MAT JOURNALS

Journal of Automation and Automobile Engineering
Volume 2 Issue 1

Automated Unmanned Railway Level Crossings

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Abstract

Railroad related mischance's are more hazardous than other transportation mishaps regarding seriousness and demise rate and so on. In this manner more endeavors are essential for enhancing security. There are numerous railroads crossing which are unmanned because of bolt of labor expected to satisfy the requests. Consequently numerous mishaps happen at such intersection since there is nobody to deal with the working of the railroad door when a prepare approaches the intersection. The principle goal of this paper is to computerize the control arrangement of railroad door utilizing microcontroller. The flag is considered as a contribution to this proposed framework and entryways are intended for the Indian street conditions and they are controlled by engines. A photoelectric vicinity sensor is put at the doors for the discovery of any impediments in the crash territory and a few cautioning lights, cautioning alerts are put for the wellbeing and for alarming the street clients. A vibration sensor is deployed in the tracks few meter apart from the level crossing for the detection of the trains so that which controls the opening of the gates and allow the road users for transportation.

Keywords: *Automation, Railway Gate, Level Crossing, Obstacle detection*

INTRODUCTION

Indian Railways is a state-claimed railroad organization, in charge of rail transport in India. It is claimed and worked by the Government of India through the Ministry of Railways. It is one of the world's biggest railroad systems involving 115,000 km of track over a course of 67,312 km and 7,112 stations. In 2015-16, Indian Railways conveyed 8.101 billion travelers every year or more than 22 million travelers a day and 1.107Indian Railways conveyed 8.101 billion travelers yearly or more than 22 million travelers a day and 1.107 billion tons of cargo in the year. In 2014–2015 Indian Railways had incomes of ₹ 1.709 trillion which comprises of ₹ 1.118 trillion from cargo and ₹ 451.26 billion from travelers tickets Railroad wellbeing is a critical part of rail operation the world over. Glitches bringing about mischances generally get wide media scope notwithstanding when the railroad is not to blame. [2].

This paper is aimed at helping the railway administrations concerned to strengthen their safety culture and develop the monitoring tools Students Pravin kumar. N,Mohanraj.M,Maheshwaran.A,Department of Information Technology Sri Ramakrishna Engineering College Coimbatore Required by modern safety management. The potential for mishaps is

made higher as the railroads control just a large portion of the issue. The other half, then, can't generally be said to be controlled by one element, as despite the fact that activity tenets and street outline benchmarks as far as anyone knows exist, the developments of street clients are not composed and checked by one particular element as inflexibly as rail developments.
The railroad frameworks of Asia and the Pacific are no exemption to this. Every year, mischances at level intersections not just aim fatalities or genuine wounds to a huge number of street clients and railroad travelers, additionally force a substantial money related weight as far as interruptions of rail line and street administrations and harms to rail line and street vehicles and property. A high number of these crashes are brought about by the carelessness, inadequacy or insufficiency of street vehicle drivers, who all things considered work their vehicles in conditions in which wellbeing cognizance is for all intents and purposes non-existent.
Elements impacting the likelihood of mishap event at level intersections include:

1. Rail movement thickness (measured as far as the greatest number of trains passing the intersection inside a 24 hour time span)
2. Street movement thickness (measured as far as the most extreme number of engine vehicles of assorted types passing the intersection inside a 24 hour time span).
3. Nearness of physical blocks limiting the perceivability of the track, cautioning signs or flags to street clients.
4. Nonattendance of full width obstruction insurance at level intersections.
5. Nonattendance of glimmering lights and capable of being heard cautioning gadgets at level intersections.
6. Poor street surface condition at level intersections (prompting the establishing of low threw street vehicles).
7. Poor arrangement and height of the street crossing the track (the street may cross the track at a sideways point or may approach the intersection on a steeply rising level).
8. Weather conditions.
9. Human errors.

It is emphatically prescribed that mischance probabilities ought to be computed for all official level intersections on the railroad framework (and potentially for the more reproachful of the informal intersections) and that these estimations ought to be refreshed to consistently to take into account the progressions to any of the variables recorded previously. Measurably, about 44% of LC clients have a negative view of the earth, which consequently increases the risk of accidents. However, we know from the mishap insights that the conduct of people on foot, street vehicle drivers, and railroad administrators can't be evaluated beforehand. According to Griffioen, human blunders cause 99% of mischances at the LCs, 93% of which are brought on by street clients. It is critical additionally to take note of the high cost identified with every mischance, which is around 100 million Euros for every year in the EU for all LC mishaps. For this purpose road and railways a professionals from several nations have been centered around giving a LC that is as more secure as possible. Railroad related mishaps are more risky than other transportation mischance's regarding seriousness and demise rate and so on. Thusly more endeavors are essential for enhancing security. There are numerous railroads crossing which are unmanned because of absence of labor expected to satisfy the requests. Henceforth numerous mischance's happen at such intersection since there is nobody to deal with the working of the railroad door when a prepare approaches the intersection. The fundamental goal of this paper is to deal with the control arrangement of railroad entryway utilizing microcontroller. [3]The idea is to detect the trains using the signals which are nearer to the level crossings and when the signal goes green which indicates the arrival of train. The microcontroller detects the input and alerts the road vehicle drivers with a warning lights and warning sounds and additionally it displays a ten-count display which alerts the road users about the closing of gates. The specially designed gates allow to close the gate without any obstacles inside it. When the train crosses the level crossing the train is detected using vibration sensor and the gates opened for the road users.

The key feature of the proposed system is the system is highly cost effective and the sensors deployed in these systems can withstand all kind of climatic conditions.

LITERATURE SURVEY

Several level crossing safety systems exist in the literature. Imaging system for train detection is one of the prominent systems adopted by Indian Railways. In [4], track occupancy status is monitored using camcorder. The major limitations of this method are the requirement of high end camcorders with separate illumination equipment for night time monitoring, which in turn increases the cost of the system. In [5], track occupancy is estimated using medieval IR transceiver system. The handset framework persistently transmits, medieval IR flag. This flag occurrence on the prepare gets reflected because of its non-infiltrating property. The separation estimation is registered in light of the force of the reflected medieval IR flag. However the significant confinement experienced by the framework is the impact of ecological conditions and outline multifaceted nature. In [7], optical source based target discovery framework is created. Optical source and detector along with a communication module are deployed across the railway tracks. Whenever a train crosses the track, the optical energy radiated from the source is not detected. In this way, the intrusion is reported to the Level Crossing via the communication module. Application specific optical source design is complex and this system is highly prone to environmental factors such as humidity, rain, pressure, etc. Wheel detection [8] is an emerging technology which detects the train through different methodologies such as acceleration determination or velocity determination and axle counting. Both acceleration and velocity are determined from the shear vibration exerted on the track due to presence of train. Axle counter counts the number of train wheels passing by the sensor. Sensors convert a measured mechanical signal into an electrical signal. There are a multitude of sensor types used for detecting the presence of a wheel such as axle counters. Axle counters [9] are expensive due to inductive sensors. In [10], Fiber Bragg grating (FBG) sensors are used for monitoring railway traffic. Fiber Bragg grating sensors assure immunity to electromagnetic fields and simple multiplexing, allowing the use of tens of sensors in a single fiber cable. At the point when a broadband light transmits through the optical fiber, the FBG sensors in the center reflects back a wavelength and the move in the reflected wavelength of the Bragg grinding sensor is around straight to any connected strain or temperature (inside a specific estimation extend). Consequently, the discovery method utilized by the checking framework is to recognize this wavelength move as a component of strain or temperature. (Inside a specific estimation extend).Therefore, the detection technique used by the monitoring system is to identify this wavelength shift as a function of strain or temperature. However, this detection system is found to be complex. Also, the highly variable and dynamic conditions of measurement make the real-time monitoring of track a difficult task. In particular, two main classes of disturbances acting on the measurement system can be distinguished. The first one is the class of "persistent" disturbances, including vibration, dampness, and changes in external temperature. These types of disturbances can influence the accuracy of the measurement. Nevertheless, repeatability tests on measured data confirm that it remains sufficiently high. The second class encompasses random disturbances, which cause the occurrence of impulsive spike like noise contaminating the acquired data. Spike commotion is especially undesirable since it can bring about false positives for the imperfections that the framework was intended to identify. Hence, it is of principal significance to legitimately distinguish and conceivably expel this clamor from the procured signals. In paper [11], Fuzzy Logic is utilized to build up a heuristic spike location and end calculation. The goal of [11] is to identify the event of each spike, and all the while to reproduce a gauge of the flag with the spike expelled. Hence, an alternative cost effective solution is required. By taking all the above factors into consideration it is found that acoustic sensors are less affected by adverse weather conditions and they are more economical compared with all other sensors.

SAFETYISSUES

Usually, a standard automatic LC is an intersection of a single or double (or even more) railway track with a (bidirectional) road that is equipped with train sensors, road lights, sound alarms, and two half-barriers. The LC area is managed as follows: where a train is detected using sensor in the approaching direction detects the arrival of a train, the alarms are triggered, the road lights are switched on, and the barriers are lowered. In other words, the LC closure cycle must be initiated. The LC is reopened to road traffic as soon as the train is detected in the leaving direction if any other train has not arrived meanwhile from the opposite side. Therefore, alarms are stopped, the road lights are switched off, and the barriers are elevated. In this paper, we only deal with the train detection and opening and closing of gates using sensor. This work aims at suggesting a new procedure to prevent these risky situations to increase safety at LCs.

TRAIN DETECTION

While the current framework manages the location of trains utilizing sensors in our proposed framework we utilize movement motions as a contribution to the microcontroller. The prepare signals have tri-hued lights in particular Red, Yellow and Green. Where the signs are been controlled by the control rooms in Railway. At the point when the flag goes to red, the doors stays open and if there is any adjustment in the activity flag and the light goes to green or yellow the controller distinguishes the entry of the prepare. As red denotes to stop the train and yellow denoting the train to continue to slow down the speed and Green states that it's clear ahead. As the current system at level crossings the man is appointed as a gatekeeper and control room instructs the gatekeeper about the arrival of train by the telephone. The gatekeeper closes the gate before few minutes about the arrival of the train. Then gatekeeper should intimate about the status of the train at the level crossing area. In this proposed system which is specially designed for the unmanned level crossing areas due to the accident rate is high when compared to manned level crossing. The traffic signal is totally controlled by the control room of the railways. Whereas the Indian Railways uses various traffic signs and warnings near the level crossing but the road users are not aware of the safety measures because of the low safety features at the unmanned level crossing.

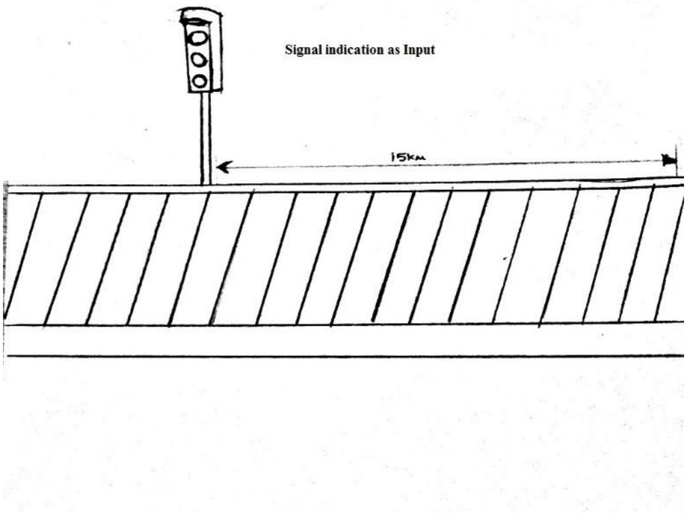

Fig.1. *Signals placed few kilometers apart from level crossing*

DESIGN OF LEVEL CROSSING GATES

Once the microcontroller receives the signal about the arrival of the train the level crossing is alerted with several warning lamps, alert sounds where LED lamps are used for low power consumption and buzzers are used for alerting the road users. A LED display is been mounted on the top of the level crossing area on either sides of it which indicates the time of closing the gates to road users. The gates are specially designed as per the Indian road conditions and climatic situations they have been splits into four regions for the easy avoidance of the collision in between the gates. Each motor is controlled by separate servo motors and the power source is totally utilized by solar energy. Several solar panels to be installed over the level crossings to power the control board and other objects like warning alarms and lamps.

WORKING OF LEVEL CROSSING GATES

Working principle

The level crossing gates working have been changed apart from the normal working of gates in current process. In case, if we automate the current working process of gates in the same manner then the collision avoidance cannot be rectified just by opening one way of gates. Hence the gates are been replaced with the different model and working principle. Fig.3 shows the general working process of newly designed gates. The opening mechanism is completely changed for the automation using motors. The gates are placed over the railway tracks and they are supposed to turn 90◦ towards the road side every gates works on the same principle so that the gates are independently controlled by the controller. When the train approaches the level crossings the gates the road passers are been stopped before the gates and there is no collision between the gates and the vehicles passes by. The main advantage of the gate is that these kinds of gates can opened partially for the passing of the vehicles during the hazardous situations.

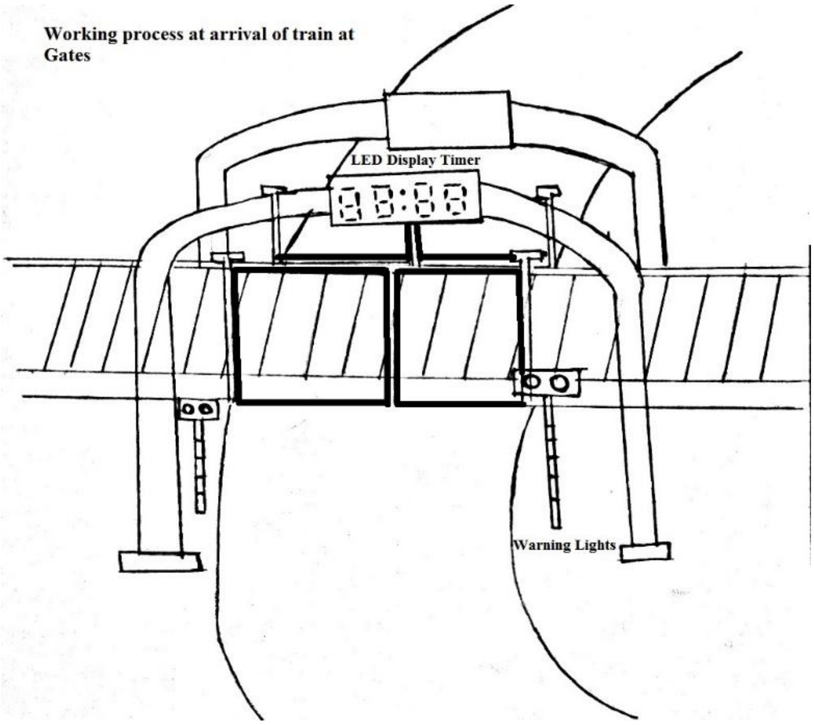

Fig.2. *Design of the Level Crossing gates*

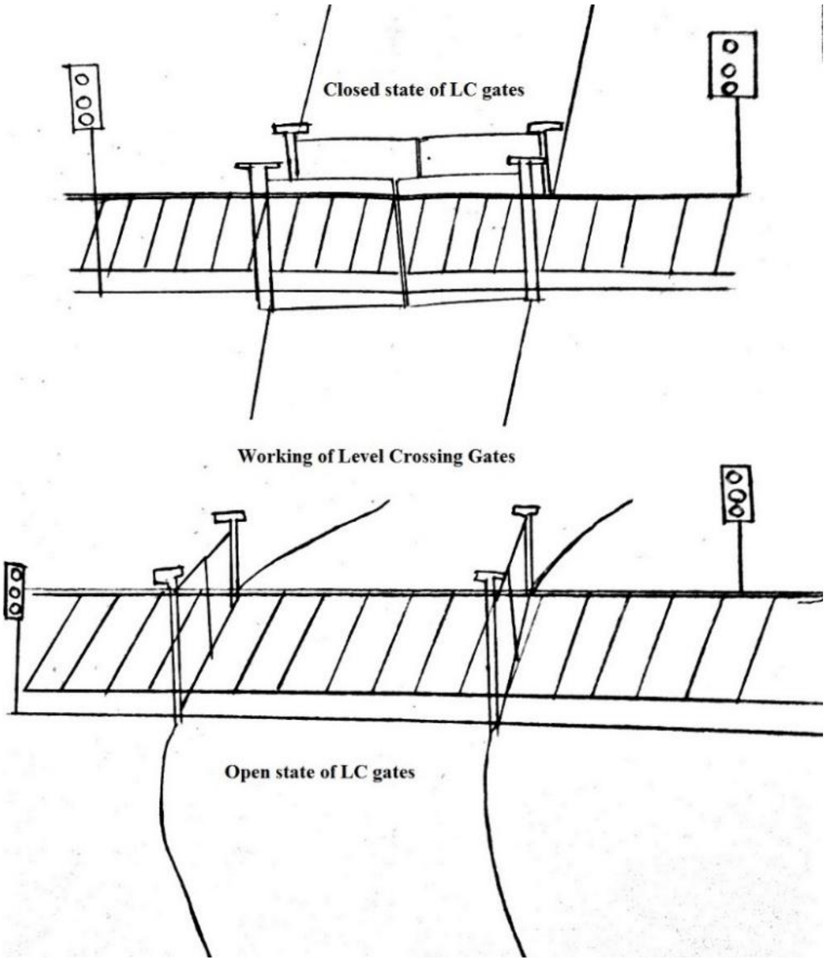

Fig.3. *Working of Level Crossing gates*

Working of gates at obstacle detection

The working of gates when an obstacle is detected in between the gates is shown in Fig.4

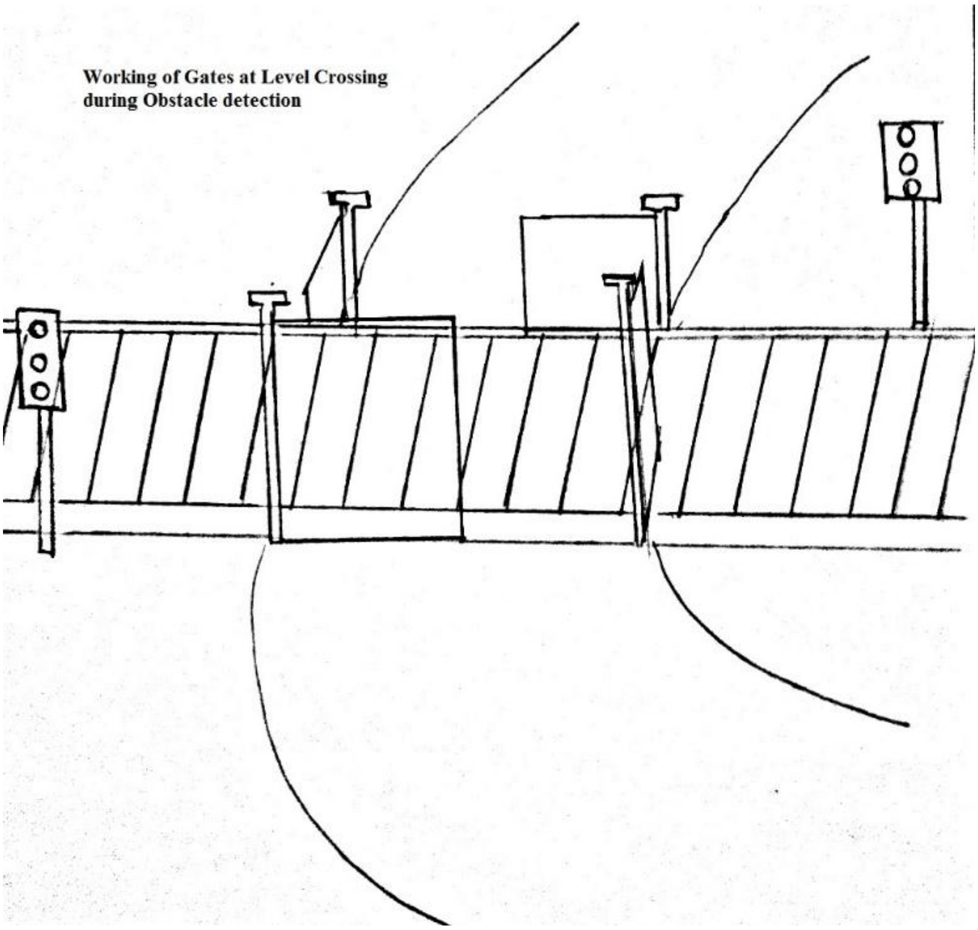

Fig.4. *Working of Level Crossing gates at obstacle detection*

When the trains approaching the level crossing the gates are said to be closed and since the gates are controlled by separate motors the gate can be opened partially on opposite direction in order to allow the vehicle inside the gates and the gate is allowed to close. In case, of any critical situations at the level crossing and the gate cannot be closed in these kind of situations the GSM module is placed in the level crossing will send a notification to the station master to the control room immediately. So, the accident occurrence is completely reduced and after the clearance of the problem the train will be allowed to cross over the level crossing. The main design of the gates play a major role in the accidental avoidance at the level crossings. The GSM module sends information only if the gate is not closed at the arrival time of the train.

OBSTACLE DETECTION AND COLLISION AVOIDANCE

The level crossing gates remain closed during the arrival of train. A photoelectric proximity sensor is deployed on the gates which detects the obstacles in between the gates. If the sensor detects any obstacle such as vehicles it sends the signal to the controller and opens the gate in a manner by which the vehicle can cross through easily and the gate closes immediately. If the obstacle remains inside the gate it cannot be closed completely, in these kind of situation the GSM module embedded in to the controller sends the message to the control room in order to intimate the situation to the train guard. So that the accidents at the level crossing can be rectified. There is a possibility of closing the gates in the presence of obstacles also so the system once again checks for the obstacle in between the gate for once so that the check confirms that there is no obstacles in between the gates. The collision at the level crossing is completely rectified in this system. The main advantage of this system is to completely rectify the collision occurrence at the level crossings. The photoelectric proximity sensor is deployed on the one end of the gates and it is made to rotate about 90◦ for detection of obstacles in between the gates and the sensor returns to its original position. It is made as dual check process and sends the signal to the controller. Then the gate is allowed to close completely. Fig.5. shows the working of the sensors in between the gates at the level crossing area.

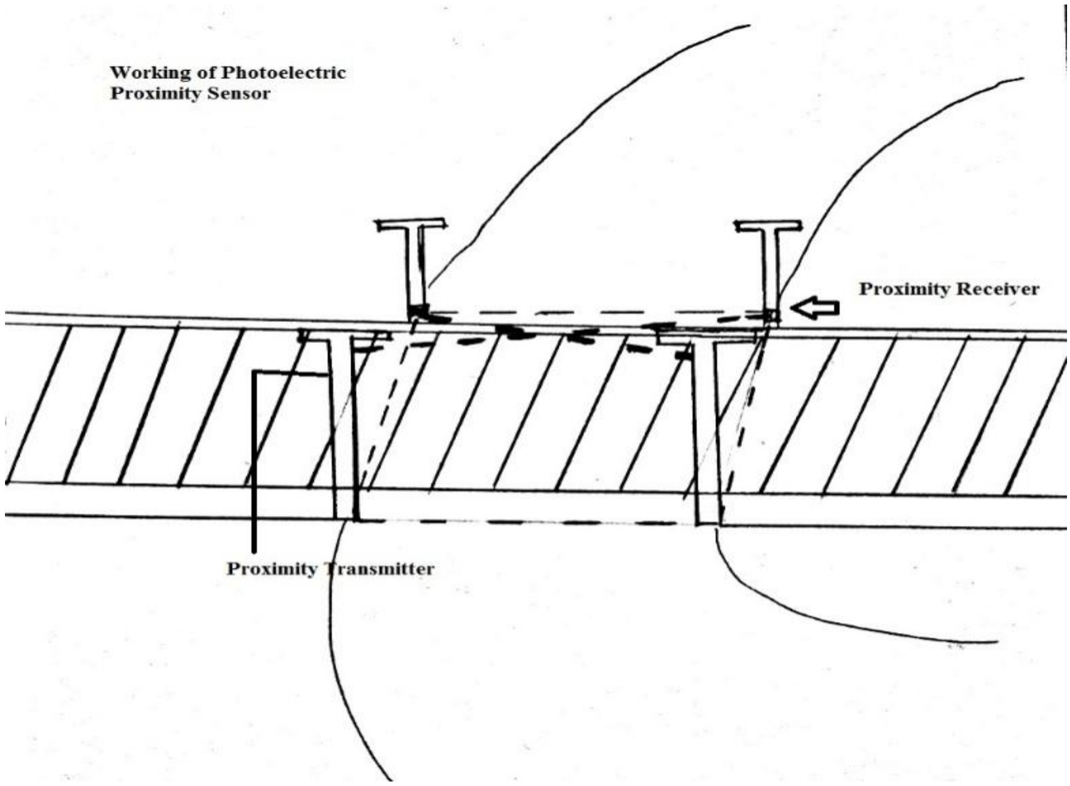

Fig.5. *Working of Photoelectric proximity sensor for obstacle detection at level crossing*

METHODOLOGY

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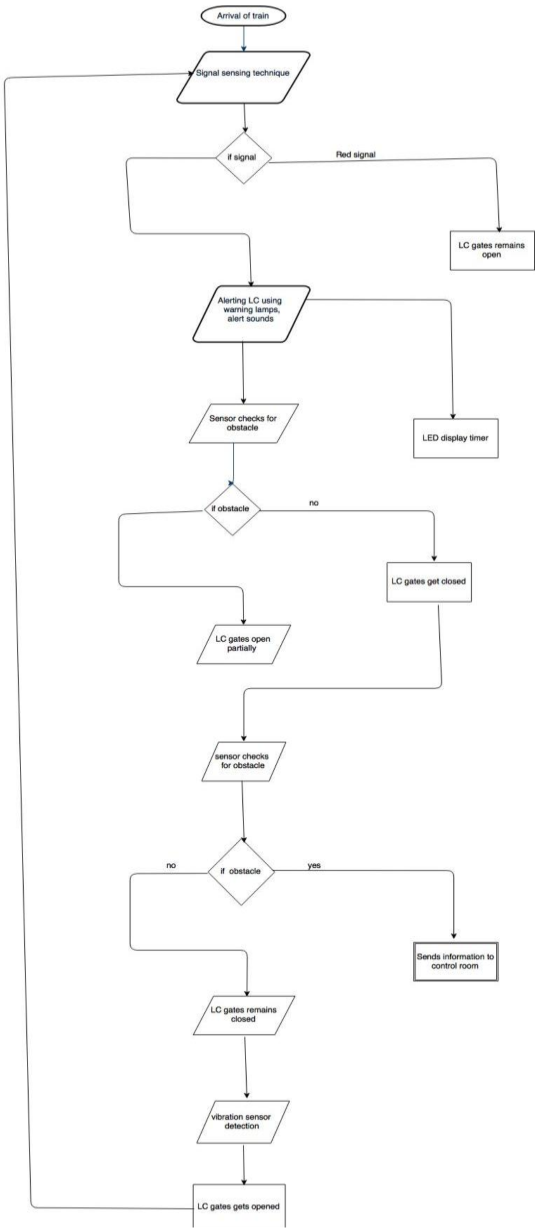

Fig.6. *Flow diagram of automated unmanned level crossing*

CONCLUSION

In this paper, level crossing mechanism is explained and the accident occurrence working principle of normal level crossing gates and the proposed system is represented diagrammatically. The level crossing gates is been controlled by separate motors and the microcontroller handles the overall working process of the system. The obstacle detection mechanism is handled using sensor deployed in the gates. The signal sensing technique plays a major role in this system where the arrival of trains is detected without any sensors and the methodology is made much easier and the system is completely cost effective. No man force is required for any of the functionalities. Overall the paper concludes by introducing a new technique for the unmanned railway level crossings using basic methodologies

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