JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Review paper on lidar based train safety model for Railway

[1]Mr. Ramesh Jha, [2]Prof. Shalini Sahay

[1,2]Department of ECE/Sagar Institute of Research and Technology/RGPV/INDIA

Abstract: Due to increase in speed of train early Train Detection and warning system has been a complex in Railways. For the safety of the worker on the track a system needs to be developed for early warning of the people working on the tack. Particularly in areas with a high risk of accidents such as unnamed railway crossings, and railway track maintenance location, etc. To prevent future accident, the system must detect the train passing through the area with high accuracy and this process must be performed fulfilling real-time applications. LIDAR based detection system has been focused the work and high speed data communication system has been focused. Different review has been made for the train detection and early warning system.

Index Terms **- Rail safety, Train detection, WNS (Wireless SENSOR NETWORK), Safety.**

I. Introduction

II. Indian Railways is used in India as a major mode of transport for passengers and goods. It plays an important role in the development department. It is one of the largest and busiest rail networks in the world, stretching 1, 23,236 km with 13,523 passenger trains and 9,146 freight trains. It carries approximately 23 million passengers and 3 million tons (MT) of cargo daily. One of the world's largest rail networks with a variety of terrains including hills, forests, deserts, seas, countryside and urban areas. Manually maintaining this large network is costly, time consuming, and inaccurate. An unmanned railroad crossing warning system detects approaching trains. This machine features automatic train detection without human intervention. A train detection sent a wireless RF transmission to a cross-level receiver. System alerts by horn and turn signals. Therefore, the pastor guarded on foot when crossing the train tracks. This solution avoids accidents when crossing unauthorized tracks. 24/7 operation It is also possible to add an obstacle gate to the circuit breaker. This warns vehicles and passers-by not to cross the tracks until the train has departed. The complete system operates on DC power. An additional solar panel with backup battery is selected. The system compiler can install such a power supply on site. Indian Railways has long needed a lightweight and robust system based on over 35,000 Cross Country (LC) gates, including approximately 23,000 LC gates. These risk losing many deaths each year. The reason for this is likely that empty LC gates do not have a specific type of identification or alarm system or have warning signs and signals for people passing through them. Several automated machines have been placed in these empty LCs in the past, but most of them have been stolen. Therefore, there is a need for such anti-theft and automatic warning systems that can assist in such areas.

III. Literature Survey

This chapter mainly consists of the detailed study on work conducted on Lidar Technology and algorithm in different parts of worlds. This part briefly discussed various performance improvements in terms of Track maintenance, Unnamed Railway Crossing and Safety and Security in railway. The following reviews a survey type study and developments in state are in Railway Track Maintenance with help of Lidar and ZigBee Technology around the world.

G. S. Larue et al. [1] proposed the relationship between waiting times and driver behavior. Advanced Driving Simulator has been used to detect limited steps to cross the law. The following steps for driver frustration and decision-making processes are also compiled. The 60 participants completed six driving tasks each; the tasks vary according to traffic conditions, number of trains and corresponding waiting times. This study shows that extended waiting times lead to higher levels of frustration and increased risk of risky behaviors, especially waiting times longer than 3 minutes. Non-compliance includes activation before the boom gates go down, intersections after the train has passed but before the signs do not work, stopping / reversing when crossing. Involvement data indicated that participants did not comply with the rules of overriding due to factors including time stress, intolerance / frustration and perceived risk. The results show that, where possible, waiting times should be measured in terms of less than three minutes to reduce the chances of dangerous user behavior

Mario Bijelic et al. [2] proposed a system of Self-driving in the fifth level does not just mean driving yourself in the sun. Extreme weather is especially critical because fog, rain, and snow dampen the view of the surrounding area. In this work, the current state of artistic light detection and various sensors (lidar) are tested in controlled conditions in the fog chamber. We present the current problems and disruption patterns of four different scenarios of lidar art programs. In addition, we are investigating how the adjustment of internal parameters can improve their performance in adverse weather conditions. This is very important because most of the state of the art acquisition algorithm is based on uninterrupted lidar data.

A. Filgueira, et al. [3] proposed a current function measures the effect of rainfall on different LiDAR parameters: width, strength, and number of points obtained. Six sites with a variety of targeted use were used in this study. Distance levels appear stable despite significant rainfall impacts. The difference is usually less than 20 (cm). This difference stems from the testing process (average points earned above) and not from the non-availability of LiDAR detection and rainfall. LiDAR energy was obtained and sample points reduced rainfall increased. Distribution of drop size is always considered in the study area. The highest decrease in the number of points results from road exposure. However, the power restored to the pavement was not particularly affected by the rain. All other items show the same trend in strength and number of points obtained.

Attila Börcset al. [4] proposed a framework of blue 3-D cloud sequence installed in the Velodyne HDL-64 Lidar, and aimed to deploy all vehicles and pedestrians in the moving sensor area. We propose a complete pipeline specifically designed to separate 3-D urban exterior objects. First, we divide the point cloud into parts of the earth, the shorter objects (e.g., the lower part), and the longer objects (the upper part). After that, we use our two-layer grid structure, performing practical analysis linked to the previous regions, producing different groups of points, representing different urban objects. Next, we create the depth of the images from the participants, and then apply the first visual layout based on a flexible neural network. Finally, we refine the categorization of the elements taking into account the potential environmental conditions. We tested our algorithm with real Lidar ratings, containing 1485 items taken from various urban environments.

M. M. Rahman [5] With the rapid development of deep learning technology and other powerful tools, 3D object recognition has made great strides and has become one of the fastest growing areas of computer vision. Many automated applications such as robot navigation, autonomous driving, virtual or augmented reality systems need to estimate accurate 3D object positioning and recognition. Under this requirement, many methods have been proposed to improve the performance of searching and recognizing 3D objects. Despite recent efforts, detecting 3D objects remains a daunting task due to occlusion, perspective changes, scaling, and limited information in 3D scenes. This article provides a comprehensive overview of current approaches to 3D object recognition technology. Starting with some basic concepts, we'll discuss some of the available datasets aimed at facilitating performance evaluation of 3D object detection algorithms. It then reviews the latest technologies in this area and highlights their contributions, importance, and limitations in guiding future research. Finally, it provides a quantitative comparison of state-of-the-art method results with popular public datasets.

C. Tastimur, M. Karakose, and E. Akän[6] Railroad crossings are an important part of rail and road transportation and areas where serious accidents occur. Most railroad accidents occur at railroad crossings. In this paper, we propose a visual-based method to avoid these accidents at railroad crossings. This method is based on image processing and is used to monitor railroad crossing conditions. The proposed method detects obstacles in railroad crossings and calculates the estimated distance of these obstacles from the camera. In order to recognize the obstacles of the railroad crossing, first determine the railroad crossing with the railroad image. YCbCr color transforms, edge extractions, filtering, and Hough transforms were applied to the image when detecting railroad crossings. The captured railroad crossing area was marked as a railroad crossing in the image. I checked if there were any obstacles at the railroad crossing. HSV color conversion, image difference extraction, gradient calculation, filtering, connected component detection, and feature extraction have been applied to object detection.

V. P. Milan Pavlovic and T. Nenad Pavlovic [7] (Unnamed) level crossing is one of the most dangerous parts of the railway traffic. There, railway and road infrastructure are intersected at the same level, thus it becomes a weak safety point with very often terrible accidents. In addition to motor vehicles, the crossings are not rarely used by pedestrians who are also participants in traffic exposed to the risk. Accidents can happen due to malfunctioning of warning system (flashing lights, warning tones and boom gates) which informs traffic participants that a train is coming. However, even in the case of complete regularity of the warning system, very often fatal accidents happen due to not possessing enough awareness of traffic safety and "traffic culture". Because of that, drivers, cyclists and pedestrians, despite the activated warning system, use the railway crossing. This behavior leads to the violating of the law, endangering traffic participants and accidents with material damage and possible fatal outcomes. This paper presents actual solutions in the field of detection of obstacles on the railway crossing. The aim of those systems is to monitor the railway crossing with the goal to inform the train driver about possible obstacles existence, and timely response for preventing an accident.

V. Amaral, F. Marques [8] In this paper, we presented a system for detecting railroad crossing obstacles from a group of 3D points captured by a tiltable 2D laser scanner. Large railroad crossing obstacles can be detected with current solutions, but small railroad crossing detection remains an unresolved issue. By using a tilted laser scanner, the proposed system can collect very dense and accurate point clouds, enabling the detection of small obstacles such as stones near rails. During the offline training phase, the system learns a railroad crossing background model from a set of point clouds. Second, online obstacles are perceived as occupied space, as opposed to the background model. To reduce the need for manual on-site calibration, the system automatically estimates railroad crossing and track poses associated with the laser scanner. Experimental results show the ability of the system to operate normally with a set of 41 point clouds captured at a single lane railroad crossing in operation.

Bo Li, Tianlei Zhang, Tian Xia [9] Convolutional network technology has recently been very successful in visual recognition tasks. This paper presents recent developments in our research on transferring fully complex network techniques to the detection task of 3D range scan data. Specifically, the scenario is set as a vehicle detection task from Velodyne64E rider range data. We propose plotting the data on a 2D point map and using a single end-to-end 2D full convolutional network to simultaneously predict object reliability and the bounding box. By carefully designing the bounding box encoding, you can predict a complete 3D bounding box even with a 2D convolutional network. Experiments with the KITTI dataset show the cutting-edge performance of the proposed method.

J. Portilla, A. de Castro, [10] The growth of sensor networks over the last few years is true, and wireless sensor networks are especially growing in this area as there are many applications that require the use of hundreds or thousands of nodes. With this technology, more and more applications are solving multiple data acquisition and control issues in different environments. In this context, the hardware design of the sensor network node is important to meet the stringent constraints imposed by wireless sensor networks, such as low power consumption, small size, and low cost. In addition, these nodes need to be able to collect, process, and communicate physical parameters in order to be truly intelligent sensors in the network. With this goal in mind, we propose a modular architecture for the node, which consists of four layers: communication, processing, power, and sensing. The goal is to minimize the effort of redesigning and to make the node flexible and adaptable to many different applications. The first prototype of the node will introduce a mixed design node based on a microcontroller and FPGA for the processing layer and Bluetooth technology for communication.

K. Burnett, S. Samavi, [11] The University of Toronto is one of eight teams participating in the SAE Auto Drive Challenge, a contest to develop self-driving cars by 2020. After taking first place in the first year's challenge, we will go on to the second challenge in June 2019. City. There, interact with pedestrians, cyclists, and cars. Accurately estimating the position of all objects around the vehicle is important for safe operation. There are two contributions to this work. First, we present a new object detection and tracking dataset (UofTPed50) that uses GPS to determine the position and speed of pedestrians. As far as we know, this type of dataset for pedestrians has not yet been published in the literature. Next, we introduce a lightweight object detection and tracking system (auto Track) that uses vision, lidar, and GPS / IMU positioning to achieve cutting-edge performance in KITTI object tracking benchmarks. Shows that auto Track uses only the CPU to accurately estimate real-time pedestrian position and speed. auto Track has been tested in closed-loop experiments in real self-driving cars and has demonstrated its performance in datasets.

J.-R. Xue, D. Wang [12] Most state-of-the-art robotic cars’ perception systems are quite different from the way a human driver understands traffic environments. In this paper, a vision centered multisensory fusing framework for a traffic environment perception approach to autonomous driving, which fuses camera, LIDAR, and GIS information consistently via both geometrical and semantic constraints for efficient self-localization and obstacle perception. We also discuss robust machine vision algorithms that have been successfully integrated with the framework and address multiple levels of machine vision techniques, from collecting training data, efficiently processing sensor data, and extracting low-level features, to higher-level object and environment mapping. Most state-of-the-art robotic cars’ perception systems are quite different from the way a human driver understands traffic environments.

IV. CONCLUSION AND FUTURE SCOPE

This survey paper describes us the study of train safety model for Railways. The system plays an important role in the development of a smart and intelligent transportation system. Identification of train can be done by using lidar technology. The wireless communication protocol is used to send the approaching train information to the next end device. The device is able to detect all type of rolling stock running on the track. This technology can help in reducing the accident of key man, patrolman and people working on the track. This technology is evolving and will be able to see advancement in near future.

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