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BLIND NAVIGATION SUPPORT SYSTEM USING RASPBERRY PI AND YOLO(OPEN CV)

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Abstract : Blind Navigation Support System using Raspberry Pi & YOLO integrates various sensors and modules to aid visually impaired individuals in safe navigation through walkways. The system incorporates a soil moisture sensor to assess wet conditions, an ultrasonic sensor for obstacle detection, a push button for emergency situations, a GPS module for acquiring latitude and longitude coordinates, and a GSM module for sending SMS alerts. Upon detecting an obstacle, the system utilizes a camera and earphones to announce the object's name via the YOLO (You Only Look Once) algorithm. Additionally the temperature and heartbeat sensor will able to measure the vital signs of the user. And also the solar panel is placed in the project which represents the charging of the battery.The inclusion of a GPS module enhances the system's functionality by providing accurate location data, allowing users to navigate with confidence and facilitating rescue operations if necessary. Additionally, the integration of the YOLO algorithm with a camera and earphones enables real-time object recognition, empowering users with information about their surroundings. Overall, the Blind Navigation Support System offers a comprehensive solution to enhance the safety and autonomy of visually impaired individuals, leveraging Raspberry Pi's versatility and YOLO's robust object recognition capabilities.

Index Terms - **Raspberry Pi, Yolo Algorithm,GSM,GPS,Web Camera,Ear Phones,Ir sensor,ultrasonic sensor, Push button.**

I. INTRODUCTION

The project introduces a groundbreaking initiative focusing on the design and implementation of a smart belt prototype named the Blind Stick. This innovative device is tailored to augment the mobility and safety of visually impaired individuals by integrating cutting-edge technologies. At its core, the Blind Stick utilizes an Arduino microcontroller to efficiently manage various components, including an ultrasonic sensor, GSM module, GPS module, USB web camera, speakers, and a switch. The combination of these elements enables the prototype to offer essential functionalities such as object detection, alert generation, and location sharing.

The ultrasonic sensor plays a pivotal role in enhancing user safety by detecting obstacles in the path of the visually impaired individual. Upon detecting potential collisions, a buzzer alert is triggered to promptly warn the user. Furthermore, the inclusion of a switch empowers the user to initiate an emergency alert. When activated, the GSM module sends a text message containing, ensuring swift assistance in emergency situations.

The Blind Stick prototype takes a significant leap forward by incorporating computer vision techniques, leveraging the YOLO (You Only Look Once) framework. Through the use of a USB web camera connected to a PC, the Blind Stick captures images, and YOLO identifies detected objects. The user is then provided with audio alerts through earphones, offering a more comprehensive understanding of their surroundings.

II. LITERATURE SURVEY

Sylvain Cardin, Daniel Thalmann and Frederic Vexo [1] used stereoscopic architecture to develop new obstacle sensing abilities. First they determine from which direction the obstacles are coming from. There are vibrators on left and right shoulder of user. With these vibrators he can detect the position of the obstacle. Then user in this system will be able to position himself.

Osama Bader AL-Barrm, JeenVinouth [2] proposed that detects the obstacles in the path of the blind using ultrasonic sensors. It consists of these sensors to scan three different directions, a microcontroller, buzzer and DC vibration motor. The buzzer and vibration motor is activated when any obstacle is detected.

In addition, the stick is equipped with GPS and SMS message system.B.Mohan Sitaramaiah, M.Naganaik [3] this system has ability of overcoming the drawbacks with the existed technologies like guide cane and talking signs that they are only giving a support while they are walking, but not avoiding the accidents due to some vehicles and man holes.

The existed systems are also failed in information sending in case of emergencies. This system enhances blind system assistance with ultrasonic sensors. The system consists of two ultrasonic sensors modules, voice playback module, and a vibration motor.F. van der Heijden, P.P.L. Regtien [4] this paper describes the system architecture for a navigation tool for visually impaired persons. The major parts are: a multi-sensory system comprising stereo vision, acoustic range finding and movement sensors, a mapper, a warning system and a tactile human-machine interface. There are three main sensors in this project stereovision, optical flow, and sonar.Output is in the form of voice which the blind person can hear e.g., right, left etc. The hardware consists of Arduino Uno board, ultrasonic sensors and speaker.

III. EXISTING METHOLOGY

Existing methods for assisting visually impaired individuals in navigation often rely on traditional aids such as white canes, guide dogs, or tactile paving. While these methods have provided some level of support, they possess significant drawbacks. White canes, for instance, primarily rely on physical contact with the ground, making them ineffective in detecting obstacles above ground level, such as overhanging branches or low-hanging signage. Guide dogs require extensive training and ongoing care, making them inaccessible to many individuals. Tactile paving, while helpful in indicating pathways and hazards, may not always be present or properly maintained, leading to inconsistencies in navigation aids. Furthermore, these methods offer limited assistance in dynamically changing environments, such as crowded streets or unfamiliar terrain.

IV. DISADVANTAGES OFEXISTING METHOLOGY

Generally guide dogs only work for 6-8 years.Dogs get sick, and their veterinery expenses are not cheap.Guided dogs may struggle in certain environments, such as busy streets with heavy traffic or areas with obstacles like construction Vision loss can effect physical health and quality of life.The cane only senses obstacles that are waist level. sometimes wear and tear on a white cane can lead to unsafe.They provide less support than walkers. Overtime could lead to repetitive strain issues.Users may become overlay dependent on their guide dog, which could hinder their ability to navigate without it in certain situations.Magnifiers typically only provide a magnified view of a small area, making it difficult to navigate larger spaces.

V. PROPOSED METHODOLOGY

In response to the limitations of conventional methods, a proposed solution, the Blind Navigation Support System using Raspberry Pi & YOLO, offers a comprehensive and versatile approach to aid visually impaired individuals in safe navigation. By integrating various sensors and modules into a single system, including a soil moisture sensor, ultrasonic sensor, push button, GPS module, GSM module, camera, and earphones, the proposed method addresses key shortcomings of existing approaches. The soil moisture sensor provides real-time feedback on ground conditions, alerting users to potentially hazardous wet surfaces. The ultrasonic sensor scans the environment for obstacles, enabling early detection and avoidance. In emergencies, the push button triggers immediate assistance through SMS alerts sent via the GSM module. The inclusion of a GPS module enhances navigation by providing accurate location data, while the integration of the YOLO algorithm with a camera and earphones enables real-time object recognition, empowering users with information about their surroundings. By leveraging the versatility of Raspberry Pi as the central processing unit, the proposed method offers a scalable and adaptable solution to improve the safety and autonomy of visually impaired individuals in navigating various environments.

5.1. Implementation Method :

A blind navigation support system using Raspberry Pi and Yolo OpenCV in Python typically involves the following steps:

Connect a camera module to the Raspberry Pi to capture live video feed. Install OpenCV and Yolo object detection framework on the Raspberry Pi.Use Yolo's pre-trained model to detect objects in the captured video feed. Yolo is capable of detecting various objects, including obstacles, people, and vehicles.Process the detected objects to extract relevant information for blind navigation, such as the distance and direction of obstacles.Convert the processed information into speech using TTS libraries. This allows the Raspberry Pi to provide auditory feedback to the user about their surroundings.Based on the detected obstacles and the user's location, provide navigation guidance to help the user navigate safely.Develop a user-friendly interface for interaction, which could involve using buttons, voice commands, or gestures.Test the system in various environments to ensure accuracy and reliability. Optimize the performance of the system for real-time usage, considering factors like processing speed and power consumption. By combining these elements, the blind navigation support system can assist visually impaired individuals in navigating their surroundings safely.

VI. RESULTS AND DISCUSSION

Here Ultrasonic sensor is used to detect the objects which are near to the visually impaired person or any Obstacles occur near the person, An alert message will be given by sensor and and buzzer will be on And a Message will be send to the registered number with location.These results are shown in fig1and fig2.

Fig:1 Sample Output through one of the Sensor used in the Prototype

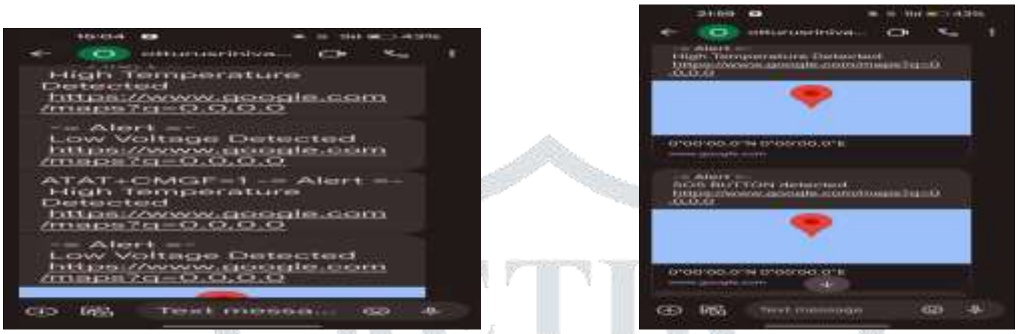

Fig:2 Outputs of Proposed System By one of the Sensor

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