AUTOMATIC IDENTIFICATION OF OBSTACLES AND CRACK SENSING SCHEME IN RAIL TRACKING SYSTEM

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Abstract -- **A system for preventing trains fromderailing and colliding with hazards on railways is disclose. According to the innovation, the system includes a safety vehicle (i.e., "trolley") that travels along a railway a head of a train. Railway safety is a crucial aspect of rail operation the world over. Malfunctions follow-on in accidents usually get wide media coverage even when the railway is not at fault and give to rail transport, among the unaware public, an unjustified image of inefficiency often fueling calls for immediate reforms. This paper is designed at helping the railway administrations concerned to strengthen their safety culture and develop the monitoring tools required by modern safety management.**

The train and trolley each include GPS receivers which constantly provide GPS location information to a microcontroller in the train. The CPU calculates the space between the trolley and the train, rate at which the train is roaming, and the distance required for the train to stop. The microcontroller transmit speeding up and deceleration commands to the trolley and/or train to maintain a safe distance between the trolley and a train. If the trolley derail, stop or slow downward due to a hazard on the railway or another difficulty, the CPU generates guidelines to slow down or end the train, as needed, to avoid the train from derailing or colliding with the trolley or a hazard on the railway. The wireless communication can be possible using ZigBee or RF transmitter.

Keywords **- Track damage detection sensor, PIC micro Controller, Detection, GSM, GPS and GPRS**

Methodology:

The following analyses are considered:

1. estimation of the necessities of a Safety Management Information System which adequately addresses the needs of railway management for information on level crossing safety performance;
2.Review of the essential and effective safety, Enhancements,measures and prioritiesforlevel crossings;
3. Assessment of level crossing safety performance and safety measures in some countries;
4. Examination of Cost Benefit Analysis of investments on level crossing safety enhancement;
5. Review of the technical attributes and suitability of Networked Anti Collision System (ACD) for level crossing protection system;
6. Recommendations and guidelines for adoption of networked ACD Systems by railways.

I. INTRODUCTION

Modern level crossings (or railroad crossings) have come a long way from the early days of human railway employees waving red flags and shining lanterns to clear railroad tracks of vehicles and pedestrian traffic for reaching trains. As still the case today, nineteenth century railways were deeply concerned with preventing accidents and protecting resources. respond to these concern, railroad began to implement manual, and eventually electrical, boom gates (crossing barriers) to block road traffic from the rail tracks. Although plain, easy signage may be plenty for level crossings in sparsely inhabit region, high traffic intersection today often aspect active notice system, which include electrical explosion gates, blinking lights, and caution bells that are triggered when an approaching train trips a nearby track circuit.

The survey in 2011 until the month of July comments that the frequency of accidents is going and in that year itself 11 accidents occur. To explain the root of the trouble, the accidents in railways are owed to 60% derailments and 90% crack troubles. Irrespective of normal or harmful reasons. Hence, this difficulty of cracks on railwaysbecame a crucial

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problem. Which has to be dealt with paramount importance and kindness, as the occurrence of procedure of Indian railways is great. This difficult of cracks which is in mainquantity, contributes for main train coincidences will driveignored. Because of Indiscretion in physical track line monitoring and it'sMaintenance. So, to avoid this drastic condition of Indian railway networks from stopping down still more, an automated system which does not rely upon the manual labor is fetched into bright. Due to the criticalimpacts of this problematic, this paper offerings an execution of an efficient and cost effective solution suitable for large scale presentation. With the beginning of controlling digital signal processors, Image Processing techniques have been explored to formulate solutions to the problem of railway crack finding. However it offers good correctness, this way uses systems like image breakdown. The custom of microwaveprojections in crack detection ininspected in enquiry. Furthermainmethod for crack recognition is infrared sensing which seemed to more suitable but later it becameincorrect. Other methods based on ultra-Sonic are also contributed to the detection scheme but they can investigate the crux of the track rather than checking for surface cracks and the surfaces where faults are situated. Several other policiesand techniques like observation and investigation of the wave. Circulation involving model impacts and piezo actuation came into light but the approaches are luxurious. The difficultintrinsic in all these techniques is that the cost sustained is great. Hence this paper suggests a low-priced, novel yet humblestructure with adequate ruggedness suitable to the Indian scenario that uses an IR-Photo diode arrangement to detect the crack in railway positions, which verifies to be cost operational as associated to the surviving methods. The mainpart played by transportation in the development of an economy has been calculated. In addition, measurements of the amount of rail accidents and their corresponding causes have also been calculated.

*II.*CURRENT-INDIANRAILWAYSAFTY

2.1. Present Perspective Indian

Railways are the world's second-largestrailway, with 6,853 locations, 63,028 kilometers of path, 37,840 customertrains and 222,147 load cars. Yearly it brings some 4.83 billion customers and 492 million tons of freight cars. Of the 11 million passengers who climb on-board one of8,520 trains every day, about 550,000 have reserve accommodations.

2.2 Train Collisions

Collisions are the most feared accidents.It is very hard to stop such crashes because of speed of the Moving trains, which need a lead distance Tostop. Collisions happen due to human error and/or faulty equipment.

Two types

1. Head-On

2. Rear-End-Collisions

A directaccident is one where the forward-facingends of two ships, trains, planes or vehicles hit each other, as opposed to aside-collision or rear-end crash.. With rail, a face-to-facecrash often implies a collision on a single line railway.

III.EXISITNG METHODS

The finding of cracks in railways tracks takes time consumption due to physicalinspection. It shrinks the correctness too. This method of design is having limited intelligence and time consuming.TRAIN Accidents are commonly occurring in a country .They are mainly due to bad condition of tracks and absence of monitoring in level crossings Tracks are prone to cracks or expansion of metal plates It is impossible to identify the obstacles from the train and on identification it is difficult to stop the train suddenly

3.1HARDWARE REQUIREMENTS

we have built two self-propelled carts which move over the railroad track. The two industrial laser range scanners are installed on a cart directly over each rail. The characteristics of the lasers are such that they scan 700 points each with angular step of 0.1 degree, which at the fixed distance to the rail of 2.2 feet corresponds to about 20 distance measurements (opinions) per inch. Assumed the ordinary rail width of 2 ¾ inches, this roughly corresponds to about 50 measurements on top of each rail head. The scanners are placed perpendicularly to the rail, and their co-alignment has been measured. Every scanner is able to see only one rail. They are able to produce more than 200 readings per second, which, at the average cart speed of 20 mph, matches to 5-6 analyses per foot. According to industrial requirements, the systems of this type must produce at least one measurement per foot of rail track. It is typical for range scanner systems to have some uncertainty in measured signal (noise), which, for our setup, corresponds to about +/-0.5 inch of noise for every distance measurement. The typical scans of a rail

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head profile measured by scanners are displayed in Figure.

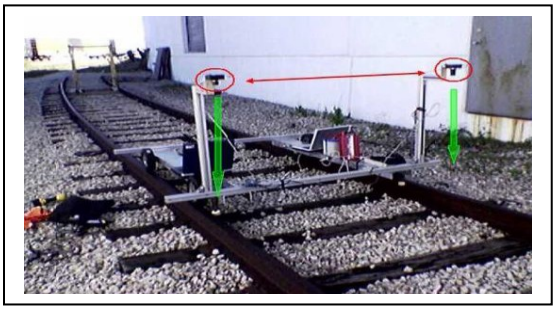
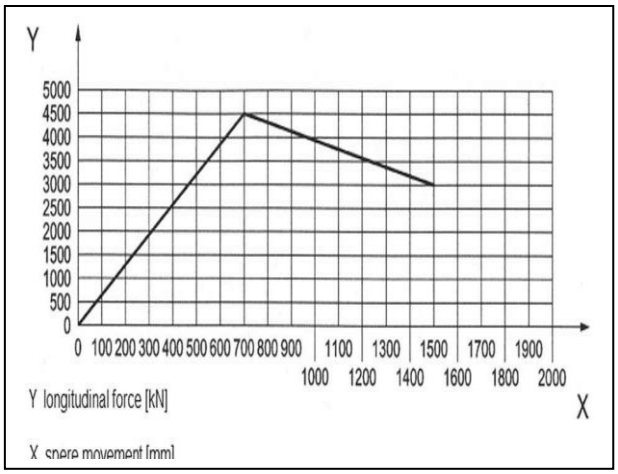


Fig.3.1 layout design of railway line

3.2. Related Methods

GPS based Cab Signaling, BlockSignaling, Automatic Train Control (ATP),and Railway Collision Avoidance System(RCAS) andhave been developed and used for avoidingcollision and for getting correct communication, butnot that much value. Train Crash AvoidanceSystem (TCAS) has also developed recently andAnti-collision Device (ACD) is being developedand will be used till December 2013.



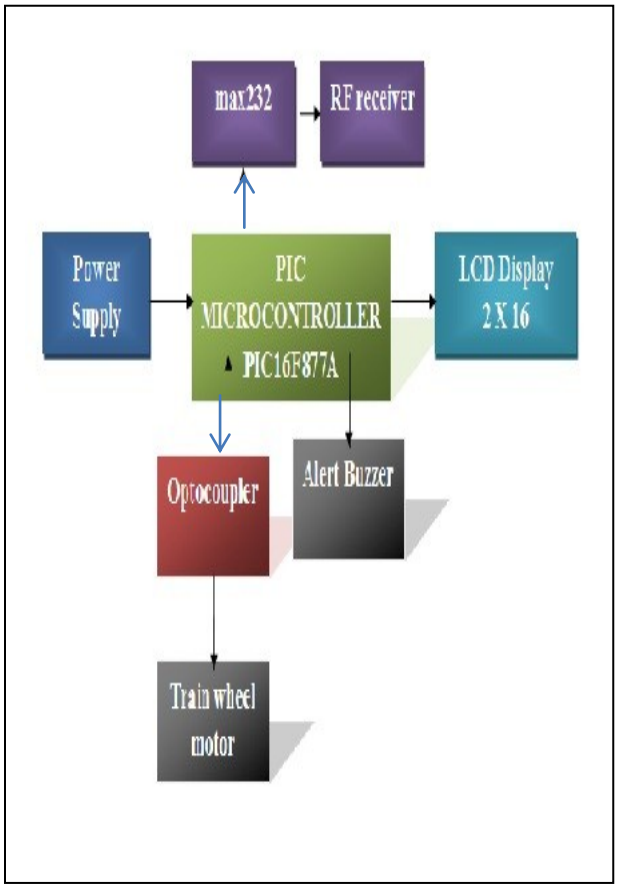
IV. PROPOSED SYSTEM DESIGN

This project proposes a cost effectivesolution to the problem of railway track crackdetection utilizing Zigbee communication andARM control, track damage detection robot, GPS, GSM assembly which tracks the exact location oftrack damage which then mended immediately sothat many lives will be saved.The sensor network is a wireless networkformed by a group of sensors deployed in sameregion, which can be used to measure the airdensity, temperature, acceleration, etc. Sensorscan transmit signals via radio motion. Meanwhile sensorsare now minor and economy, they can be organized ona big scale

- Trolley system for monitoring the condition of tracks and obstacle detection has been proposed
- Trolley is moved at certain distance in front of train and monitor the track
- If any fault is present it sends the message to controller Centre in train through GPS
- Using ultrasonic sensor detect any obstacle and send information to controller Centre.

4.1 BLOCK DIAGRAM

TRAIN UNIT:



The train and trolley bothcontain GPS receivers which constantly provide GPS location information to a microcontroller in the train. The CPUcomputes the space between the trolley and the train, promptness at which the train is roaming, and the distance required for the train to stop.

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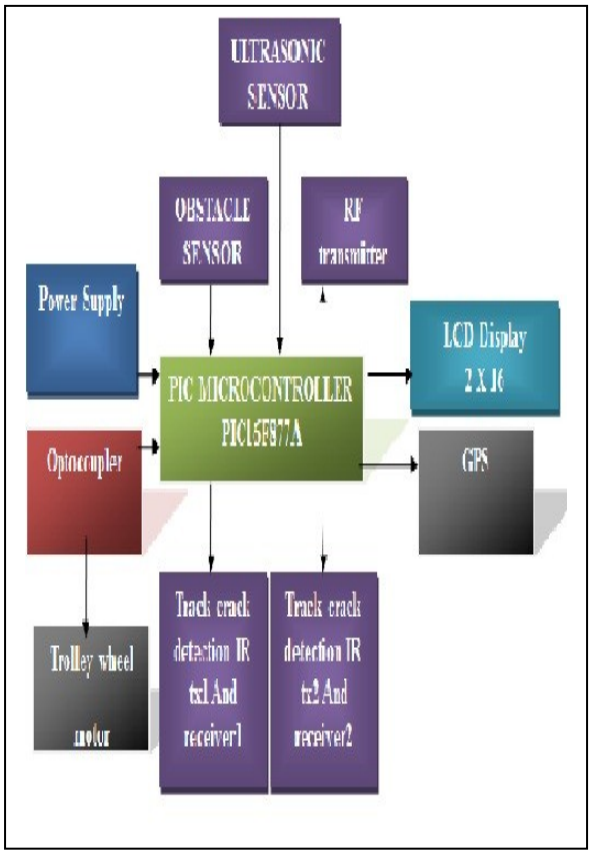
4.2 TROLLEY UNIT:



The numerousmodules in the block diagram are mentioned below:

1. pic 16f877a Microcontroller
2. GPS Module
3. 16x2 Liquid Crystal Display(LCD)
4. MAX 232
5. Multiplexer
6. PC
7. Reset
8. Crystal Oscillator
9. Power Supply

4.3 Power Supply

The input to the circuit is applied from the regulated power source. The microcontroller power is of 5V. The A.C. input i.e., 230V after the mains supply is step down by the transformer to 12V and is fed to a rectifier. The productiongained from the rectifier is a pulsating D.C voltage. So in order to get a pure D.C voltage, the output voltage from the rectifier is fed to a filter to remove any A.C components present even after rectification. Currently, this power is given to a voltage regulator to obtain a pure continuous dc voltage. We are consuming an IC 7805 as voltage regulator to get a 5V output Voltage.

4.4 Opto-coupler

An opto-coupler, photo coupler, or optical isolator, is aelement that transmissions electrical signals between two isolated circuits by using light. Opto-isolators avoid greatpowers from affecting the system getting the signal. Commercially accessibleopto-isolators withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 10 kV/µs.

A common type of opto-isolator consists of an LED and a phototransistor in the same dense package. Furtherkinds of source-sensor combinations include LED-photodiode, LED-LASCR, and lamp-photo resistor sets. Usually opto-isolators transfer digital (on-off) signals,nevertheless some methods allow them to be used with analog signals.

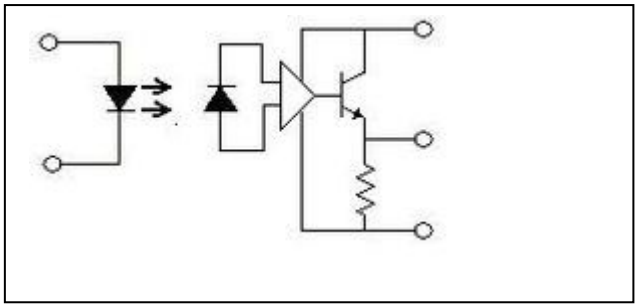


Fig. 4.4.1 OPTOCOUPLER

An opto-isolator contains a source (emitter) of bright, almost constantly a near infrared light-emitting diode (LED), that converts electrical input signal into light, a closed optical channel (also called dielectrically channel), and a photo sensor, which detects incoming light and either generates electric energy straight constant or controls electric current flowing from an external power source. Opto-isolator cantransmission the light signal not transfer the electrical signal. The sensor can be a photoresist or, a photodiode, a phototransistor, a silicon-controlled rectifier (SCR) or a triac. Since LEDs can intellect light in calculation to discharging it, structure of regular, bidirectional opto-isolators is possible. An opto coupled solid state relay contains a photodiode opto-isolator which drives a power switch, usually a complementary pair of MOSFETs. A slotted optical switch contains a source of light and a sensor, but its optical channel is open, allowing modulation of light by external objects obstructing the path of light or reflecting light into the sensor.

4.5 NSK OBSTACLE SENSOR ver2.0

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- IR Based Obstacle Detector
- Adjustable Range with POT
- Operating Voltage 5v
- Sensitivityup to - 30cm-Adjustable
- Logic output -1/0 -5v
- Application - Industrial safety devices

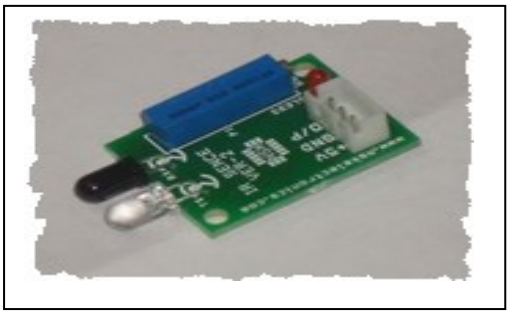

Fig. 4.5.1 Obstacle sensor

Ranging sensors include sensors that require no physical contact with the object being detected. They allow a robot to see an obstacle without actually having to come into contact with it. This can prevent possible entanglement, allow for better obstacle avoidance (over touch-feedback methods), and possibly allow software to distinguish between obstacles of different shapes and sizes. There are several methods used to allow a sensor to detect obstacles from a distance. Below are a few common methods ranging in complexity and capability from very basic to very intricate.

The following examples are only made to give a general understanding of many common types of ranging and proximity sensors as they commonly apply to robotics. Many variances can exist within each type.The diagrams show the sound fields of an unfocused and a focusing ultrasonic transducer in water.

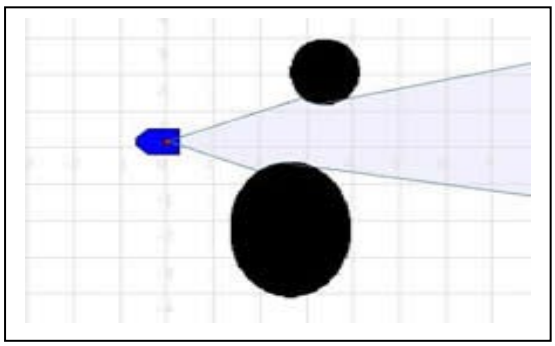

Fig. 4.5.2working of obstacle sensor

4.6 Ultrasonic sensors

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.

An ultrasonic transducer is a device that converts energy into ultrasound, or sound waves above the normal range of human hearing. While technically a dog whistle is an ultrasonic transducer that converts mechanical energy in the form of air pressure into ultrasonic sound waves, the term is more apt to be used to refer to piezoelectric transducers or capacitive transducers that convert electrical energy into sound. Piezoelectric crystals have the property of changing size when a voltage is applied; applying an alternating current (AC) across them causes them to oscillate at very high frequencies, thus producing very high frequency sound waves.

The location at which a transducer focuses the sound can be determined by the active transducer area and outline, the ultrasound rate, and the sound velocity of the propagation medium.

Since piezoelectric crystals generate a voltage when force is functional to them, the similarmineral can be used as an ultrasonic sensor. Variousstructures use separate transmitter and receiver components while others combine both in a single piezoelectric transceiver.

4.7 Global Positioning System (GPS)

GPS (Global Positioning System) technology is used to find the location of any object or vehicle to monitor or a child continuously using satellite signals.

Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accurateness. GPS will stretch the info of

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constraints like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of someitem. In this GPS equipment, the communication takes place between GPS transceiver and GPS satellite.

4.8 Global System for Mobile (GSM)

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. The GSM conditionsdescribe the functions and interface requirements in detail but do not address the hardware.

A GSM modem is a specialized type of modem which receives a SIM card, and operates over a contribution to a portable operator, just like a mobile phone. From the mobile operator viewpoint, a GSM modem aspectsfairsimilar a portablereceiver. When a GSM modem is linked to a CPU, this permits the CPU to use the GSM modem to communicate over the mobile network.

4.9 GPRS

GPRS (General Packet Radio Service) is a packet based communication service for mobile Devices that allows data to be sent and received across a mobile handsetsystem. GPRS is a phasenear 3G and is frequentlymentioned to as 2.5G. Here are certainmain benefits of GPRS: Speed 20-50 kbps. The serving GPRS support node (SGSN), like the GSM mobile switching center and visitor location register (MSC/VLR), panels the linking between the network and the mobile station (MS). The SGSN provides session management and GPRS mobility management functions such as handovers and paging. It attaches to the HLR via the Gr interface and to the MSC/VLR via the Gs' interface. It also counts the number of packets transmitted. It is linked to a computer, this allows the computer to use the GPRS modem to communicate over the mobile network.

4.10 PIC CONTROLLER

The microcontroller that has been used for this project is from PIC sequence. PIC microcontroller is the major RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.

The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a minor pin amount. The chiefbenefit of CMOS is that it has immunity to noise than other productionmethods. Various microcontrollers proposalchangedtypes of memories. EEPROM, FLASH etc. are certain of the memories of which FLASH is the most newlyestablished. Equipment that is used in pic16F877 is flash equipment, so that statistics is taken even once the control is transferred off. InformalEncoding and Erasing are other features of PIC 16F877.

4.10.1 CORE FEATURES:

• High-performance RISC CPU

• Only 35 solodiscussion instructions to study

• All single cycle instructions excluding for program branches which are two cycle

• Power-on Reset (POR)

• Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)

• Watchdog Timer (WDT) with its own on-chip RC Oscillator for reliable operation

• Power saving SLEEP mode

• Only single 5V power iswanted for encoding capability

• Wide operating voltage series: 2.4V to 5.3V

• High Sink/Source Current: 25 mA

• Marketable and Manufacturing temperature ranges

The microcontroller that has remained used for this project is from PIC series of pic 16F877.

Informal Programming and Deleting are other features of PIC 16F877

4.11 Reset

Switch reset is to implement the whole program sequence from launch.

4.12 MAX232

The microcontroller can communicate with the serial devices using its single sequential port. The

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reasonstages at which this serial port operates is TTL logics. Thencertain of the sequential devices function at RS 232 logic levels. Thus in demand to communicate with the microcontroller through modem, aincompatibility between the logic levels occurs. In instruction to escape this incompatibility, in other words to match the Logic levels, a sequentialmotorist is used. A MAX232 is a sequential line driver used to establish communication between modem and microcontroller. The interfacing of GSM modem through microcontroller using MAX 232 as a serial line driver.

V. Introduction to C Programming For Embedded Systems

C used for embedded systems is slightly different compared to C used for general purpose (under a PC platform) Programs for embedded systems are usually expected to monitor and control external devices and directly manipulate and use the internal architecture of the processor such as interrupt handling, timers, serial communications and other available features.There are many factors to consider when selecting languages for embedded systems examine and utilise various features of the

5.1 Software that support this programmer

There is several software that support this PIC programmer such as WinPic800, ProPIC18 etc. On behalf of each software can support altered devices. In case Epic Win support PIC12F, PIC16F and some PIC18F and can be run on all windows But, Winpic800 support PIC12F,PIC16F, PIC18F including ds Pic (when setting up hardware as ProPIC2) and ProPIC18 support PIC18F only and run on all window.

At times GPS data is not available in shadow zone; however this is taken care by supplementing with Dead Reckoning Devices Protection at levelcrossings is possible only when the train and the level crossings are fitted with ACDs, by this method. At times the Track side equipment may become targets of vandalism

Therefore, these are long sequences of invalidated frames where we can lose some gauge results. Our system included the feature that, if the measure is overturned, the gap in gauge data was displayed so the track operator could choose to verify the gauge manually.

5.2 Rail detection experiments

Since rail gauge measurement is straightforward as long as we locate the rail in images, we concentrated our experiments on rail detection. Rail detection performance was evaluated on dataset group 6, which holds nine rail videos reserved from different tracks. The total number of rail images in these videos is 11900. All videos share the same common properties. They were taken using both shield and strobe lights, the position of opinion was straight, and the rise level of the features in view was appropriate for our method. Some input videos were not fit for our experiments. In videos 3 and 7, the rail stays.

Table: Cost-Benefit Analysis of ACD & Barrier Installation at Level Crossings vis-à-vis other systems. Benefits of the ACD /GPS based Wireless Lx Protection

ITEM	Description	INR
1	ROBs & RUBs	230 mn
2	Automatic Level Crossing Gate (sensor Based)	6.0 mn
3	Change of Unmanned Level Junction to Operatewith Signal Interlocking	5.1 mn
4	GPS based Wireless Redundant Level Crossing system	1.8 mn
5	Gate Security System using Anti Crash Device Networked System (without Loco ACD price)	0.8 mn

5.4 Limitations of the ACD /GPS based Wireless LX protection system:

By way of the message is radio based, there is a probability of propagation and weather conditions affecting the communication and failure in communication may result in level crossing gate not functioning as expected.

However, percentage of such incidents may be as low as 0.25% of total train crossings; Protection at level crossings is possible only when thetrain and the level crossings are fitted with ACDs, by this method. At times GPS data is not available in shadow zone;

However this is taken care by supplementing with Dead Reckoning Devices. At times the Track side equipment's may become targetsof vandalism.

VI. CONCLUSION

In this project, track damage detection system for trains have been calculated, computer-generated and verified. The simulation has been done using proteus and testing has been carried out using the establishedmodel. It has remainedprojected that if the system is applied in railways, trains accidently on the

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track errornotices automatically stops train and send the location of the track fault to control place to alert, train collision can be barred and human life saved if this scheme is implemented. Level Crossing safetyschemes is established using microcontroller to give additional safety shield at manned and unmanned level crossings, over an audio-visual warning to way users. The automatic railway gate controller thus can be used in unmanned level crossings to reduce the occurrence of coincidences. Then the scheme is completely automatic it can be used in remote villages where no station master or line man is present. Also it saves lot of times as it is automated whereas manual systems take time for the line man to inform the station master to close and open the gate which will consume a considerable amount of time. Also since it is completely automated there are fewer chances for error to occur. Thus this design is very useful in railway applications.

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