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Innovative Solution for Visual Impairment Implementation of Real Time Assistance Through Object Detection and Classification

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ABSTRACT: Visual impairment poses significant challenges to individuals in their daily lives, limiting their independence and access to information. This project focuses on the design and implementation of an innovative real-time assistance system to address the needs of visually impaired peoples. The system aims to enhance their mobility, communication, and overall quality of life through technological advancements. The proposed system utilizes cutting-edge technologies such as computer vision, machine learning, and wearable devices to provide real- time assistance to visually impaired peoples. It employs a combination of image processing algorithms and deep learning models to recognize and interpret the surrounding environment, enabling users to navigate their surroundings more effectively and safely. The core functionalities of the system include object detection and recognition, obstacle detection and avoidance, text-to-speech conversion, and indoor localization. Through the integration of a wearable device equipped with sensors and cameras, the system captures and processes visual information in real-time, generating auditory cues and providing spoken instructions to the user. The implementation of the assistance system involves the development of a custom hardware setup, software algorithms, and user-friendly interfaces. The system is designed to be portable, lightweight, and non-intrusive, allowing users to seamlessly integrate it into their daily routines. Additionally, considerations are given to accessibility and usability to ensure the system caters to a diverse range of visually impaired peoples. Extensive testing and evaluation are conducted to assess the system's performance, accuracy, and user experience. User feedback and suggestions are incorporated into iterative design improvements to enhance the system's effectiveness and usability. The results demonstrate that the proposed assistance system provides valuable support to visually impaired peoples, promoting their independence, mobility, and engagement with the environment. The real-time nature of the system allows for prompt response to changing surroundings and dynamic situations, facilitating easy navigation & interaction in both in and outdoor environments.

KEYWORDS: face recognition, object detection, python, text recognition, CNN.

I. INTRODUCTION

Our world is witnessing a growing occurrence of different disasters either natural or manmade almost daily and no society can claim im-munity against disasters. Most countries have commenced focusing on their disaster management plan by emphasising disaster risk re-duction and enhancing the readiness of different organisations in New Zealand, according to the Civil Defense Emergency Management Act2002, the importance and emphasis on preparedness requirements and plans are highlighted (Ministry of Civil Defence and Emergency Management, 2002; New Zealand Legislation, 2017). Nevertheless, it is believed that these plans will be more effective, if the requirements and demands of all citizens from different groups are considered and addressed. In the other words, the plan requires all-of-society engagement and partnerships (Duncan, Parkinson, Keech,2018). However, in most cases, there are some neglected communities like physically challenged people who require additional and often special needs. People living with visual impairment are unable to experience the world the way people with normal eyesight do. A fundamental challenge faced by this group of people is the inability to navigate between locations effectively like people with normal eyesight would. In non-disaster situations, these people have access to different assistive technological aids and supporting services; how-ever, during disaster situations, these supporting devices and ser-vices may become either unavailable or inaccessible. Depending on the disaster type and severity, the aftermath can disrupt different infrastructures and the fundamental services provided by government that people rely on. This interruption can seriously impact the lives of citizens and people living with conditions. Furthermore, the situation is made even worse for physically challenged individuals. According to the American Foundation for the Blind, this group of individuals has been identified as a vulnerable group that is highly impacted by the influence of disasters (American Foundation for the Blind, 2016).The study discovered that Christchurch New Zealand's 2011 earth-quake and Japan's Honshu Island

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earthquake of 2016 affected people with visual impairment, and particularly the older adults. Today, many physically challenged individuals depend on assistive technologies to undertake their day-to-day activities. As a result, they will require additional support during and after disasters especially when the infrastructure and other services are unavailable. Different dis-aster management plans (Duncan et al., 2018; Ulmasova, Silcock,Schranz, 2009; World Health Organizations, 2011) have been put for-ward addressing groups with special requirements. Compared to the diversity of the problems and their population, this is still minimal(World Health Organization, 2017). The term 'disability' covers a wide range of disability forms; this study however, focuses on individuals living with visual impairment. A World Health Organization (WHO) re-port states that there are 285 million people with visual impairment worldwide. According to their statistics, of this group, 39 million are partially blind and more than 1.3 million are completely blind. In most industrial countries, approximately 0.4 of the population is unsighted and in developing countries, it rises to 1 (World Health Organization,2017). Smart glasses is an assistant for visually impaired that is design to narrate the description of a scene through pictures via webcam. There are millions of visually impaired people in the world. They are not able to experience the world which we people can. So our project "Smart glasses for visually impaired people" will try to provide them the missing experience of the beautiful world. The blind people who live in our society faces numerous problems like People walking on the street, Approaching of vehicles Uncertainty of the roads, Numerous obstacle present on the street.

II. RELATED WORK

Rohilla, Yogesh Parihar, Vipul K Rohilla, Kusum. " Ultra-sonic Sensor based Smart Cap as Electronic Travel Aid for Blind People." 2020 [1].This paper aims to develop an ultrasonic sensor based smart cap prototype as an electronic travel aid for blind people that can help them travel independently. The smart cap consists of AT-mega microcontroller, Arduino board, three ultrasonic sensors, and a buzzer Vijitha, D. and Mrs. P. Pushparani. "A Smart Walking Assistance for Visually Impaired People – A Review." (2019)[2].This paper proposes an Arduino Nano based obstacle finding stick for visually impaired people, which helps a blind person by detecting the obstacles using Ultrasonic sensors and android mobile application. It is able to inform the blind person about the circumstances & present condition of the path where he/she is walking.

Gaikwad, Arun G., and H. K. Waghmare. "Ultrasonic smart node. cane indicating a safe free path to blind people." 2015.Human vision plays a vital role in awareness about surrounding environment.[3] The term visual impairment covers wide range and variety of 3 vision, from blindness and lack of usable sight; to low vision, which cannot be corrected to normal vision with standard eyeglasses or contact lenses. Visually impaired tool scan assist them to enrich their lifestyle.
Oladayo, Olakanmi O.. "A Multidimensional Walking Aid for Visually Impaired Using Ultrasonic Sensors Network with Voice Guidance." 2014[4].Science and technology always try to make human life easier. The people who are having complete blindness or low vision faces many difficulties during their navigation. In this paper, we de-sign and implement a smart cap which helps the blind and the visually impaired people to navigate freely by experiencing their surroundings.

Mahmud, Mohammad Hazzaz Saha, R Islam, Sayemul. (2013)[5].Smart walking stick-an electronic approach to assist visually disabled persons. International Journal of Scientific and Engineering Research .Visually impaired people face lot of difficulties in their daily life. Most of the times they depend on others for help. Several technologies for assistance of visually impaired people have been developed. Among the various technologies being utilized to assist the blind, Computer Vision based solutions are emerging as one of the most promising options due to their affordability and acces sibility .

III. PROPOSED ALGORITHM

A. *System Design:*

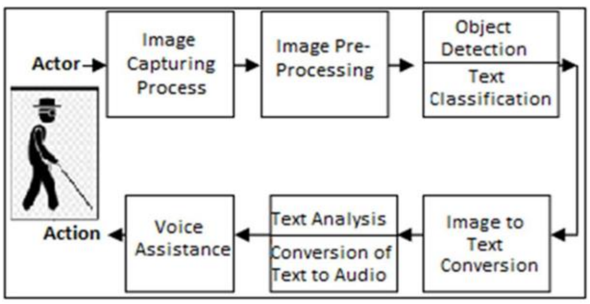

Fig 1: System Architecture

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B. *Modules:*

1) Image Acquisition
Image is acquired by Camera, The above mentioned process is done on each image.
•Training Model The model is trained with images so that they are able to recognize objects, Text and faces later.
•Face, text and Object Recognition The model is tested to give results for face recognition, text recognition and Object Recognition
2) Relatives Module
Relative module has relative information.
•Adding the Relative Information
•Displaying the Relative Information

IV. PSEUDO CODE – CNN ENCODER

- Step 1: Dataset containing images along with reference Dataset is fed into the system
- Step 2: The convolutional neural network is used a encoder which extracts image features 'f' pixel by pixel
- .Step 3: Matrix factorization is performed on the extracted pixels. The matrix is of m x n.
- Step 4: Max pooling is performed on this matrix where maximum value is selected and again fixed into matrix.
- Step 5: Normalization is performed where the every negative value is converted to zero.
- Step 6: To convert values to zero rectified linear units are used where each value is filtered and negative value is set to zero.
- Step 7: The hidden layers take the input values from the visible layers and assign the weights after calculating maximum prob-ability.

V. RESULT AND EVALATION

The experimental results prove that the proposed work can help visually impaired people by notifying them of their surrounding objects and absolute location. Experiments were conducted in many different settings and almost all the objects that were present at that time were detected and notified to the user. The average computational time required for detection was 2000 ms. By conducting these experiments, the computational time varies according to the number of objects present is observed. Computational time increases as the number of objects present increases. More than 75% of the objects are detected and recognized accurately at a time.

Accuracy of the proposed system: The proposed system shows upto 95% accuracy in detection of objects. The model is trained in such a way that it detects objects correctly with the extracted features and boundary boxes. Detection results of the trained YOLO & CNN algorithm and for sample 6 objects are shown in table 1 and 2.

Table.1: Result Analysis

Algorithm	Precision	Recall	F1-Score
YOLO	0.92	0.87	0.89
CNN	0.85	0.92	0.88

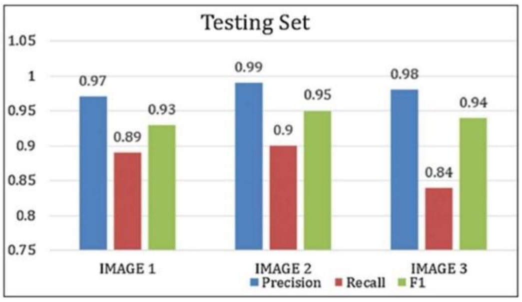

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Table 2: Result Analysis

NAME OF THE INPUT	NO OF INPUTS GIVEN	NO OF TIMES CORRECTLY DETECTED	CLASSIFICATION ACCURACY IN %
Person	30	30	100%
CAR	40	38	95%
BOTTLE	20	18	95%
CHAIR	30	27	96%
POTTED PLANT	20	18	90%
SOFA	30	28	98%

VI. CONCLUSION AND FUTURE WORK

Various research studies have investigated the challenges that disabled people, especially those with visual impairment face during and after disasters. Unfortunately, this group of individuals are constantly being excluded from disaster management plans in different countries, and no specific supporting devices or services are provided for them during and after disaster situations. These people have been identified as a vulnerable group who may be affected dramatically by disasters. Besides their loss of vision, their challenges also extend to mobility and communication difficulty in disaster scenarios. To address this challenge, this research study has proposed the Smart Glasses solution that can be utilized by the visually impaired for normal activities ,and especially during disaster situations. This Smart Glasses device will provide a real-time navigation and narrative system. The device is cost effective ,which makes it affordable and accessible for the wider community who suffer from this problem. We hope that this proposed Smart Glasses can be a step to providing the visually-impaired people with the missing support and services they so desperately need during and after disaster situations. This research work is only a proof-of-work; in our future work, we hope to make a complete standalone version with additional assistive functionalities for the blind.

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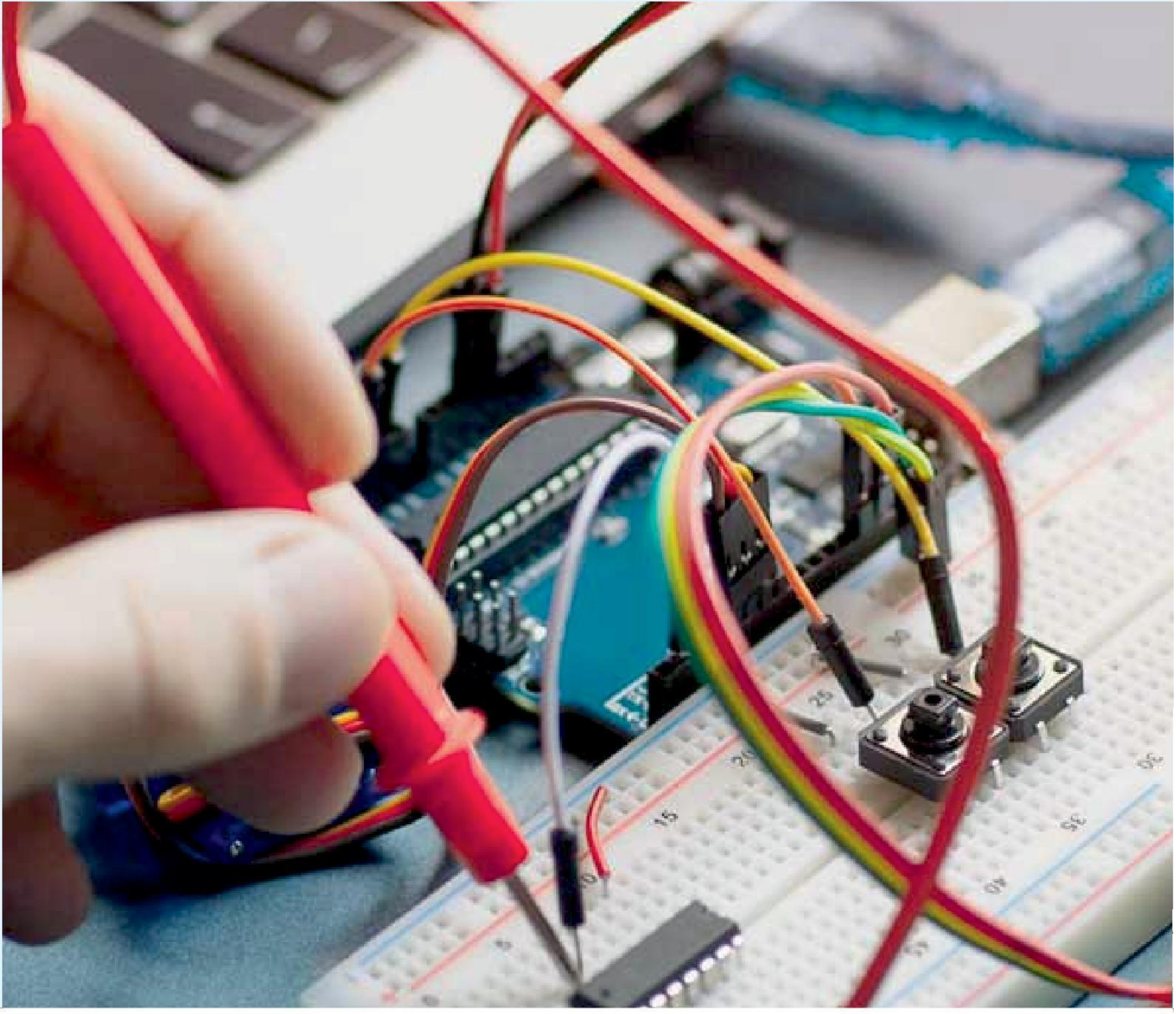

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