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OBJECT DETECTION AND COLLISION AVOIDANCE IN RAILWAYS USING GSM

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Abstract : In this project the arrival of the train near railway gate is detected by IR based sensor system. This information is feed to micro controller which gives signal to gate motor through relay in same way the train departure from the gate is also detected by the same type IR sensor and gate motor open process is carried on. In train engine object in the track also detected by IR sensor consequently train stopped and information is taken to responsible person by GSM.

Key words: Railway, GSM & Detection.

1. INTRODUCTION

India is the country which having world's largest railway network. Over hundreds of railways running on track every day. As we know that it is surely impossible to stop, the running train at instant in some critical situation or emergency arises. Train accidents having serious repercussion in terms of loss of human life, injury, damage to railway property. These consequential train accidents include Collisions Derailments, Fire in Trains, and Collisions of trains at Level Crossings. Our country is a progressive country. It has already enough economical problems which are ever been unsolved. To avoid all these things some sort of automatic and independent system comes in picture. There are mainly two types. They are manned level crossing and unmanned level crossing. Manned level crossing is classified into special Class, A Class, B Class, C Class. Unmanned level crossing is classified into C Class, D Class. Railways being the cheapest mode of transportation is preferred over all the other means. When we go through the daily newspapers welcome across many railway crossings. This is mainly due to the carelessness in manual operations or lack of workers. Using simple electronic component, we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed at a certain distance from the gate which detects the approaching train and accordingly controls the operation of the gate. When the wheels of the train move over both tracks are shorted to ground and this acts as a signal to the microcontroller indicating train arrival and also indicator light has been provided to alert the motorists about the approaching train.

1.1 OBJECTIVES

In this project the arrival of the train near railway gate is detected by IR based sensor system. This information is feed to microcontroller which gives signal to gate motor through relay. In same way the train departure from the gate is also detected by the same type IR sensor and gate motor open process is carried on. In train engine ,object in the track also detected by IR sensor consequently train stopped and information is taken to responsible person by GSM.

2. LITERATURE SURVEY

S.NO	JOURNALS NAME & YEAR	TITLE	TECHNOLOGY	DRAWBACK
	International	Object	Radio	In this method
1	Journal of Engineering and technology science and Research - May - 2018	Detection and collision avoidance with train using GSM	Communication technology	It does not receive inputs from railway control system.
2	International Journal of Recent technology and Engineering Research - July - 2019	Train collision avoidance and crack detection using GPS	Zigbee technology	Shorter range of communication.
3	International Journal of research in electrical, electronic and instrumentation	Wireless based collision avoidance system for railway sectors	Wireless technology	Monitoring of the track is very difficult.
4	International Journal of Innovative and control engineering - Jun - 2018	Train collision avoidance system by using RFID and GSM technology	RFID technology	Delay in tag reading
5	Journal of Engineering and technology - May - 2018	Railway Management system	using GSM	Management is not Efficient.

3. EXISTING SYSTEM

3.1 SYSTEM ANALYSIS

The existing system uses traditional telecommunication systems like Walkie-Talkies and other communication devices. Due to railway personal carelessness it fail sometimes. The Anti-Collision Device (ACD) is also another method introduced by Kankan railways. The ACD uses radio modems for communication and receive inputs from GPS through satellites. Indian Railway has implemented Anti Collision Device (ACD) patented by Konkan Railway. The ACD system is based on GPS for positioning and track detection. This had its own inherent problems as it is based on GPS- Standard Positioning, GPS service or coarse acquisition. The best possible horizontal accuracy is 10m. This is inadequate for detection of rail tracks separated by a distance of 10–15 feet.

The ACD system though in use with the Indian Railways, has its own inherent problems in Station Sections due to its design concept of using GPS for track detection that is not viable. Shadowing (near mountains) is a problem in GPS.

3.2 WORKING

This project is based on avoiding train collisions through android system integrated with ultrasonic and MEMS sensor inbuilt in the train. Emergency alerts can be sent through phones or other communication devices. Konkan Railways has developed Anti-collision devices inbuilt with ZigBee and Infrared based sensor concepts. The ACD system is based on GPS based positioning and track detection. This has inherent problems as with GPS service and course acquisition, the best possible accuracy is 10 m. This is inadequate for detection of rail tracks separated by a distance of 10–15 feet. Vibration sensors are used to detect a object in railway track to identify a objects in case objects are detected it may alert a loco pilot and automatic gate close and open system also implemented using IR (Infrared Sensor). Both of the sensors are implemented for travelers safety journey for railways. ACD does not even have DGPS, differential GPS that gives accuracy up to 2.5m. It has limited range of signal covered Hence these drawbacks can be overcome in our project by using android based control system with latest technology to avoid collision and it is operated through the GPS /GSM concepts.

4. HARDWARE REQUIREMENTS

4.1 INFRARED SENSOR:

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region. The wavelengths of these regions and their applications are shown below.

Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic Mid infrared region — 1400 nm to 3000 nm — Heat sensing Far infrared region — 3000 nm to 1 mm — Thermal imaging The frequency range of infrared is higher than microwave and lesser than visible light. For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications. An infrared sensor emits and/or detects infrared radiation to sense its surroundings.

The working of any Infrared sensor is governed by three laws: Planck's Radiation law, Stephen – Boltzmann law and Wien's Displacement law. Planck's law states that "every object emits radiation at a temperature not equal to 0 degree kelvin. Stephen – Boltzmann law states that "at all wavelengths, the

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total energy emitted by a black body is proportional to the fourth power of the absolute temperature". According to Wien's Displacement law, "the radiation curve of a black body for different temperatures will reach its peak at a wavelength inversely proportional to the temperature".

The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

Optical lenses made of Quartz, Germanium and Silicon are used to focus the infrared radiation. Infrared receivers can be photodiodes, phototransistors etc. some important specifications of infrared receivers are photosensitivity, directivity and noise equivalent power. Signal processing is done by amplifiers as the output of infrared detector is very small.

4.2 PCB DESIGN

A printed circuit board has pre-designed copper tracks on a conducting sheet. The pre- defined tracks reduce the wiring thereby reducing the faults arising due to lose connections. One needs to simply place the components on the PCB and solder them.

5. MATERIALS REQUIRED IN PCB DESIGNING

Over Head Projector sheet (known as OHP sheets) or a wax paper.

Laser Printer.

Electric Iron.

Steel wool.

Two plastic trays.

Copper board/ PCB (Eg: paper phenolic, glass epoxy, FR4, FR10, etc.) Black permanent marker.

Etching solution (Ferric chloride).

Drill machine.

STEP 1

Prepare a layout of the circuit on any commonly used PCB designing software. A layout is a design which interconnects the components according to the schematic diagram (circuit diagram).

Take a mirror image print of the layout on the OHP sheet using a laser printer. Make sure that the design is correct with proper placement of the Components.

STEP 2

Cut the copper board according to the size of layout. A copper board is the base of a PCB, it can be single layer, double layer or multilayer board. Single layer copper board has copper on one side of the PCB, they are used to make single layer PCBs, it is widely used by hobbyist or in the small circuits. A double layer copper board consists of copper on both the sides of the PCB.

These boards are generally used by the industries. A multilayer board has multiple layers of copper; they are quite costly and mainly used for complex circuitries like mother board of PC.

STEP 3

Rub the copper side of PCB using steel wool. This removes the top oxide layer of copper as well as the photo resists layer if any.

STEP 4

Place the OHP sheet (wax paper) which has the printed layout on the PCB sheet. Make sure that the printed/mirror side should be placed on the copper side of PCB.

STEP 5

Put a white paper on the OHP sheet and start ironing. The heat applied by the electric iron causes the ink of the traces on the OHP sheet to stick on the copper plate exactly in the same way it is printed on the OHP sheet. This means that the copper sheet will now have the layout of the PCB printed on it. Allow the PCB plate to cool down and slowly remove the OHP sheet. Since it is manual process it may happen that the layout doesn't comes properly on PCB or some of the tracks are broken in between. Use the permanent marker and complete the tracks properly.

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STEP 6

Now the layout is printed on PCB. The area covered by ink is known as the masked area and the unwanted copper, not covered by the ink is known as unmasked area. Now make a solution of ferric chloride. Take a plastic box and fill it up with some water. Dissolve 2-3 tea spoon of ferric chloride power in the water. Dip the PCB into the Etching solution (Ferric chloride solution, Fecl3) for approximately 30 mins. The Fecl3 reacts with the unmasked copper and removes the unwanted copper from the PCB. This process is called as Etching. Use pliers to take out the PCB and check if the entire unmasked area has been etched or not. In case it is not etched leave it for some more time in the solution.

STEP 7

Take out the PCB wash it in cold water and remove the ink by rubbing it with steel wool.

The remaining area which has not been etched is the conductive copper tracks which connect the components.

STEP 8

Now carefully drill the PCB using a drilling machine on the pads.

STEP 9

Put the components in the correct holes and solder them. Finally, the PCB design all steps are completed. So after we are solder to this board fix with the components.

6.ADVANTAGES

Reduces chances of human error.

Less time consuming.

No human resource is required.

Safety and quality of services Accident avoidance

7.DISADVANTAGES

To establish the entire network, it is quite a costly task. Since these are the issues of the government cost, it doesn't matter a lot.

The MC board is a delicate device so it has to be handled carefully.

8. APPLICATION

8.1. AUTOMATIC CRACK CHECKING:

The vehicle draws power from the battery. The optical sensor is used to detect the crack in the railway track. Suppose any crack in the track, the vehicle automatically stop and activates the GSM transmitter circuits.

8.2 CORDLESS IDENTIFICATION TO THE STATION MASTER:

The unit can also be used to intimate the nearest railway station. The GSM receiver circuit is fixed in the room of the station master.

9. CONCLUSION

A new approach for improving safety at LCs and train collision on IR has been suggested. Formats have been given to maintain records of LC inventories accident/incident reports.

A regular assessment of safety performance should be done. This approach should be able to bring down the rising trend in accidents at LCs and train collision accident. This project uses the present infrastructure of railways e.g. present signaling method and meets all the requirements to have an automatic controlling of the railway traffic. It provides the supervision and control system provide the mean for real time inspection review and data collection of the purpose of maintenance on the movable and fixed facilities for the guarantee of operation safety and maintenance efficiency as well as the safety appraisal decision-making system based on the share of safety data. The great achievement of modern technologies in each relevant field and the technological development of the railway industry itself have provided railway with feasibility to win higher service quality and faster speed.

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