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| **Department of E&TC Engineering**  **Vishwakarma Institute of Technology, Pune**      **Title – Staircase detection for visually impaired people**  **Engineering Design and Innovation (EDI)**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**    **BATCH – B3**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **GROUP: 2**   |  |  |  |  | | --- | --- | --- | --- | | **Sr No.** | **Roll No** | **Name** | **PRN No** | | **1** | **62** | **Shweta Munjewar** | **12010753** | | **2** | **63** | **Rutuja Nagdekar** | **12011119** | | **3** | **71** | **Nimase Mitali** | **12010777** | | **4** | **76** | **Rahul Paikrao** | **12010757** |   **Batch guide: Prof. Jyoti Madake** |

**Methodology Table -**

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| **Sr.no** | **Paper Name** | **Dataset used** | **Method** | **Accuracy** |
| 1 | Detecting stairs and pedestrian crosswalks for the blind by RGBD camera. | 106 stairs images+ 52 pedestrian crosswalks + 70 negative images + custom | RGBD camera + Hough transform + SVM | 91.14% |
| 2 | Technology assisting the blind — Video processing based staircase detection | 100 short video with staircase & without staircase | Video processing + Morphology + Canny edge detector + Gabor filters | 96% |
| 3 | Staircase Detection Systems for the Visually Impaired People: A Review | custom | Sensors RGB-D camera + SURF + BGMM + Voxel Grid Filter + RANSAC | 95.2 % |
| 4 | Computer Vision Based Real-Time Stairs And Door Detection For Indoor Navigation Of Visually Impaired People | 140 stairs images | stereo cameras + Canny edge detector + Gaussian filter + Haar line transform | 70 % |
| 5 | Vision-based Detection of Stair-cases | custom | Gabor Filters + homogra-phy search approach + Canny edge detector + Intensity variation | 75% |
| 6 | Detecting Walkable Plane Areas By Using Rgb-D Camera & Accelerometer For Visually Impaired People | custom | RGB-D camera + accelerometer + texture consistency + white cane + plane detection | 80% |
| 7 | RGB-D camera based wearable navigation system for the visually impaired | custom | RGB-D camera + GPS + sparse features + SLAM algorithm +(ICP) algorithm | 75% |
| 8 | Stair Detection & Classification Using Deep Neural Network for the Visually Impaired | custom | R-CNN ResNet50v1 + VGG-19 + VGG-16 + deep learning | 83%. |
| 9 | Deep Learning-Based Ultra-Fast Stair Detection | 3094 images, | semantic segmentation + object detection + Group dilated convolution + Deep learning + LiDAR + CNN | 85.32% |
| 10 | Real-time staircase detection from a wearable stereo system | custom | Haar features + Ad-aboost learning + spatial context + stereo cameras | 80% |
| 11 | Staircase Detection to Guide Visually Impaired People: A Hybrid Approach | 510 images, 310 images are captured and 210 are from google | ultrasonic sensor, an R-GBD camera, a raspberry pi and a buzzer,  Faster-RCNN Inception-V2-COCO model | 98.73% |
| 12 | A Comparative Study of Walking Assistance Tools Developed for the Visually Impaired People | Custom | raspberry pi, Arduino and ultrasonic sensor | With Raspberry pi- 98.47%  With Arduino- 95.22% |
| 13 | Smart cane for visually impaired people | Custom | Infrared sensor, GPS, GSM, ultrasonic sensor,Raspberry pi, Buzzer, Headset | \_ |
| 14 | Detection of manhole and staircase for visually impaired | Custom | Ultrasonic sensor, CNN, Raspberry pi, OpenCV, NumPy,Tensorflow,Server, | \_ |
| 15 | Assistive Technologies for Blind People to Describe Indoor Sensing by Raspberry-Pi | 15 indoor objects considered | Raspberry-Pi, GSM, and APR 9600 Voice IC, Camera, LCD, ALARM, Ultrasonic Sensor, and Two Emergency keys | \_ |
| 16 | RGB-D Sensor-Based Computer Vision Assistive Technology for Visually Impaired Persons | 30 images for each category (i.e., upstairs, downstairs, crosswalks, and negative images that contain neither stairs nor pedestrian crosswalks) | RGB-D sensor-based computer vision technologies  RGB-D camera, a microphone, a portable computer, and a speaker | 91.14% |
| 17 | Electronic Travel Aid for Visually Impaired People based on Computer Vision and Sensor Nodes using Raspberry Pi | Custom | Raspberry pi 3,Camera, four ultrasonic sensor nodes, opencv libraries, SURF feature extraction, Smart Cane Stick, | \_ |
| 18 | Design and Implementation of a Walking Stick Aid for Visually Challenged People | Custom | Raspberry Pi and programmable interface controller (PIC) as a control kernel, sensors, a global position system (GPS) module, and alert-providing components,Water Level Sensor, GPS Module | \_ |
| 19 | Stair Climbing Robot Based on Convolutional Neural Networks for Visual Impaired | For First CNN- 1200 images  For second CNN-  70,000 images | Raspberry Pi , ultrasonic sensor ,CNN, DC motors, Arduino, stepper motor, | For first CNN model - 98.47%  For second CNN model - 98.87% |
| 20 | Smart Navigation Guidance System for Visually Challenged People | 300 pretrained models | Raspberry pi 3, Webcam, Ultrasonic sensor, Infrared sensor, and Heart beat sensor, Light emitting diodes (LEDs), GPS, GSM modem and headset. | \_ |
| 21 | Negative Obstacle Detection for Wearable Assistive Devices for Visually Impaired | 750 frames | stereo vision system + C++ and OpenCv + assistive devices + negative obstacles | \_ |
| 22 | Depth-aware indoor staircase detection and recognition for the visually impaired | 66 downstairs, 70 upstairs, and 73 negative training samples | RGB-D camera + SVM + Hough transform + Indoor Navigation + KLT stair tracker | 88.89% - upstairs, 95.56% - downstairs  93.62% - negatives. |
| 23 | Staircase Detection Algorithm Based on Projection-histogram |  | Gabor filter + Canny edge detector + projection histogram |  |
| 24 | A Hybrid Approach for Identification of Manhole and Staircase to Assist Visually Challenged | 52 downstairs, 40 upstairs, and 46 negative samples | Arduino Kit+ Feature Selection + Ultrasonic Sensor + Frequency Spectrum + BGMM Classification. | 88% |
| 25 | Computer Vision and Iot Based Smart System for Visually Impaired People | 6 elements | Computer Vision + Machine Learning + IoT + Object Detection + Navigation + raspberry pi zero + network module + camera + ultrasound + servo motors | \_ |
| 26 | A Neural Network Based Technique for Staircase Detection using Smart Phone Images | 75,960 images | Stair detection + RGB Image + Image Pixels + Horizontal Edge Detection + GPS Metadata + Neural Network | Geo-spatial - 76.61% image feature - 87.82% |
| 27 | Multisensor - Based Object Detection in Indoor Environment for Visually Impaired People | 650 image | SVM + ultrasonic sensor + artificial intelligence + assistive systems + computer vision + deep learning + machine learning + object recognition + YOLO-v3 | 95.19% and 99.69% for object detection and recognition |
| 28 | Smart Cap - Wearable Visual Guidance System for Blind | 90 various classes | Raspberry Pi 3 + TensorFlow API + TTS + eSpeak + NoIR camera | \_ |
| 29 | Detection of Indoor and Outdoor Stairs | 852 frames | Vision + stairs + navigation + blind + autonomous robots. | true and false recognition rates of 83% and 81.5% |
| 30 | Deep-Learning-Based Stair Detection Using 3D Point Cloud Data for Preventing Walking Accidents of the Visually Impaired | 1000 training and 500 validation datasets for each of the classes and conducted experiments with 3000 training and 1500 validation datasets | Visually impaired support systems + depth sensor + 3D point cloud data + deep-learning + PointNet. | 97.3% |
| 31 | An Efficient Smart Cane Based Navigation System for Visually Impaired People |  | Smart Cane + Laser Distance Sensor(LDS) + Stereo Vision | 95 to 98.7% |
| 32 | Object Detection and Identification for Blind People in Video Scene | Videos of scenes from daily life with images of all the objects | SIFT Algorithm | 95% |
| 33 | Road Surface Obstacle Detection using Vision and LIDAR for Autonomous Vehicle | Videos and Images of Roads | Camera and 2D LIDAR System | 86.18% and 98.36% for Pothole and Speed bumps |
| 34 | Smart Detection and Reporting of Potholes via Image-Processing using Raspberry-Pi Microcontroller | Camera will capture the images in front of moving car | Raspberry Pi, Cloud Storage, GPS | 87.45% |
| 35 | Road Pothole Detection System Based on Stereo Vision | Fixed Stereo Camera | Stereo Vision, Raspberry Pi | \_ |
| 36 | A Neural Network Based Technique for Staircase Detection using Smart Phone Images | 937 images converted to 75,960 images | CNN, Horizontal Edge Detection, SVM, GPS | 89.74% |
| 37 | Stairs recognition using Stereo Vision-based algorithm in NAO robot |  | Stereo Vision, NAO Robot | \_ |
| 38 | Obstacle Detection for Pedestrian with a Visual Impairment based on 3D Imaging | 90 Positive Images | 3D Sensor, GPS | 95% |
| 39 | Real-Time Object Detection for Visually Challenged People | 80 Classes in Yolo V3 | Machine Learning, YOLO v3, RCNN, | 75% |
| 40 | Development of a Smartphone-based Real Time Outdoor Navigational System for Visually Impaired People | 20 Videos with average time of 3 minutes | Hough Transform | 83% |