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IMPLEMENTATION OF SMART SYSTEM FOR THE VISUALLY CHALLENGED PEOPLE BY USING CONVOLUTIONAL NEURAL NETWORK (CNN) ALGORITHM

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Abstract: Vision is crucial for understanding the world around us, yet visually impaired individuals face significant challenges in navigating their environment independently. To address this, computer vision techniques, particularly Convolutional Neural Networks (CNN), offer promising solutions. This study utilizes CNN algorithms, specifically the YOLO v3 model, to accurately detect objects both indoors (like chairs and tables) and outdoors (such as buses and cars). The system processes images in real- time and provides voice instructions to guide visually impaired individuals. Additionally, it distinguishes between normal and hazardous objects using a Google database. Implemented with ease of use in mind, the system incorporates pyttsx3 for voice alerts. Furthermore, it employs a Nano microcontroller and tilt sensors to detect falls or obstacles, triggering a buzzer alert. An integrated SOS button in an Android app sends emergency alerts to designated contacts when needed.

INTRODUCTION

The ability to navigate from place to place is a significant part of daily life. Human beings process the world around them mostly via the sense of sound and vision. It is general belief that vision plays a critical role, but many would have great difficulty in identifying the visual information they use, or when they use it. We find it easy to navigate in extremely familiar places without the sense of vision. This is possible mostly due to muscle memory. This can be experienced in examples such as going to the bathroom from your bedroom in the middle of the night. But only a small minority of people has experienced navigating large-scale, unfamiliar environments without the aid of their eyes. Consider trying to catch a train in railway station blindfolded at peak hours. Yet, the visually challenged travel independently on a daily basis. To facilitate safe and efficient navigation, blind individuals must acquire travel skills and use sources of non-visual environmental information that are rarely considered by their sighted peers. Their sense of smell and their hearing are very sharp, as they rely a lot upon these senses. They also take to feeling the environment around them.

The application developed can detect the objects in the user's surroundings. It can alert the user of the obstacles in his pathway and this way helps the user to navigate from one place to another saving him from tripping anywhere. It will also solve the problem of keeping a special device. The reason it is more reliable is because it is developed on the Android operating system are very common and highly available almost everywhere.

LITERATURE SURVEY

[1] Rajput et al. (2017) present a Smart Obstacle Detector using MATLAB for signal processing. They use a camcorder for video recording and employ video processing methods to detect obstacles. The system provides audio and vibration feedback using an ultrasonic sensor connected to a vibrating motor.

[2] Rajput et al. (2020) present another Smart Obstacle Detector, similar to [1], focusing on

obstacle detection and providing audio and vibration feedback using MATLAB and an ultrasonic sensor.

[3] Khurana and Awasthi (2019) discuss techniques for object recognition and multi-object detection, similar to [2], with the potential to improve performance by running multiple object detectors in parallel.

[4] Udgirkar et al. (2019) introduce a wearable device with two cameras on glasses, an infrared sensor, and a blind stick for object detection. The system provides audio information about objects and requires training and feature extraction.

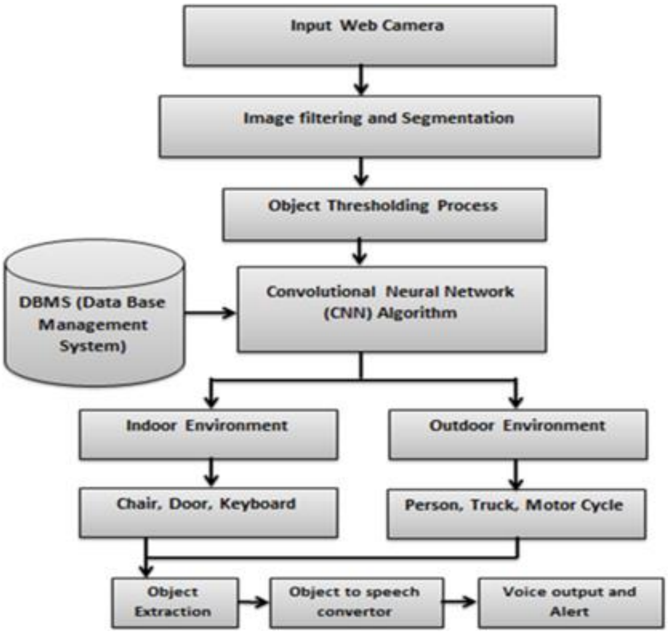
EXISTING SYSTEM

This system combines deep learning with a camera to help visually impaired individuals identify objects, like furniture and daily necessities, in indoor spaces. It detects if furniture has been moved using a general RGB camera and deep learning algorithms. A camera positioned above the entrance of a room captures images, sending them to a server for processing. The user initiates detection using voice commands via an application, and the results are communicated back to the user audibly. The system employs fast RCNN for furniture detection.

PROPOSED SYSTEM

The proposed system utilizes continuous video streaming for image capture to enhance object detection and recognition speed, crucial for aiding visually impaired individuals in navigation. Employing a CNN algorithm, the system ensures accurate and rapid object detection. Initially, camera permission is obtained to capture objects, followed by sub segmentation of images to form multiple regions.Similar regions are merged to identify areas of interest. The YOLO v3 pre-trained CNN is retrained for specific object classes, enabling efficient detection. Object and background classification, along with bounding box generation via linear regression, are conducted based on the identified regions. The system detects objects in both indoor (e.g., persons, chairs, benches) and outdoor (e.g., cars, buses, motorcycles) environments, providing directional instructions. Recognized information is converted into vocal format for accessibility. Controlled by a Nano microcontroller, the system integrates tilt sensors for obstacle detection, triggering audible alerts through a buzzer during emergencies or hazard encounters.

CIRCUIT DIAGRAM



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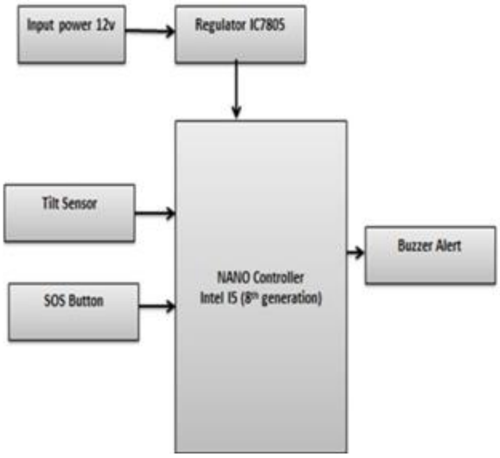
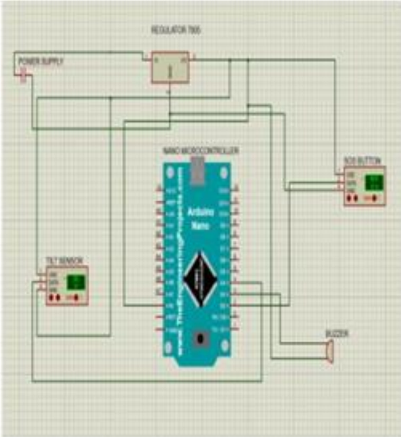
SYSTEM FUNCTION ARCHITECTURE DESIGN

HARDWARE BLOCK DIAGRAM





RESULTS

The implemented system successfully enhances the mobility and safety of visually impaired individuals by providing real-time object detection and navigation assistance.

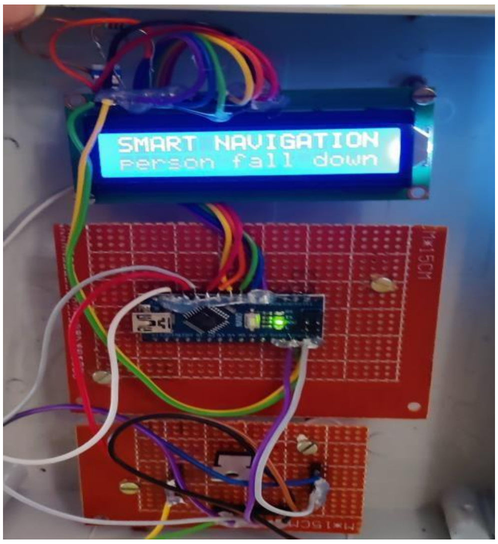
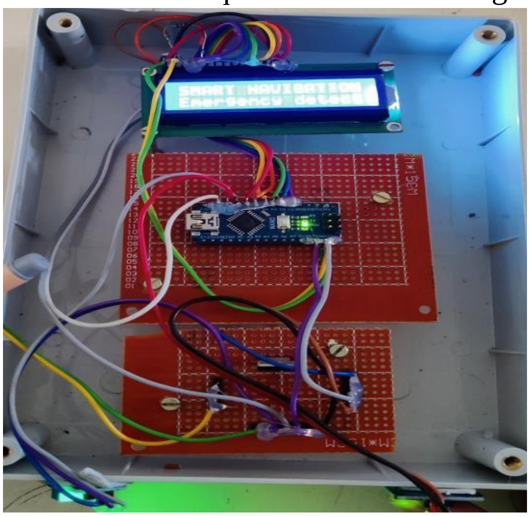


Figure: Tilt Sensor Output

Through the utilization of computer vision techniques and the CNN algorithm, accurate indoor and



outdoor object detection is achieved, enabling effective navigation instructions.

Figure: Touch Sensor output

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Through the utilization of computer vision techniques and the CNN algorithm, accurate indoor and outdoor object detection is achieved, enabling effective navigation instructions.

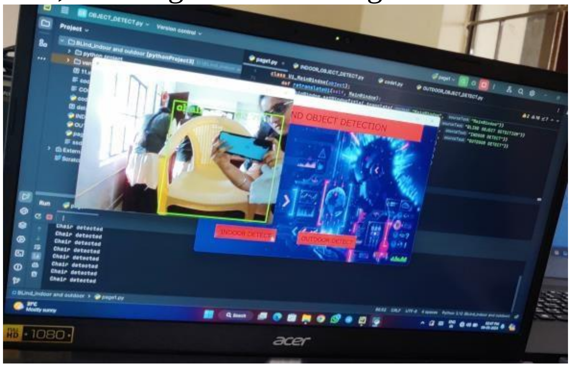

Figure: Object Detection

CONCLUSION

The creation of an assistive system for visually impaired individuals marks a major stride in utilizing technology to tackle mobility and safety hurdles. Through computer vision, convolutional neural networks, and real-time object detection, the system provides accurate navigation support indoors and outdoors. Voice alerts and tactile feedback convey environmental details, empowering users to navigate confidently. Tilt sensors and an SOS feature bolster safety by swiftly detecting falls and facilitating emergency assistance.

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