Steps Detection to Guide Visually Impaired People: A novel 2 way Hybrid Novel Approach

Purtee Jethi Kohli[1]
Research Scholar
Banasthali Vidyapith

Deepak Kumar[2]
Assistant Professor
Banasthali Vidyapith

Abstract

Very often we encounter climbing steps. It is a very common task but more difficult for visually disabled people to move around . To assist maneuver in current spaces we work on a half breed framework for locating the staircase on a plane surface .In this paper we use electronic gadgets like ultrasonic sensor, ordinary camera then we try to use raspberry pi. Staircase pictures are captured by this ordinary RGB Camera. At long last, our framework was applied to distinguish diverse staircase pictures under different environments (e.g. low light conditions), we achieved a value for normal around 98%. these results give us some direction for needy and visually blind people

Keywords: CNN ,RGB –D, COCO model ultrasonic , raspberry pi

1. Introduction

Nearly 253 million people are unable to see as per the World Well Being Organization (WHO). Approximally 36 million people are dazed among them and the rest 217 million people have some kind of vision related impairments amid this part of the population, on an average nearly 80% individuals fall in the age group of 50 years or above in age [1]. As the world is very fast approaching in science and innovation at a phenomenal rate, unused frameworks are being created each day to make every day living more convenient. But the large sections of individuals, who have physical incapacities, require more assistance than the ordinary people primarily who can see. Elementary leading edge has been created to basic camera; a raspberry pi and a buzzer fixed on a strolling adhesive. From all the collected information, staircase pictures are captured by an RGB-D camera and after that compared with pre-trained layout pictures. At long last, our framework was applied to distinguish distinctive staircase pictures beneath different conditions (e.g. dull and commotion), and found to accomplish a normal precision of 98.73%. This inquire about gives an viable help to

2. Literature survey

3. Literature survey

Generally 253 million individuals are outwardly impeded concurring to the World Prosperity Organization (WHO). Generally 36 million individuals are trance among them and the rest 217 million individuals have particular vision impedances. Among these people, around 80% people are 50 a long time or over in age [1]. As the world is progressing in science and advancement at a quicker rate, unused systems are being made each day to create each day living more comfortable. But the people who have physical incapacities, require more offer help than the conventional individuals. Development has been made to prove a camera, a raspberry pi and a buzzer settled on a walking follow. In the midst of the disclosure handle, staircase pictures are captured by an RGB-D camera and after that compared with pre-trained format pictures. At long final, our system was connected to recognize particular staircase pictures underneath distinctive conditions (e.g. dull and commotion), and found to achieve an ordinary exactness of 98.73%.

4. Methodology

In this paper apart from high end option for elite only a small personal lift In this paper we working on 2 fronts we have suggested 2 methods one very rudimentary approach a secure chair on railing to climb up or down and another very technical method making use of CNN as the base tata who have physical incapacities, require more to offer

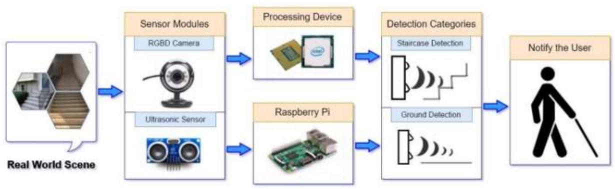


Figure 1. Block diagram of hybrid staircase detection system

Figure 2: a chair on the hand railing

5 Proposed Work

We have suggested 2 methods one very rudimentary method a secure chair on railing to climb up or down and another very technical method making use of CNN as the base
One very rudimentary approach or a basic method

A)In which we have a very comfortable a secure chair fastened very securely to a railing for a visually disabled person climbing up and down

B) The developed framework utilized vision-based innovation where we used a show of neural organizes [25-27] which is described below. The pictures are collected from our environment and google looks so that the framework covers all sorts of stairs. Our students at my college collected 210 images in order to conduct the research. Jaypee Institute of Information Technology campus that are captured through camera of a cell phone and rest are from Google

5.1 **Data collection and description**

As the framework practiced the concept of the neural arrangement, hence pre-processing is vital as per the mandatory of the pre-trained show. The collected pictures were in tall resolution and the measure was around 5 MB but for preparing those images, time spend on preparing data is additional time expending. In the next step we subsequently resized the images and changed them into around 720X960 estimates which are less than 150 KB with no actual altar of output. We partitioned the pictures into two parts, one bundle is for preparing purpose and another bundle is for testing. We utilized "Labeling" for naming preparing pictures with "upstairs" and "downstairs" classes. When the preparing image contains the upstairs, it is named with "upstairs" and for downstairs; it is named with "downstairs". The naming of the images is illustrated in Figure 3. In Figure 3(a) as the image contains upstairs, it is named with "upstairs" and in case of Figure 3(b) it is named with "downstairs" as the image contains ground floor.

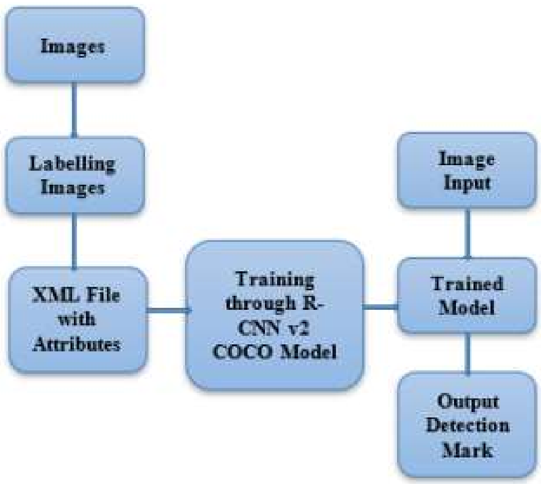
5.2 Data preparation

As the framework utilized the concept of the neural organization, hence pre-processing is vital as per the necessity of the pre-trained demonstration. The captured pictures were in tall resolution and the estimate was around 5 MB but for preparing those images, the preparation is exceptionally time consuming. Thus, we resize the images and change over them into around 720X960 which are less than 150 KB with no altar of result. We partitioned the pictures into two parts, one parcel is for preparing purpose and another group is for testing. We utilized "Labeling" for naming and preparing pictures with "upstairs" and "downstairs" classes. When the preparing image contains the upstairs, it is named with "upstairs" and for downstairs, it is named with "downstairs". The naming of the image is illustrated in Figure 3. In Figure 3(a) as the image contains upstairs, it is named with "upstairs" and in case of Figure 3(b) it is named with "downstairs" as the image contains downstairs. 3.3 Faster-RCNN-Inception-V2-COCO

figure 3 (a) and (b)

The show is pre-trained and comes about when the real time picture is sent within the show. For this, a high-speed processor was required for quicker yield. The training procedure of the Faster-RCNN-Inception-V2-COCO show is depicted in Figure 4.

We utilized "Labeling", a graphical image annotation instrument, together in python with QT graphical interface for naming our preparing pictures. As the proposed framework can classify the pictures into two parts, one parcel is for preparing purposes and another parcel is for testing. We utilized "LabeliImg" for naming and preparing pictures with "upstairs" and "downstairs" classes. When the preparing image contains the upstairs, it is named with "upstairs" and for downstairs; it is named with "downstairs". The naming of the images is illustrated in Figure 3. In



A flow diagram -Training procedure of
f Faster-RCNN-Inception-V2- COCO model

Figure 3(a) as the image contains upstairs, it is named with "upstairs" and in case of Figure 3(b) it is named with "downstairs" as the image contains downstairs. 3.3 Faster-RCNN-Inception-V2-COCO

6 IMPLEMENTATION OF THE PROTOTYPE

The usage of the framework may be partitioned into four parts as the diverse parts of the framework had different challenges to overcome. The in general framework was integrated with ultrasonic sensor, raspberry pi, buzzer and camera into a stick. The biggest challenge was to coordinate these diverse parts into the strolling adhere so that the individual who would use the device would have no complexity amid utilization and the main objectives can be accomplished. The created model for staircase location framework appears in Figure 5. The description of the method of execution is as follows.

6.1 **Integration of components**

We have associated the ultrasonic sensor by utilizing jumper cables. We utilized HC-SR04 ultrasonic Sensor where four pins needed to be put through with the pie out of the five. We measured the separation of the ground after setting the sonar sensor on a fixed position with a settled point. With that settled point we measured a settled separate for ground which had been set as threshold underneath which it would identify up stair and over the threshold the raspberry pi would distinguish up stair no matter what is ahead. The sensor had difficulty when it was set on noisy places. Indeed with moving impediments ahead the information would deviate very much. To overcome this major mishap we took 1 thousand pieces of information per moment and found the means to compare it with the limit esteem instead of comparing each information. For future enhancement we ought to take more information for getting the mean as the information of the sonar sensor goes astray with fair a minor change of clamor ahead it to urge more exact result from the sensor

6.2 Training the model with dataset

We collected a add up to of 300 pictures in several buildings in the genuine world and around 210 pictures from Google of staircases of distinctive sorts so that the framework would be able to detect staircases. We partitioned them as training set and testing set of 353 pictures and 157 pictures, individually. The testing set consists of the around 30% of the entire pictures. We resize the images to lower quality with a resolution of 720 x 960 pixels so that the preparation of the show may well be speedier. We named the staircase within the pictures so that we may extricate the attributes of the staircase in a CSV records. At that point we passed these images with the CSV records into the Faster-RCNN-Inception-V2- COCO demonstrate which would produce a neural organize by the given information which would distinguish staircase when genuine time image is passed to the created demonstrate

7. EXPERIMENTAL RESULTS

This section shows the experimental results of various upstairs and downstairs images. First, experimental setup is discussed

The results and discussion

1 Experimental setup

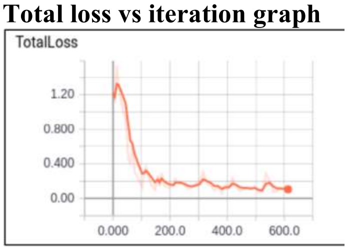
For vision framework, all tests were done utilizing Intel(R) Core (TM) i3-5005U CPU @ 2.00 GHz processor along with 4.00GB Smash and NVIDIA (940M). The higher precision rate is accomplished with the higher determination of pictures like 1920x1080 or more. But the preparation time is higher with higher determination. We changed over the pictures with measure 720x960 for preparing and found a palatable result. the staircase within the pictures so that we may extricate the attributes of the staircase in CSV records. At that point we passed these images with the CSV records into the Faster-RCNN-Inception-V2-COCO demonstration which would create a neural organizer by the given information which would identify the staircase when a genuine time image is passed to the created show.

Results and discussion

to the show, Faster-RCNN-Inception-V2-COCO, was trained and there happened a few misfortunes in each step. Normally loss begins at tall and gets lower as preparation advances. We stopped our preparation until the misfortune reliably dropped below 0.05, which took around 600 steps. The misfortune may change with the models. The misfortune bent amid the preparing stage appeared in Figure 6. In Figures 7-8, a few yield pictures of the created system are displayed. Figures 7(a)-(d) contain the pictures of upstairs which are redressed identified by the framework. Figures 7(e)-(h) contain pictures of ground floor which are accurately distinguished by images with the CSV records into the Faster-RCNN-Inception-V2- COCO demonstrate which would produce a neural arrange by the given information which would distinguish staircase when genuine time image is passed to the created demonstrate.

Amid reenactment, in some cases the created framework failed to classify between upstairs and first floor when the contrast of pictures is as well tall or moo. On the other hand, in the case of real time, there's no issue when the environment is shiny. However, the framework may come up short to classify upstairs and downstairs in a light environment. In Figure 8(a), the image with ground floor is identified as upstairs since of moo contrast of the picture, whereas in Figure 8(b), the picture with upstairs is detected as first floor for the same reason

Total loss vs iteration graph



Iteration

In this investigation, we propose a strategy both for upstairs and downstairs location approaches utilizing ultrasonic sensors and RGBD cameras for outwardly impeded individuals. We utilized a pre-trained question discovery show named Faster-RCNNInception-V2-COCO show to create the framework. The main purpose of this proposed framework is to construct a user-friendly and cost-effective direction framework. The created system obtained the exactness of 95.24% and 96% for upstairs detection in ordinary light conditions utilizing RGBD camera and ultrasonic sensor, individually. With this framework, a user receives real-time notices of the environment by means of buzzer and mouthpiece. The framework encompasses a potential to assist visually impaired individuals in route and make their life much safer and simpler. In our proposed gadget, we utilize a crossover approach that combines and comes about with two diverse sensors so that the device seems to work in all conceivable cases. Still, there are some minor issues to be r detected as first floor for the same reason. In this investigation, we propose a strategy both for upstairs and downstairs location approaches utilizing ultrasonic sensors and RGBD cameras for outwardly impeded individuals. We utilized a pre-trained question discovery show named Faster-RCNNInception-V2-COCO show to create the framework. The main purpose of this proposed framework is to construct a user-friendly and cost-effective direction framework. The created system obtained the exactness of 95.24% and 96% for upstairs detection in ordinary light conditions utilizing RGBD camera and ultrasonic sensor, individually. With this framework, a user receives real-time notices of the environment by means of buzzer and mouthpiece. The framework encompasses a potential to assist visually impaired individuals in route and make their life much safer and simpler. In our proposed gadget, we utilize a crossover approach that combines the comes about of two diverse sensors so that the device seems to work in all conceivable cases. Still, there are some minor issues to be detected on the first floor for the same reason.

In this investigation, we propose a strategy both for upstairs and downstairs location approaches utilizing ultrasonic sensors and RGBD cameras for outwardly impeded individuals. We utilized a pre-trained question discovery show named Faster-RCNNInception-V2-COCO show to create the framework. The main purpose of this proposed framework is to construct a user-friendly and cost-effective direction framework. The created system obtained the exactness of 95.24% and 96% for upstairs detection in ordinary light conditions utilizing RGBD camera and ultrasonic sensor, individually. With this framework, a user receives real-time notices of the environment by means of buzzer and mouthpiece. The framework encompasses a potential to assist visually impaired individuals in route and make their life much safer and simpler. In our proposed gadget, we utilize a crossover approach that combines and comes about with two diverse sensors so that the device seems to work in all conceivable cases. Still, there are some minor issues to be r detected as first floor for the same reason. In this investigation, we propose a strategy both for upstairs and downstairs location approaches utilizing ultrasonic sensors and RGBD cameras

outwardly impeded individuals. We utilized a pre-trained question discovery show named Faster-RCNNInception-V2-COCO show to create the framework. The main purpose of this proposed framework is to construct a user-friendly and cost-effective direction framework. The created system obtained the exactness of 95.24% and 96% for upstairs detection in ordinary light conditions utilizing RGBD camera and ultrasonic sensor, individually. With this framework, a user receives real-time notices of the environment by means of buzzer and mouthpiece. The framework encompasses a potential to assist visually impaired individuals in route and make their life much safer and simpler. In our proposed gadget, we utilize a crossover approach that combines the comes about of two diverse sensors so that the device seems to work in all conceivable cases. Still, there are some minor issues to be r detected as first floor for the same reason.

Resultant images; (a)- (d) Correctly upstairs detected; (e)-(h) Correctly downstairs detected

Conclusion

In this investigation, we propose a strategy both for upstairs and downstairs location approaches utilizing ultrasonic sensors and RGBD cameras for outwardly impeded individuals. We utilized a pre-trained question discovery show named Faster-RCNNInception-V2-COCO show to create the framework. The main purpose of this proposed framework is to construct a user-friendly and cost-effective direction framework. The created system obtained the exactness of 95.24% and 96% for upstairs detection in ordinary light conditions utilizing RGBD camera and ultrasonic sensor, individually. With this framework, a user receives real-time notices of the environment by means of buzzer and mouthpiece. The framework encompasses a potential to assist visually impaired individuals in route and make their life much safer and simpler. In our proposed gadget, we utilize a crossover approach that combines and comes about with two diverse sensors so that the device seems to work in all conceivable cases. Still, there are some minor issues to be r detected as first floor for the same- reason.

References

[1] Bourne, R.R., Flaxman, S.R., Braithwaite, T., Cicinelli, M.V., Das, A., Jonas, J.B., Keeffe, J., Kempen, J.H., Leasher, J., Limburg, H., Naidoo, K., Pesudovs, K., Resnikoff, S., Silvester, A., Stevens, G.A., Tahhan, N., Wong, T.Y., Taylor, H.R. (2017). Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: A systematic review and meta-analysis. The Lancet Global Health, 5(9): e888-e897.

[2] Islam, M.M., Sadi, M.S., Zamli, K.Z., Ahmed, M.M.(2019). Developing walking assistants for visually impaired people: A review. IEEE Sensors Journal, 19(8):2814-2828. https://doi.org/10.1109/JSEN.2018.2890423

[3] Tapu, R., Mocanu, B., Zaharia, T. (2018). Wearableassistive devices for visually impaired: A state of the art survey. Pattern Recognition Letters.333https://doi.org/10.1016/j.patrec.2018.10.031

[4] Bauer, Z., Dominguez, A., Cruz, E., Gomez-Donoso, F.,Orts-Escolano, S., Cazorla, M. (2019). Enhancing Perception for the visually impaired with deep learningtechniques and low-cost wearable sensors. Pattern Recognition Letters.https://doi.org/10.1016/j.patrec.2019.03.008

[5] Real, S., Araujo, A. (2019). Navigation systems for theblind and visually impaired: Past work, challenges, and open problems. Sensors, 19(15): 3404.https://doi.org/10.3390/s19153404

[6] Cardillo, E., Caddemi, A. (2019). Insight on electronictravel aids for visually impaired people: A review on the electromagnetic technology. Electronics, 8(11): 1281.https://doi.org/10.3390/electronics8111281

[7] Anthierens, C., Groux, D., Hugel, V. (2018). Sensorynavigation guide for visually impaired sea kayakers. Journal of Field Robotics, 35(5): 732-747.https://doi.org/10.1002/rob.21775

[8] Abdulkader, S.N., Atia, A., Mostafa, M.S.M. (2015).Brain computer interfacing: Applications and challenges. Egyptian Informatics Journal, 16(2): 213-230.https://doi.org/10.1016/j.eij.2015.06.002

[9] Meshram, V.V., Patil, K., Meshram, V.A., Shu, F.C.(2019). An astute assistive device for mobility and object recognition for visually impaired people. IEEETransactions on Human-Machine Systems, 49(5): 449-

460.https://doi.org/10.1109/THMS.2019.2931745
[10] Rahman, M.M., Islam, M.M., Ahmmed, S. (2019)."BlindShoe": An electronic guidance system for the visually impaired people. Journal of Telecommunication,Electronic and Computer Engineering (JTEC), 11(2): 49-54.
[11] Sahoo, N., Lin, H.W., Chang, Y.H. (2019). Design andimplementation of a walking stick aid for visually challenged people. Sensors, 19(1): 130.https://doi.org/10.3390/s19010130
[12] Bai, J.Q., Liu, Z.X., Lin, Y.M., Li, Y., Lian, S.G., Liu,D.J. (2019). Wearable travel aid for environment perception and navigation of visually impaired people.Electronics, 8(6): 697.https://doi.org/10.3390/electronics8060697
[13] Zhang, X.C., Yao, X.Y., Zhu, Y., Hu, F. (2019). AnARCore based user centric assistive navigation system for visually impaired people. Applied Sciences, 9(5): 989.https://doi.org/10.3390/app9050989
[14] Islam, M.M., Sadi, M.S. (2018). Path hole detection toassist the visually impaired people in navigation. 4th International Conference on Electrical Engineering andInformation & Communication Technology (iCEEiCT), Dhaka, Bangladesh, pp. 268-273.https://doi.org/10.1109/CEEICT.2018.8628134
[15] Kamal, M.M., Bayazid, A.I., Sadi, M.S., Islam, M.M.,Hasan, N. (2017). Towards developing walking assistants for the visually impaired people. IEEE Region10 Humanitarian Technology Conference (R10-HTC), Dhaka, pp. 238-241. https://doi.org/10.1109/R10-HTC.2017.8288947
[16] Zhang, X.C., Yao, X.Y, Zhu, Y., Hu, F. (2019). AnARCore based user centric assistive navigation system for visually impaired people. Applied Sciences, 9(5): 989.https://doi.org/10.3390/app9050989
[17] Khanom, M., Sadi, M.S, Islam, M.M. (2019). Acomparative study of walking assistance tools developed for the visually impaired people. 1st InternationalConference on Advances in Science, Engineering and Robotics Technology (ICASERT), Dhaka.
[18] Romić, K., Galić, I., Galba, T. (2015). Technologyassisting the blind-video processing based staircase detection. 57th International Symposium ELMAR, Zadar,Croatia, pp. 221-224.
[19] Ponnada, S., Yarramalle, S., TV, M.R. (2018). A hybridapproach for identification of manhole and staircase toassist visually challenged. IEEE Access, 6: 41013-41022.https://doi.org/10.1109/ACCESS.2018.2852723
[20] Pham, H.H., Le, T.L., Vuillerme, N. (2016). Real-timeobstacle detection system in indoor environment for the visually impaired using microsoftkinect sensor. Journalof Sensors, 2016: 1-13.http://dx.doi.org/10.1155/2016/3754918
[21] Jing, W., Kuangen, Z. (2019). Unsupervised DomainAdaptation Learning Algorithm for RGB-D Staircase Recognition. arXiv preprint arXiv:1903.01212.
[22] Therib, M.A. (2017). Smart blinding stick with holes,obstacles and ponds detector based on microcontrollers. Journal of University of Babylon, 25(5): 1759-1768.
[23] Huang, X., Tang, Z. (2018). Staircase detectionalgorithm based on projection-histogram. 2nd IEEE Advanced Information Management, Communicates,Electronic and Automation Control Conference (IMCEC), Xi'an, China, pp. 1130-1133.
[24] Chun, A.C.B., Theng, L.B., WeiYen, A.C., Deverell, L.,Mahmud, A.A., McCarthy, C. (2019). A ground plane hazards detection tool for the visually impaired.International Journal of Mechanical Engineering and Robotics Research, 8(1).https://doi.org/10.18178/ijmerr.8.1.146-156
[25] Le, T.H. (2011). Applying artificial neural networks forface recognition. Advances in Artificial Neural Systems2011: 1-16. http://dx.doi.org/10.1155/2011/673016
[26] Sallam, A.A., Kabir, M.N., Ahmed, A.A., Farhan, K.,Tarek, E. (2018). Epilepsy detection from EEG signals using artificial neural networks. International Conferenceon Intelligent Computing & Optimization, Pattaya, Thailand, pp. 320-327.
[27] Dwivedi, A.K. (2018). Artificial neural network modelfor effective cancer classification using microarray geneexpression data. Neural Computing and Applications29(12): 1545-1554. https://doi.org/10.1007/s00521-016-2701-1
[28] Ren, S.Q., He, K.M, Girshick, R., Sun, J. (2015). FasterR-CNN: Towards real-time object detection with regionproposal networks. Advances in Neural InformationProcessing Systems, 91-99.

Acknowledgments

Thanks to JIIT college and to my guide Dr Deepak Kumar for his support and last but not the least to T 31 the blind school A/5 begumpur, Malviya Nagar, New Delhi