Internet of Things-Based Remote Animal Tracking Near Railway Tracks

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ABSTRACT

Railway accidents pose a threat to animal life and result in the loss of many resources annually. Constant surveillance is required to keep wild animals away from railway lines. Our proposed system would keep an eye out for both people and animals along a railway track. Our first set of monitoring tools includes infrared and pulsed infrared sensors for motion detection, a microelectromechanical system (MEMS) sensor for vibration and pressure, and ultrasonic range finders. When applied to data-driven ITS and emerging IoV services, such as railroad barrier tracking at railroad crossings, railroad alerts, and light signalling systems, IoT-based solutions might significantly enhance both. In the world's largest cities, using the train is the most popular and eco-friendly option for getting about. The train is the most popular mode of transportation since it is inexpensive, safe, and convenient. Many different types of workers can afford it. This project uses an ESP32 NODE MCU to build a multi-sensor railway track geometry surveying system, which is one of the most effective methods to avoid train accidents. There is complete command and control of all sensors, and data is sent and received. Animals and humans alike may be protected from harm and accidents can be avoided. Thing Talk, an Internet of Things (IoT) cloud platform, receives updates from this system on the track's state in real time. So that they may act swiftly to avoid railway accidents, these details are sent to adjacent railway authorities via mail or sent to their cell phones.

INTRODUCTION

We know that the railways are the most convenient and cheapest mode of transportation because of its capability, speed and safety. Indian Railways are the largest railway in Asia and the second largest network in the world. The small

improvement in this sector will lead to a great development in the country. Due to its huge size, there is a system to monitor and maintain the rails properly and the poor maintenance will create accidents in the rails. Many lives are affected due to the lack of carelessness. To avoid this, we were introduced a system that can avoid many of the accidents occur on rails. This system mainly focuses on some areas where creatures are always seen on the railway tracks. Using the cameras, the presence of creatures can be easily identified and thus the accidents can be prevented. The system contains details of train, loco-pilot, alert system and camera. In the proposed system, the images were captured using the camera and recognized using the process of image processing. If it detects an object in the image, then another image will also be captured within fractions of seconds and again the processing takes place. Both the images will be then compared and if it detects the image in both images, then the alert message will be immediately created by the application and send to loco-pilot and also to nearby control room. In 2007, Oh et al. proposed an ultrasonic crack detection method and used in the complete station for the railway track surveying system [1]. This system identified any living being was crossing the railway track [1]. By using the system, the flaws in the railway tracks could be detected and when ever technique, it detected even the minor cracks on the track. [1]. In 2017, Parvathy et al. introduced a real time monitoring fault observation system which was based on microcontroller [2]. The authors described about a methodology where issues identified automatically. It detected the rail stress, evaluated the stream and provided the rail break alerts, so that the concerned authorities were notified easily [2]. In 2016, Lad et al. introduced a vision based platform monitoring system for railway station safety [3]. The system monitored the complete length of the track in the platform. There were
many video cameras which conducted surveillance [3]. When the objects were identified to be fallen, immediately the notification was sent to the control room [3]. Closed circuit television cameras that were located at busy areas for monitoring and controlling passengers from the Central Control Room (CCR). But it was too difficult to manage this system when an urgent situation arrives [3]. In 2017, Manikandan et al. proposed a method enhances the track image using adaptive histogram equalization technique and further feature are extracted from the enhanced rail track image [4].

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LITERATURE REVIEW

Railway Track Tracer System (RTTS) for creature detection was introduced for monitoring railway tracks. In the proposed system, the accidents could be avoided if any living creatures that are on rails. We were contributed this system to places where accidents occur frequently. Accidents may be caused due to crossing of animals like elephants that may tumble down the train which may affect lot of life including those animals.

Camera

The Capturing process is done through camera which was in railway tracks [6]. The railway images were added into the database file with creature in the track and without creature in the track. Both the images were compared and detection of object took place [7]. The images stored in the database file in Train application includes Clear railway track image, and obstacle detected image. The elephant and car images were used as input images. Two images of elephant were present for recapturing process also which is shown in figure 1.

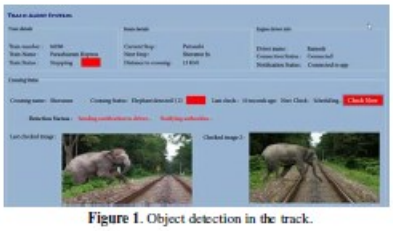

Figure 1. Object detection in the track.

Capturing Process

The proposed system contained two capturing processes, capturing process 1 and capturing process 2. When only one image was captured and any obstacle was identified in the image, a sudden stopping decision would not be a best one. If the object was still in the track then red alert was produced. There are three processes in each capturing. The feature detection, the feature abstraction and the feature recognition [8]. sama [25] proposes a machine learning model for near-accident prediction from observed vehicle kinematics data. Chenariyan [26] presents recent applications of machine learning in railway maintenance. Case-based reasoning (CBR) is attracting more and more attention from researchers and experts in the rail transport sector. This therefore argues for the need to review recent research in this area with a view to providing a comprehensive review of the major recent applications in the context of rail transport. CBR is a well-established field of research based on artificial intelligence techniques

and in particular machine learning, as evidenced by the 27th International Conference on Case-Based Reasoning (ICCBR) held in Stockholm, Sweden from July 10 to 12, 2018. This mode of reasoning, which is based on the notion of similarity, focuses primarily on problem solving based on experience. It is a cognitive process of human reasoning that relies heavily on how people acquire a new skill based on their past habits and experiences. CBR means using and exploiting old experiences to understand, explain, interpret or solve new situations similar to similar past situations. CBRs are increasingly used in industrial applications such as technical diagnostics, medical diagnostics, image processing, law, design, planning, and so on. In the field of transportation, our literature search covered three transport sectors: Air, road and rail. In the field of air transport we can cite, for example, the prediction of accidents and incidents [27]. In the road transport sector, the application of CBR is numerous: Transport planning [28], management of traffic flows [29,30], control of urban intersections to avoid road congestion [31], the analysis of road collisions [32], the improvement of traffic in urban intersections by developing new signaling plans [33], the control of traffic flow at intersections (traffic control systems (TCS)) [34], the diagnosis of the driver's stress level [35], or the modeling of the risk of driver fatigue [36]. Finally, in the rail transport sector, studies include the diagnosis of locomotive failures [37], the recovery of incident reports [38], the prevention of rail operations incidents [39], the command of railway rescue (Emergency Relief Command) [40], analysis of safety risks related to the operation of the metro [41], automatic train conduction to reduce travel time and save fuel consumption [42] and finally the diagnosis of failures of the rail switching system [43]. All of this work clearly shows that AI, BDA and machine learning will likely have an increasing impact on the safety of rail transport.

EXISTING SYSTEM

The word train accident and station crowding is frequently heard to have an immense effect on human life and time. Enthusiastic about this issue, this paper offers a solution to this serious issue. Multi-faceted color light signals are added, relay interlocking and separate block operations, point operations, train tracking and microwave radio are incorporated Before arrival at the station, the railway system plans to follow a monitoring approach to

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PROPOSED SYSTEM

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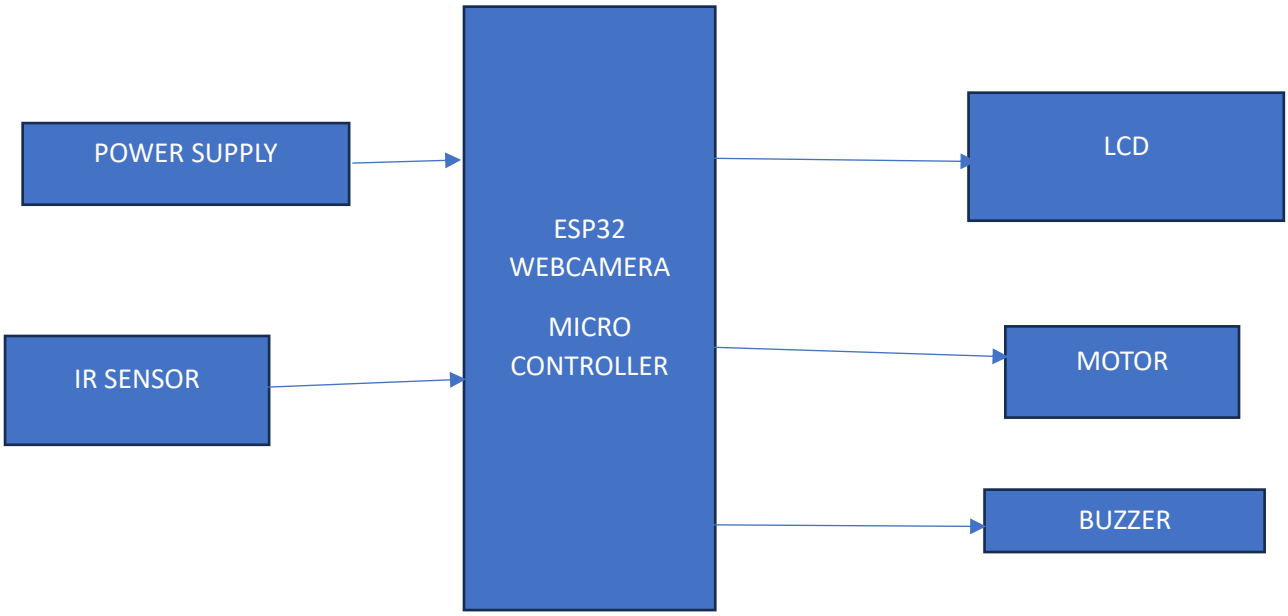
BLOCK DAIGRAM



HARDWARE COMPONENTS

LCD (Liquid Cristal Display)

Introduction:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the

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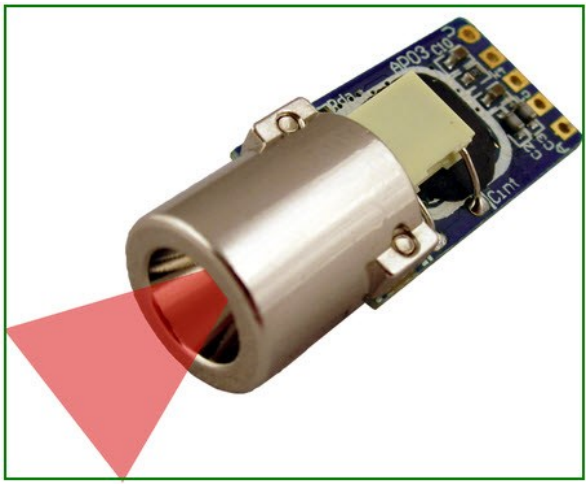
polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the contollers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

IR SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.



Gas Analyzers

IR sensors are used in gas analyzers which use absorption characteristics of gases in the IR region. Two types of methods are used to measure the density of gas such as dispersive and non dispersive.

Gas Analizer

Dispersive: An Emitted light is spectroscopically divided and their absorption characteristics are used to

analyze the gas ingredients and the sample quantity.

Non dispersive: It is most commonly used method and it uses absorption characteristics without dividing the emitted light. Non dispersive types use discrete optical band pass filters, similar to sunglasses that are used for eye protection to filter out unwanted UV radiation.

This type of configuration is commonly referred to as non dispersive infrared (NDIR) technology. This type of analyzer is used for carbonated drinks, whereas non dispersive analyzer is used in most of the commercial IR instruments, for an automobile exhaust gas fuel leakages.

Conclusion

The proposed system for creature detection was used for the creature detection on the rails. The

proposed system was placed in the accident prone areas where the accidents occur due to the wild animals crossing the rail, vehicle accidents, falling down of trees etc. will be monitored. This system provided the real time image using the image processing technology. According to the system, we were verified the system performance in real condition. The present state of the train and the objects were identified using the proposed image processing algorithms. Here a new recognition method was pursued using image processing technique which calculated the real image of the creature or objects in the track. This information will be helpful for the loco-pilot to stop the train and avoid accidents that harm the creature in the track. The system has an application side where we had the current status of the train and it also produced a notification or an alert message when the creature was detected. This system is a contribution to the Indian Railways that help them to deal with the accidents immediately. We expect this system will play a key role for establishing high intelligent monitoring system in railways.

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