**Vision Based guidance to Cross the Road**

Chetan S. Shinde

*Dept. of E&TC, VIT* Pune India

[*chetan.shinde20@vit.edu*](mailto:chetan.shinde20@vit.edu)

Jyoti Madake

*Dept. of E&TC, VIT Pune India*

[*jyoti.madake20@vit.edu*](mailto:jyoti.madake20@vit.edu)

***Abstract: This paper proposes a vision-based guidance system to assist visually impaired individuals in crossing the road. The lack of proper guidance for visually impaired people often leads to road accidents. To address this issue, the proposed system detects and recognizes zebra crossings and traffic lights. The final model is creates using two independent models, each for crosswalk detection and Traffic light detection and recognition respectively. The crosswalk detection is done using computer vision techniques features extraction such as Local Binary Pattern (LBP), contours and colour features. The support vector machine (SVM) classifier is for training model for detecting crosswalk region. Salgorithm is used for traffic light detection and recognition, which highlights the traffic light candidate regions while suppressing the undesired backgrounds. In the recognition stage, each candidate region is verified and further classified into different traffic light semantic classes. The proposed system provides reliable guidance to visually impaired people and has the potential to reduce accidents on the road.***

***Keywords: Adaptive Histogram Equalization, Hough Transforms, Uniform Local Binary Patterns (LBP), Support Vector Machine (SVM)***

I.INTRODUCTION

II.LITERATURE REVIEW

The paper [1], presents a zebra crossing detection and recognition method for visually impaired individuals to navigate street crossings safely. The method uses adaptive histogram equalization, flood fill operation, and Hough transforms to detect the crossing region and uniform local binary pattern with support vector machine (SVM) classifier to recognize it. The proposed method improves image contrast and sharpness, converts the pre-processed image to a binary image, and applies morphological and flood fill operations to extract the largest candidate object. The canny operator detects the edges of the largest candidate object, and the longest horizontal edges are estimated by eliminating vertical edges using four connected methods and filtering small edges using a statistical threshold procedure. Finally, the potential parallel horizontal edges are justified as zebra-crossing edge lines by drawing the Hough lines, and the SVM classifier is applied to the detected region of interest (ROI) to recognize the zebra-crossing region. The proposed method effectively detects and recognizes zebra-crossing regions from various zebra-crossing images, showing superior performance than the state-of-the-art methods in terms of recognition.

The crosswalk detection can also be done using identifying points on crosswalk and detecting and predicting its pattern. The paper [2], presents a novel approach for detecting and recognizing pedestrian crossing (PC) regions using geometrical features. The method relies on identifying two connected points (2CP) where each endpoint of the horizontal strip edges of PC is intersected with a vertical stripe width edge. Another feature is the ascending parallel order of the PC stripe edges. Using these features, the PC candidate region is detected and validated. The proposed method utilizes a rotationally invariant uniform Local Binary Pattern (LBP) for feature extraction, and a support vector machine (SVM) classifier for confirmation of the potential PC region. The results of testing the proposed method on their own dataset demonstrate significant improvement over existing approaches.

The paper [3], proposes a computer vision-based technique to discover zebra crosswalks in urban settings using existing spatial image databases such as Google Maps or OpenStreetMap. The discovery of crosswalks is critical for the safety of visually impaired individuals when planning a trip that includes street crossing. The proposed algorithm searches for zebra crosswalks in satellite images and validates them against spatially registered Google Street View images. The cascaded approach ensures fast and reliable discovery and localization of crosswalks in large image datasets. The algorithm is fully automatic but can be complemented by a crowdsourcing validation stage to increase accuracy. By augmenting existing spatial databases with information on the location of crosswalks, the proposed technique can enable blind travellers to make more informed routing decisions and enhance their safety during independent travel. Overall, the proposed technique has the potential to significantly improve the accessibility and mobility of visually impaired individuals in urban environments.

Crossing a road through the crosswalk is the most dangerous task for a blind or visually impaired person in urban areas. There should be a portable and easy to use gadget or device which helps to detecting the crosswalk and guid visually impaired people to cross the road. The paper [4] presents a system called "Crosswatch" that uses computer vision to provide information about the location and orientation of crosswalks to blind or visually impaired pedestrians. The system runs on an off-the-shelf Nokia N95 camera phone and automatically takes images and analyses them in real-time. When a crosswalk is detected, an audio tone is sounded. The system is coded in Symbian C++ to ensure real-time performance on a limited computational resource device. The system is tested with blind subjects, and the results show that the system is feasible. The paper addresses the issue of urban intersections being the most dangerous parts of a blind or visually impaired person's travel and proposes a solution that can enhance their safety by providing information about the location and orientation of crosswalks. The paper demonstrates the potential of using computer vision and mobile devices to assist visually impaired people in navigating urban environments.

To implement vision-based guidance for crossing the road also involves the detection of signals on traffic lights. The decision of crossing the road over the crosswalk depends on correctly detecting traffic and judging the traffic lights. Traffic detection in urban environment became difficult because of different lighting and illumination conditions. The paper [5], proposes a novel vision-based traffic light detection method for driving vehicles in urban and suburban areas. The paper emphasizes that illumination variation is a major technical challenge in real urban driving environments, and existing detection methods are not robust enough to handle such variations. The proposed method consists of two stages: candidate extraction and recognition. The candidate extraction stage involves an adaptive background suppression algorithm that can highlight the traffic light candidate regions while suppressing the undesired backgrounds. In the recognition stage, each candidate region is verified and classified into different traffic light semantic classes. The method is evaluated on video sequences captured from urban streets and suburban roads in varying illumination conditions and is compared with other vision-based traffic detection approaches. The experiment shows that the proposed method can achieve a high-quality detection result with robustness and can meet the real-time processing requirement of about 15 fps on video sequences. Overall, the paper proposes an effective solution to the illumination variation problem in traffic light detection, which is crucial for the development of intelligent transportation systems.

Detecting traffic signals is not the only part but, we also have to detect the red, blue and green colours present in the traffic signal and correctly judging them. The paper [6], proposes an algorithm for traffic light detection using image processing technology to reduce accidents at traffic intersections. The system consists of a CCD camera, an image acquisition card, and a PC. The proposed algorithm extracts red, green, and yellow objects from the image using the RGB colour space, and verifies the object identity based on the features of traffic lights to eliminate environmental disturbances. The algorithm then classifies the type of traffic signal. Experimental results demonstrate the stability and reliability of the algorithm.

Detection of traffic lights includes detecting different orientation and shapes (circular and arrowed light) of traffic lights. The light are mostly circular or arrow. The paper [7], discuss a novel algorithm to address this problem, which consists of two sub-modules: a detection module and a recognition module. In the detection sub-module, colour space conversion, binarization, and morphology features filtering are used to identify the candidates for blackboards. For arrow detection, segmentation based on the YCbCr colour space is used on a cropped image of the blackboard region. In the recognition sub-module, Gabor wavelet transform and 2D independent component analysis (2DICA) are employed to extract features from the traffic light candidates. A recognition library is also built, and experimental results show a recognition rate exceeding 91%. This research is important for improving the safety of autonomous vehicles in urban environments, and the proposed algorithm offers a reliable and effective solution for arrow traffic light detection and recognition.

III. METHODOLOGY

IV. RESULTS AND DISCUSSION

V. CONCLUSION

REFERENCES

[1] Adithya, P. S., R. Tejas, V. Sai Varun, and B. N. Prashanth. "Design and development of automatic cleaning and mopping robot." In *IOP Conference Series: MSE*, vol. 577, no. 1, p. 012126. IOP Publishing, 2019.

[2] Prayash, HA Shakhawat Hossen, Md Ragib Shaharear, Md Farhanul Islam, Saiful Islam, Noushad Hossain, and Shamik Datta. "Designing and optimization of an autonomous vacuum floor cleaning robot." In *2019 IEEE International Conference on Robotics, Automation, Artificial-intelligence and Internet-of-Things (RAAICON)*, pp. 25-30. IEEE, 2019.

 [3] Vishaal, Raj, P. Raghavan, R. Rajesh, Sachin Michael, and Mohan Rajesh Elara. "Design of dual purpose cleaning robot." *Procedia computer science* 133 (2018): 518-525.

 [4] Khan, Jahida, Udaysinh Bhapkar, Jitendra Bhat, Ashwini Chougule, and Sandesh Sangale. "Design and development of smart solar powered street sweeping machine." In *Materials Today: Proceedings* 46 (2021): 8663-8667.

 [5] Muthugala, MA Viraj J., SM Bhagya P. Samarakoon, Prabakaran Veerajagadheswar, and Mohan Rajesh Elara. "Ensuring Area Coverage and Safety of a Reconfigurable Staircase Cleaning Robot." in *IEEE Access* 9 (2021): 150049-150059.

 [6] Parween, Rizuwana, Manuel Vega Heredia, Madan Mohan Rayguru, Raihan Enjikalayil Abdulkader, and Mohan Rajesh Elara. "Autonomous self-reconfigurable floor cleaning robot." In *IEEE Access* 8 (2020): 114433-114442.

 [7] Murdan, Anshu Prakash, and Pawan Kumar Ramkissoon. "A smart autonomous floor cleaner with an Android-based controller." In *2020 3rd ELECOM*, pp. 235-239. IEEE, 2020.

[8] Parween, Rizuwana, Anh Vu Le, Yuyao Shi, and Mohan Rajesh Elara. "System level modeling and control design of htetrakis–a polyiamond inspired self-reconfigurable floor tiling robot." In *IEEE Access* 8 (2020): 88177-88187.

 [9] Veerajagadheswar, Prabakaran, Mohan Rajesh Elara, Thejus Pathmakumar, and Vengadesh Ayyalusami. "A tiling-theoretic approach to efficient area coverage in a tetris-inspired floor cleaning robot." In *IEEE Access* 6 (2018): 35260-35271.

 [10] Milinda, H. G. T., and B. G. D. A. Madhusanka. "Mud and dirt separation method for floor cleaning robot." In *2017 MERCon*, pp. 316-320. IEEE, 2017.

 [11] Saleem, Adeel, Atif Iqbal, and Adnan Sabir. "Design and implementation of an intelligent dust cleaner robot for uneven and nonstructural environment." In *2019 2nd iCoMET*, pp. 1-6. IEEE, 2019.

 [12] Zhong, Ruikang, Xiao Liu, Yuanwei Liu, Di Zhang, and Yue Chen. "Path Design for NOMA-Enhanced Robots: A Machine Learning Approach with Radio Map." In *2021 IEEE ICC Workshops*, pp. 1-6. IEEE, 2021.

 [13] Asafa, T. B., T. M. Afonja, E. A. Olaniyan, and H. O. Alade. "Development of a vacuum cleaner robot." In *Alexandria engineering journal* 57, no. 4 (2018): 2911-2920.

 [14] Ogiso, Satoki, Takuji Kawagishi, Koichi Mizutani, Naoto Wakatsuki, and Keiichi Zempo. "Self-localization method for mobile robot using acoustic beacons." In *ROBOMECH Journal* 2, no. 1 (2015): 1-12.

 [15] Sui, Linghui, and Lize Lin. "Design of household cleaning robot based on low-cost 2D LiDAR SLAM." In *2020 ISAS*, pp. 223-227. IEEE, 2020.

[16] Parween, Rizuwana, Leong Tze Lyn Clarissa, Min Yan Naing, Nur Aqilah Fitri Binte Mohamad Fuad, and Mohan Rajesh Elara. "Modeling and Analysis of the Cleaning System of a Reconfigurable Tiling Robot." in *IEEE Access* 8 (2020): 137770-137782.

[17] Le, Anh Vu, Phone Thiha Kyaw, Rajesh Elara Mohan, Sai Htet Moe Swe, Ashiwin Rajendran, Kamalesh Boopathi, and Nguyen Huu Khanh Nhan. "Autonomous floor and staircase cleaning framework by reconfigurable sTetro robot with perception sensors." In *JIRS* 101, no. 1 (2021): 1-19.

[18] Bormann, Richard, Joshua Hampp, and Martin Hägele. "New brooms sweep clean-an autonomous robotic cleaning assistant for professional office cleaning." In *2015 IEEE ICRA*, pp. 4470-4477. IEEE, 2015.

[19] Jarande, P. B., S. P. Murakar, N. S. Vast, N. P. Ubale, and S. S. Saraf. "Robotic Vacuum Cleaner Using Arduino with Wifi." In *2018 ICICCT*, pp. 1513-1517. IEEE, 2018.

[20] Pleshkova, Snejana, Zahari Zahariev, and Alexander Bekiarski. "Development of speech recognition algorithm and labview model for voice command control of mobille robot motio." In *2018 International Conference on High Technology for Sustainable Development (HiTech)*, pp. 1-4. IEEE, 2018.

[21] Raveena Ishalavath M, Sandhyashree N, Rakshitha R, Arpitha Shankar. “Design and Development of an Automated Floor Cleaning Robot for Domestic Application.”*in IJERT Volume 8* (2020): ISSN: 2278-0181

[22] Anmol Taneja, Gagan Bansal, Rohil Setia, Hema N.“Moedor Cleaning Robot.” *In IEEE Xplore* ( 2018 ): [10.1109/IC3.2018.8530503](https://doi.org/10.1109/IC3.2018.8530503)

[23] A.Vimala, S.Manikandan, T.S.Aravinth, S. Birundha Devi, S. Sathiya Gopika. *“Microcontroller Based Floor Cleaning Robot.” in IJITEE Volume-8* (2019): ISSN: 2278-3075

[24] S Yatmonom, M Khairudin, H S Pramono and A Asmara. “Development of Intelligent Floor Cleaning Robot”. *Journal of Physics (2019)*: 1413 012014

.

[25] Shravani Kamble, Surbhi Dorle, Manisha Kapgate, Harsha Sathawane, V. Buddhe.“Design and Development of Wireless Floor Cleaning Robot”*.in IJESC (2017*) Research Article.

[26] Sri Vishva R, Naresh R, Venkada Krishnan M.S. “An Automatic Cleaning Robot*” in IEEE Xplore (2021)* Part Number: CFP21OAB-ART; ISBN: 978-1-7281-9537-7

[27] Shripad Malavadikar, Swapnil Mungale, Toshika Johri, Harshad Lokhande. “Automatic Cleaner Robot.”in *IERJ*(2017), Volume 2 Issue 8 Page 2617-2620, 2017 ISSN 2395-1621

[28] R. Neumann Instituto de Carvalho, H.A. Vidal, P. Vieira, M.I. Ribeiro. *“Complete Coverage Path Planning and Guidance for Cleaning Robots.”in*

IEEE (2002): 97TH8280.