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Automated Unmanned Railway Level Crossing System Using WSN

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ABSTRACT: There has been an increase in the road trafficas well as the rail traffic, accidents at level crossing has increased and this has caused the concern for the Indian railways. The objective of this project is to provide an automatic railway gate at a level crossing replacing the gates operated by the gatekeepers. In this project we are proposing a simple solution for the level crossing in which we fix the Radio Frequency tag (RF tag) on the train. The system reduces the time for which the gate remains closed. This type of gates can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required.The collision of trains running on same track is also prevented by employing IR Transmitter-Receiver system at each sections of the Station and passes the information toa master control room via GSMMODEM.

KEYWORDS: Railway gate, unmanned level crossing,GSM Modem, IR Transmitter-Receiver, Microcontroller, Stepper motor.

1. INTRODUCTION

The aim of the paper is to develop an economical train watching and protection system.
Indian railways are the world's second-largest railway, with 6,853 locations, 63,028 kilometers of path, 37,840 client trains and 222,147 load cars. Yearly it brings some four.83 billion customers and 492 million plenty of freight cars. Of the eleven million passengers who climb on-board one among eight, 520 trains each day, about 550,000 have reserve accommodations.Crossroad could be a place wherever a railway and a road, or 2 railway lines, cross at identical level. It's known as crossway in North America. There are primarily 2 styles of crossroad they're manned crossroad and unmanned crossroad. Manned crossroad is generally unbroken closed to road traffic equipped with lifting barriers. Unmanned crossroad is employed for oxen crossing.
According to there are approx. 30348 level crossings (manned and unmanned) in India out of that 11563 are unmanned. Collisions at unmanned level crossings are progressively a serious downside in India. In keeping with the report revealed in Times of India by News Network most accidents i.e. four-hundredth occurred at unmanned railway level crossings. Railroad connected accidents are additional dangerous than alternative transportation accidents in terms of severity and death rate. The quantity of deaths on railway track has been on the increase within the past few years despite many measures taken by the authorities to contain such incidents. This arrange helped in reduction of accidents a quarter mile in 2003 to 17 November in 2013.

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Railway Crossing

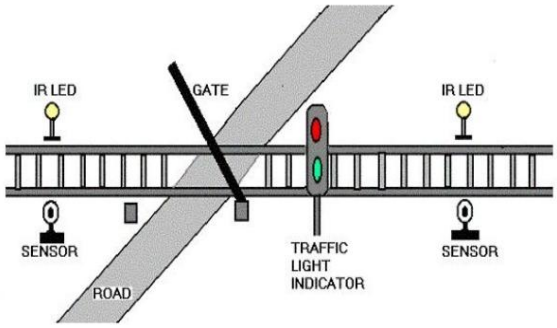

Fig.1: Railway Crossing

Railway Accidents is classified on the premise of cause and result, study of that helps in preventing similar ones in future.

Head on collision: The train colliding on an equivalent track from opposite ends referred to as head on collision.

Rear end collision: the opposite kind is once a train collides into the opposite that's before of it, referred to as a posterior collision.

Derailments: A train could derail on a merely straight track which will cause the train accident. Curves; mishap of a train is a lot of common once there's a curve on the track inflicting AN accident. Junctions; a train may additionally get derailed on a junction, that is that the place wherever 2 tracks converge into one, or one diverges into 2.

Accident contributors like train visibility advance signs, active warning, driver behavior, driver distraction and risk taking are known as common human issues contributors to vehicle train level crossing accident. Issue includes main road and railway characteristic are causative issue to accident at RLC. The environmental factors are snow, heavy rain, fog, or processing snow, that collision the train. The 3 main factors causative to accidents

at RLC is basic safety engineering studies, human factor, engineering issue, and surroundings issue. The taxonomy of railway intersection accident contributors was created to get hypotheses and deduction regarding specific cases and customary patterns of accident contributors.

II.EXISTING SYSTEM

Rail microwave radar is the new technology launched by Indian Railways recently, that updates train position on a map every time it crosses a station on its way .This system doesn't give time period following since every station is found a minimum of one kilometer apart in cities and 10-20 kilometer apart in remote places [1].

The study extracted and analyzed the Turkish State railways characteristics mistreatment Geographical Positioning System (GPS), sensors, like non-contact photography (remote sensing technology), video, laser, acoustic, radar, and infrared sensors and so developed a Geographical data system (GIS) information [2].

The study in mentioned data and communication pc controlled system that extracted processed, stored, analyzed, logically associated and diagrammatically displayed [3].

In an integrated GPS, GIS and wireless sensors primarily based information assortment system was developed [4].

- Presently railway-crossing gates area unit operated manually. At this time scenario, in level crossings, a gatekeeper operates the railway gate usually once receiving the data regarding the train's arrival. Once a train starts to go away a station, master of the actual station delivers the data to the close gate.

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- Presently per se no centralized system is there through that we are able to track the situation of trains from any canter purpose. As trains cannot be centrally placed, typically more than one train runs on a similar track in wrong way resulting in accidents.
- Presently signals area unit controlled by suggests that of interlocking system and for this technique need regular maintenance and upgrading. Thus here we tend to plan an automatic railway gate management (i.e., railway gate operated while not gate keepers system during this project [5].

Previous work has done by most of the authors may solely concentrate in avoiding of human lives from death by posing remote-controlled railway gate gap and shutting, after all it's necessary, so during this paper at the side of established ideas in grade crossing, work has moved in well direction to require live in crossing of individuals from plat kind to plat kind once train departure the station [6].

Presently no grade crossing in India is automatic. Those of that's manned desires an enormous labor price of roughly Rs.2450 crores once a year [7].

The existing system in Indian Railways bank on the signal system that was evolved to keep up the safe operating of the trains [8].

Limitations of the Existing System

- This system does not provide real-time tracking since eachstation is located at least 1 km apart in cities and 10-20 kmapart in remote places.
- Unmanned railway crossings are the spot for this kind ofmishaps. The existing technology does not hold a clue toprevent this [9].

III.PROPOSED SYSTEM

The accidents at unmanned level crossings and collision of trains running on same track unit the foremost vital accidents in railways that causes important human relation and injury to coach. Thusit's planned to develop a fail proof system to avoid such accidents. If no obstacle is detected then the server will issue command to shut the gate with an alarm/siren. In addition to automatic unmanned gate closing, the bars of collision between a pair of trains running on same track additionally are going to be enforced. Upon receiving the info regarding the gap of previous train, the speed of the train is mechanically decreased orincreased or if the gap is implausibly less the train is stopped [10].

When server receives the entire track information it'll calculate the calculable time of train to succeed in following level crossing. But that does not limit the system to predict the future time course of train. Hence, this methodology will build this technique autonomous and freelance of the External factors inflicting the delay [11].

So we tend to propose a system of automation using a pair of .45GHZ active (RFID) identification to detect the trains and thus operate the railway crossing. This technology that works in real time has features like frequency hopping, license free.

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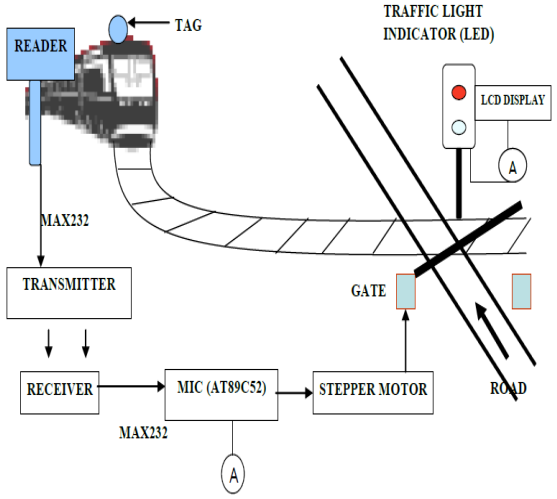

Fig.2: General Architecture of unmanned level crossing

The general architecture of unmanned level crossing is shown in figure-2. Now let us see each blocksof this system the way it works to produce efficient opening and closing of the gate using real time architecture.
This system (HP RFID) divided into five parts that's given below,
1. Positioning of RFID tag
2. Positioning of reader
3. Identification of train
4. Data communication process
5. Embedded control

3.1. Positioning of RFID Tag

The tag should be mounted on the surface of train specified it's simply detected by the reader and it should be created certain that the reader on any account doesn't miss the tag. The perfect position would get on the top of the train within the front engine. However since a pair of.45GHZ will go through several materials as well as metals and other opaque objects, it may be placed within the train. Another tag may be placed on the opposite side of the train so that even though one tag fails (though the chance is extremely low), the reader will detect the opposite train.

3.2. Positioning of RFID Reader

The reader is placed adjacent to the track mounted on a pole far (approx.7km) away fromthe gate (Fig-3). There's additionally another reader fastened on the opposite facet of the gate far away (approx.7km). The reader ought to be placed well aloof from the gate. Thus we tend to selected 7km considering the factors likeclosing the gate, alarm before closing and transmission delay.

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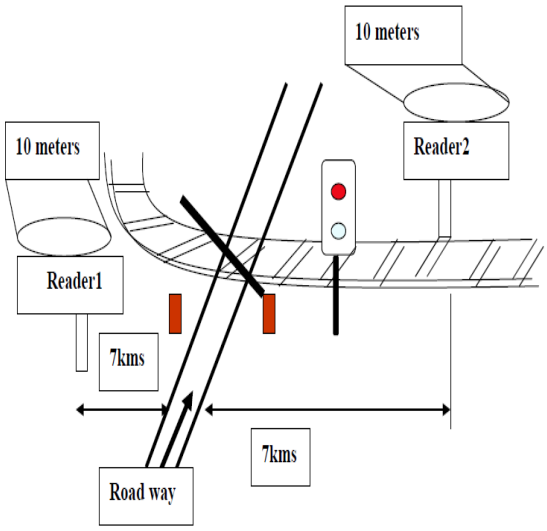

Fig.3: Positioning of RFID reader Architecture

Since the reader can detect a long distance we can safely place it away from the track on a tall polesuch that it is away from reach of stray animals. Reader used in this system detects unto 10 meters.

3.3. Identification of Train

The reader powers an antenna to get an RF field. The reader emits clock pulses. Once the tag passes through the sector of the reader, the tag picks up these clock pulses.

The tag then responds to the signal.The tag contains a singular code referred to as EPC (Electronic Product Code). EPC may be coded as ETCcode (Electronics Train Code) for convenience. Just like EPC code; ETC code has four blocks that has two parts particularly train symbol and position symbol. This symbol is employed to search out the name of the train andthe position symbol is employed to spot the aspect and compartment within which the tag is present and additionally the direction within which the train is traveling. Example of ETC is

1111101 00111 000001

Header Train codeCompartmentSide

But advanced readers will observe the direction of movement of any tag even while not this code (example: readers oversubscribed by tag master company). The tag sends this distinctive ID to the reader.

3.4. Knowledge method multidimensional language

Figure-4 Shows however the information flow through numerous parts during this system. Initially once the tag approaches the station, the reader 1 picks up the signal from the tag. I.e. the tag sends a singular ID to the reader.

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Once the train passes far away from the gate reader 2 picks up the signal from the tag. Once a reader detects a tag, this signal is passed to the micro-controller (AT89C52) placed near the gate through the communication interface. Data the info the information} is compared with predefined knowledge that claims that train passes inside that} track and which direction. During this system the reader is directly interface to the microcontroller AT89C52 through MAX232.

But in real time since the signal ought to be transmitted for long distance, reader is connected to a RF transmitter that sends the signal through wireless to the receiver. The receiver is connected to the microcontroller through RS232 interface. There could also be extra choices like connecting many readers across many gates across space a neighborhood} space network (LAN). As all are single manner transactions we have a tendency to tend to use constellation.

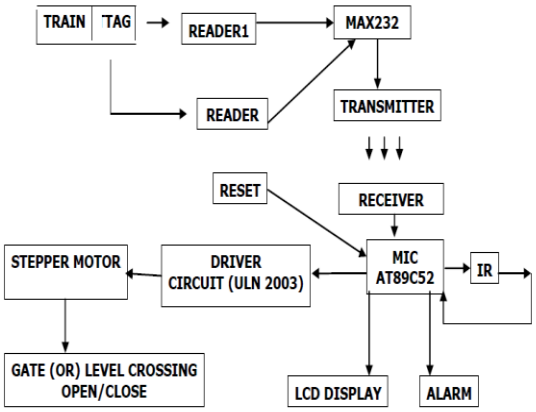

Fig.4: knowledge method flow diagram for unmanned level crossing

This is terribly helpful because the railway grade crossing will be brought beneath a centralized management by controlling it with one laptop. Additionally by this feature the safety is increased. For this several readers are connected to one laptop. Once the laptop received the information the laptop is aware of the gate that ought to be activated and now we have a tendency to use wireless communication to activate that exact receiver. Every receiver is tuned to a selected frequency. The laptop is connected to the transmitter through MAX232 port. This transmitter sends signal to theparticular receiver and this receiver is connected to the microcontroller through MAX232 port.

3.5. Embedded Control

Once the receiver receives the data with the help embedded system (hardware and software). The received information is checked and compared with the information that's given by user. Once this information is found to be correct, then the management is transferred to loud speaker (buzzer). Alongside the siren there's additionally red light warning light-emitting diode to alert the road users. The gate open/close is additionally indicated by a 16*2 show LCD display.

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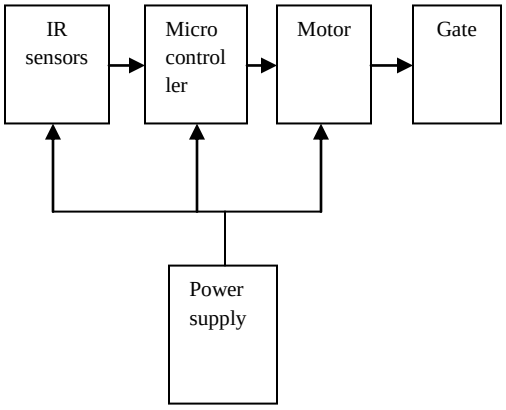
After minimum of 1 minute, the gates are going to be automatically closed. Equally the gate can even be opened. It's done using Stepper Motor. In real time hydraulic system will be used. So we tend to avoid needless accidents happening within the crossway. The most condition here is to research a way to avoid accident if somebody is stuck in middle [12].

Block Diagram Description



- The arrival of train is detected by the sensing element placed on either side of the gate at about 5km from the level crossing.
- Once the arrival is detected, the detected signal is distributed to the microcontroller.
- Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates.
- The departure of the train is detected by sensors placed at about 1km from the gate.
- The signal concerning the departure is distributed to the microcontrollers that successively operates the motor and open the gates.

Features of microcontroller

The AT89C52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

Sensors used in motion detectors:

- Ultrasonic
  Sends out pulses of ultrasonic waves and measures the reflection off a moving object.

- Microwave

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Sensor sends out microwave pulses and measures the reflection off a moving object. Similar to a police radar gun.

- **Infrared sensors**

Two IR sensor pairs are used for transmitting and receiving signals.

IR Circuits

This circuit has two stages:

- IR Transmitter

The transmitter unit consists of an infrared LED and its associated circuitry. The IR LED emitting infrared light is put on in the transmitting unit. Infrared LED is driven through transistor.

- IR Receiver

The receiver unit consists of a sensor and its associated circuitry. In receiver section, the first part is a sensor, which detects IR pulses transmitted by IR-LED.

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Whenever a train crosses the sensor, the output of IR sensor momentarily transits through a low state.
As a result the monostable is triggered; a short pulse is applied to the port pin of the microcontroller.

Stepper motor

A stepper motor could be a brushless, synchronous motor which will divide a full rotation into an outsized variety of steps.
The motor's position may be controlled exactly with none feedback mechanism, as long because the motor is fastidiously sized to the appliance.
The stepper tutorial deals with the fundamental finish drive electronic equipment for stepping motors. This electronic equipment is focused on one issue, change the present in every motor winding on and off, and dominant its direction [13].

Advantages of Proposed System

- High and long read range
- Accuracy (less than 0.001% missed or erroneous reads)
- Automatically detect the train
- Lower operating cost and No line of sight
- Less sensitive to electromagnetic interference, vibration, shock, temperature
- Real time information processing

IV.CONCLUSION

The accidents are avoided at places where there is no person managing the railway crossing gates. Here we use the stepper motor to open and close the gates automatically when it is rotated clockwise or anticlockwise direction. When the train arrives in a particular direction the transmitter IR senses and generates appropriate signal, then at the same time the receiver IR receives the signal and generates an interrupt.High performance Radio Frequency Identification (RFID) system was designed for automation ofunmanned level crossings in Indian railways. By automating the level crossings the number of accidents in thelevel crossings can be brought almost near to Nil. When the trainapproaches near the railway level crossing the gate arm closes automatically and when the train passes, the gatecloses automatically.

REFERENCES

[1]. Skolnik M.I -*"Introduction to Radar Systems"*, 3rd Edition. New York, McGraw-Hill, 2001.
[2]. F. Guler and M. Akad M. and M. Ergun, Turkey railway asset management system in Turkey: A GIS application", FIG Working Week 2004, Athens, Greece, 2004.
[3]. P. Kumar, V. Singh., and D. Reddy, Advanced traveler information system for Hyderabad city, Proc. IEEE Transactions on Intelligent Transportation Systems, Hyderabad, India, 2005.
[4]. F. Hegyi and A.K. Mookerjee, GIS and GPS based asset management for road and railway transportation systems in India", Map India, 2013.
[5]. J. Banuchandar, V. Kaliraj,P. Balasubramanian, S. Deepa, N.Thamilarasi "automated unmanned railway level crossing system" International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.1, Jan-Feb 2012 pp-458-463 ISSN: 2249-6645.
[6]. Acy M. Kottalil**,** Abhijith S, Ajmal M, Abhilash L J, Ajith Babu: "Automatic Railway Gate Control System", Vol.3, February 2014.
[7]. Ahmed Salih Mahdi. Al-Zuhairi, "Automatic Railway Gate and Crossing Control based Sensors &Microcontroller", InternationalJournal of Computer Trends and Technology (IJCTT) –Volume 4, Issue7, July 2013.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

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(An ISO 3297: 2007 Certified Organization)

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[8]. Indian Railways, Signaling notes.
[9]. Shi-Lu Dai,Hai Lin, Shuzhi Sam Ge " Scheduling and control codesign for a collection of networked control system with uncertain delays" IEEE Transaction ofcontrol systems technology, vol. 18, No 1, january2010.
[10]. "Cost effective system for railway level crossing protection" konkan Railway Corporation limited.Special Issue on NDT of Rails 47(6) 346-353 (2005).
[11]. H. N. Arvind, B. Paul, B. Ralph, M. Nadia, B. Giovanni and L. Antonio, "Railway Level Crossing Obstruction Detection Using MIMO Radar," in IEEE, Manchester, UK, 2011.
[12]. Krishna, ShashiYadav and Nidhi, "Automatic Railway Gate Control Using microcontroller", Oriental Journal Of Computer Science & Technology, Vol.6, No.4, December 2013.
[13]. The 8051 Microcontroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, Janice Gillispie, RolinD.Mckinlay.