting specific beep patterns and alert the user if there is any obstacles. Additionally, water sensor is employed to detect water ahead, triggering a distinct beep pattern when submerged. The integration of GPS and GSM modules enables the user's family to access their location, enhancing safety and support [7].

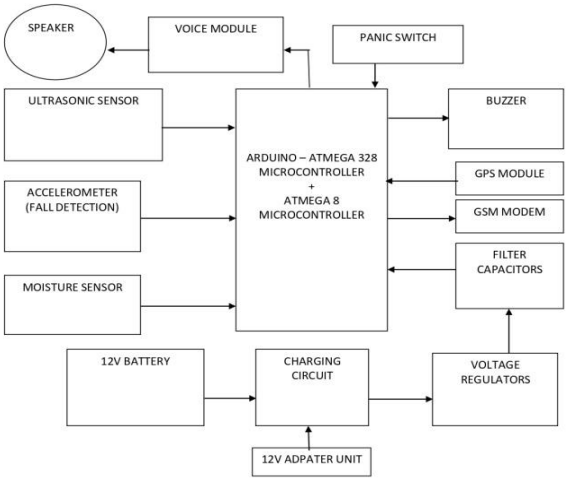
3. METHODOLOGY

3.1 .PROPOSED MODEL

Designed a simple and Innovative Blind Stick using an Arduino Controller board, GPS and GSM Modem. Using this system, users can find the obstacle in its way by hearing an

audio alert generated by the system. Voice based Alert if the person Falls down along with a Moisture Sensor audio Buzzer alert. If any Panic situation occurs, then the user presses the Panic Switch and there location will be sent to mobile phone of the family members.

3.2. BLOCK DIAGRAM



Advantages

- The system is suitable for both indoor and outdoor navigation.
- The location of a visually impaired individual can be monitored as required, guaranteeing extra safety for future applications.
- It identifies barriers and notifies the visually impaired individual through a buzzer output.
- Visually impaired individuals can move with confidence using this cane.

Applications

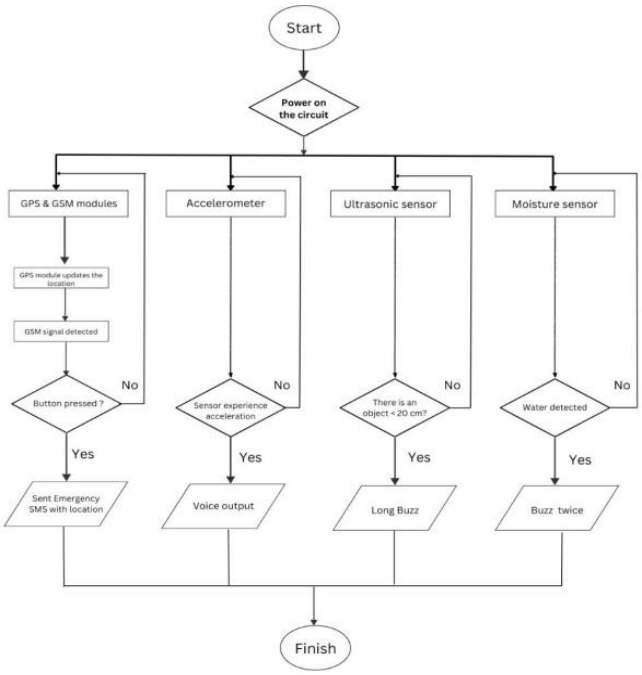
- Blind Cane for Visually Challenged Individuals.
- Automated Wheelchair for Physically Handicapped individuals.
- Obstacle Evasion and Vehicle Monitoring System utilizing GPS and GSM.

4.DESIGN AND IMPLEMENTATIONS

4.1 Algorithm:

Step 1. Turn on.
Step 2. Set up GPS and GSM.
Step 3. Activate Sensors(accelerometer, ultrasonic, moisture).
Step 4. Check button press.
Step 5. If True send an emergency SMS with the location.
Step 6. Do Sensor Monitoring.
Step 7. Do the Actuator operation(buzzer), GoTo step 6(infinite loop).
Step 8. End.

4.2 Flow Chart



4.3 WORKING:

Upon powering up, the system undergoes initialization, configuring the GSM and GPS modules to acquire location data and facilitate emergency message transmission via cellular networks. Additionally, the system activates the accelerometer for motion detection, the moisture sensor for liquid detection, and the ultrasonic sensor for object detection. The ultrasonic sensor functions by emitting ultrasonic waves to detect obstacles without the need for physical contact. When the obstacle is detected, the sensor transfers the data to the microcontroller for assessment. Following this, the microcontroller gauges the closeness of the obstacle. If it detects that an obstacle is in close proximity, the microcontroller triggers a signal to activate a buzzer, promptly notifying the user. Conversely, if no obstacle is detected, the system remains in an idle state, ready for additional input.

Additionally, a fall detection mechanism is integrated into the system. An accelerometer is utilized for this purpose. In the event of a fall by the user or their cane, voice-based alerts are generated to request assistance from nearby individuals. Furthermore, a moisture sensor is affixed to

the end of the cane to alert the user when approaching areas containing water or drains.

The system is always looking for a button press. When an emergency button is pressed , the system uses the GSM module to send the family members an emergency SMS that includes the location information (e.g., "Emergency! Located at [Latitude, Longitude]"). A 12V battery, voltage regulators, filter capacitors, and a charging circuit provide the system's power supply configuration. The microcontroller, accelerometer, and ultrasonic sensor are powered by the 12V output of the 7812 voltage regulator and the 5V output of the voltage regulators. DC voltage ripples are eliminated with the usage of filter capacitors. To charge the 12V battery, use a charging circuit and a 12V adaptor.

5. RESULTS

FIG: 5.1 – when circuit is in OFF state

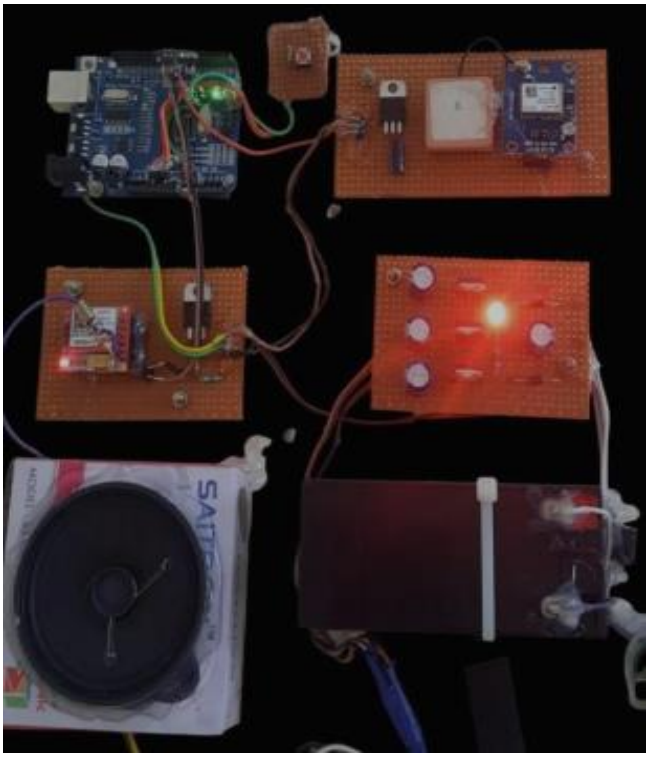


FIG: 5.2 – when circuit is in ON state

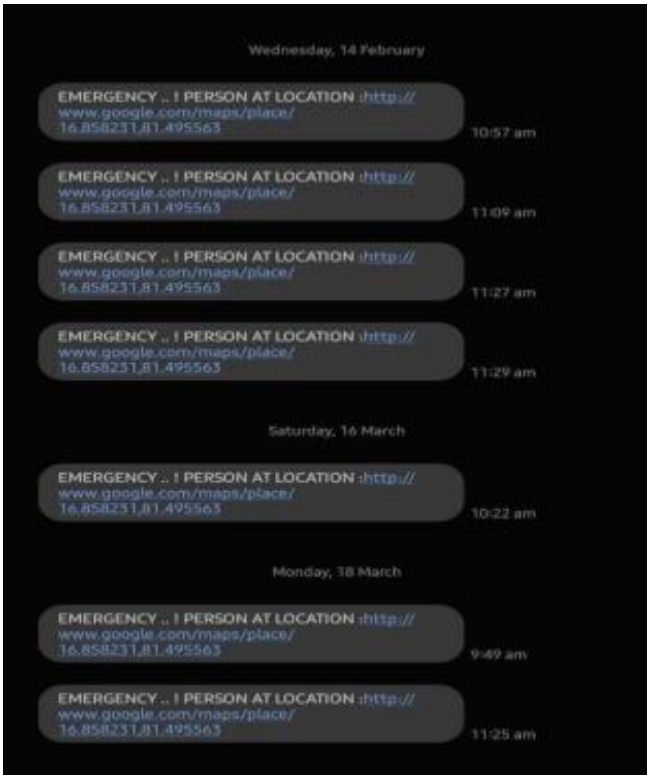


FIG: 5.3– when panic switch is pressed

FIG: 5.4 – when SMS link is pressed

FIG: 5.5 – Location details

6. CONCLUSION

At this juncture, it is crucial to highlight the successful achievement of the primary research objective: The creation and implementation of an intelligent cane customized for the needs of the visually impaired mark a significant milestone in assistive technology. The Smart Stick represents an innovative platform set to lead the path for future generations of assistive technologies, focused on enabling Visually impaired individuals to traverse securely across diverse indoor and outdoor surroundings.

Demonstrating efficiency and economic viability, this innovation holds particular significance in regions such as India, where the demand for affordable solutions is pronounced. Consequently, the product outlined in this paper emerges as highly pertinent, addressing a pressing need for widespread accessibility in developing nations.

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