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# Sensor based identification system for Train Collision Avoidance

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***Abstract*—The accidents between trains are increasing due to negligence of intelligent techniques implemented in the trains and improper control signaling from the Train Traffic Control Station (TTCS). The Train Tracking Chip (TTC) modules and Train Identification Chip (TIC) modules are using to sense the presence of trains on the same track. The signals from the moving train are transmitted through the GSM network to the stationary trains on the same track and to the TTCS. By using this method one can determine whether the trains were heading for Rear-end collision or Head on collision. The TTCS transmits control signal to stop or move the trains.**

***Keywords: Train Collision Avoidance, GSM, LabVIEW, Train Identification Chip, Train Tracking Chip.***

## I. INTRODUCTION

The Railway network is the world's biggest transport system. The Indian Railways is one of the largest railway networks in the world. There have been many accidents occurs in the railway network system. Most of the accidents occurred due to the collision between the trains and detrains. The proposed system is used to predict that kind of collision between trains and prevents them from occurring. By preventing these kinds of accidents more number of lives can be saved. Because of these cases in the railways we considered collisions are the most dreaded accidents. It is very difficult to stop such a collision, because of speed of the train, which need a lead distance to stop. Collision occurred by two ways due to human error. The two types of Collisions are,

1. Head - on collisions
2. Rear– end-collisions

As in the proposed model, collision occurred by the above stages can be predicted and controlled. Those head on collision and rear end collision are happening due to the human carelessness therefore these conditions are more in our country. The Rail Safety Act regulates the safety of most rail transport including heavy and light rail systems, therefore most public and private sidings, each tramways and tourist and heritage rail operations. The main railways regulated by the Act include the Melbourne heavy rail system, the Melbourne tram and light rail network, Victoria's regional standard and broad gauge rail networks and regional tourist and heritage railways. Thus the Railways excluded from coverage under the Act include railways in mines, amusement and theme park railways and slipways. This railway has certain duties to protect and to prevent destruction in their path. But still there is lot of train collisions are occurring due to lack of awareness.

## II. EXISTING SYSTEM

As in the existing system, the following shows some existing technics. The Anti-Collision Device (ACD) is a self-acting Microprocessor-based data communication device designed and developed by Kankan Railway. The system consists of Loco ACD with a console (message display) for the driver (in each Loco Engine), Guard ACD with remote (fitted in Guard Van), Station ACD with console (fitted in Station Masters' Cabin), Manned and Unmanned Gates ACD with hooters and flashers (in each location) and Repeater ACDs (fitted at locations having obstructions in radio communication such as hilly areas) which work in concert to prevent the following kinds of collisions and accidents like-Head on collisions ,Rear end collisions ,Collisions due to derailment, Collisions at the level crossing gates .

Train accidents can happen very often due to safety violations which results from human errors or limitations in the operation of the existing system and also due to equipment failures'. As by the project is fully concentrating on avoiding train collisions and ensures passengers safety through android system integrated asor based control system inbuilt in the train. Emergency alerts can be sent through traditional tele-communication systems such as Walkie-Talkies or other communication devices. However, Collision avoidance systems using IR sensor and anti-collision device are being

used by the Railway sector is still facing some problems due to the consideration of some factors such as cost-effectiveness, despite it is increasing the amount spent on implementation of the devices. Currently, to some extent the Konkan Railways has put efforts to provide train safety through Zigbee and Infrared based sensor concepts. Even though it has disadvantages such as limited range of signal covered and difficulty in their implementation in the real world it is still being used. Here RTOS is ported with ARM7 which deal with much more complicated tasks. Our work will be accepted worldwide because of its effectiveness and its robust communication features.

## III. PROPOSED SYSTEM DESIGN

In the proposed system the Train Identification Chip (TIC) inbuilt with GSM (Global System for Mobile Communication) module is used to communicate between the train and the Train Traffic Control Station. The TIC in the train and TTC on track at certain distances can make the assurance of train safety at each check point crossings. In the TTC [Train Tracking Chip] we have fixed the scratch pad. This scratch pad is the sensor which will give necessary signals to tracking of the train. The scratch pad is done by defining 9 pins, this pins are spring type will access the moving train. The pin holds the data about the checkpoint, train track number and direction of the moving trains. The total TTC module is placed in the railway track.

The TIC module is a module which is placed in the moving trains which consists a scratch reader. This GSM has the link between the train and the control station and vice versa. This module in the train when moving, the scratch reader will scratch the scratch pad in the track. This will retains at every checkpoints. In each checkpoint the details of the trains are communicated to the control station therefore the collision between the trains can be prevented. The messaging between the Train and TTCS is controlled by a PIC Microcontroller.

The Fig.1 explains the function of the TIC and TTC module. In the Fig. 1, it consists of two modules TTC and TIC this module is combined to train tracking module. The TTC module is the module which consists of sensor called “Scratch Pad”. This is the Sensor which is placed in the track. In the Scratch Pad the train track number, checkpoint number and the direction are fixed. The next module to the TTC is the TIC module, which consists of sensor called Scratch reader. The TIC module also consist microcontroller, LCD display and GSM module. The whole TIC module is placed in the moving Train. In the TIC module, GSM is used to transmit and receive information between TTCS and TIC.

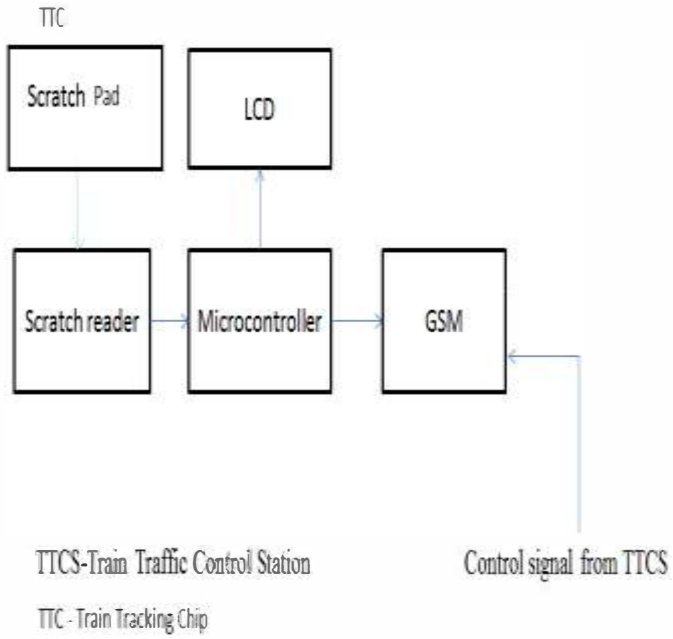


Fig.1 Block diagram of TIC and TTC

## IV. MODULES

To realize the collision detection unit system we require following Modules

1. TTC [Train Tracking Chip]
2. TIC [Train Identification Chip]
3. TTCS [Train Traffic Control Station]

### *A. TTC [Train Tracking Chip]*

The TTC module is placed in the track, where the sensor is placed to detect the position of the train. In the TTC module, sensor named scratch pad is used, were it is used to detect train. The dynamic moving of the train is possibly very fast. The train detection is done through different sensors, but it relates certain time variation. The time variation can cause problems in the detection of the train. In such case we come across certain collision between trains. This problems can be avoided TTC which built using scratch pad sensor for the detection of the train easily.

The scratch pad sensor consists data pins. This data pins are certainly used for the detection of the train, therefore it identifies it location, direction and track.

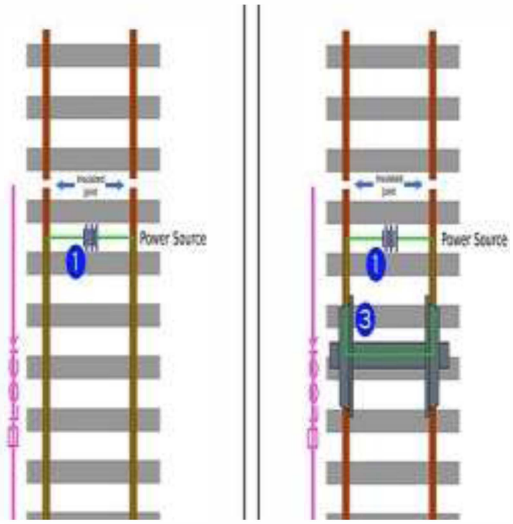


Fig. 2 TTC Module

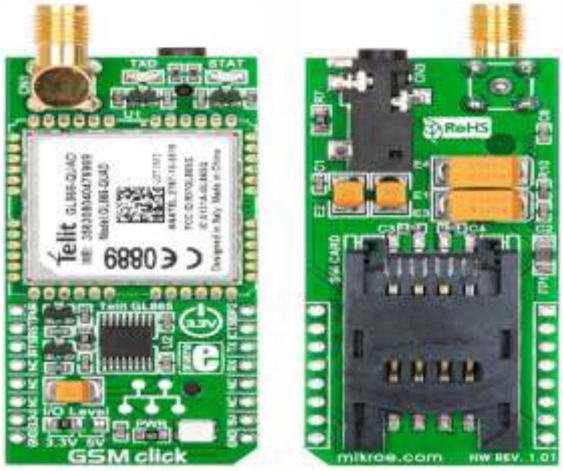


Fig. 3 GSM Module

The total TTC module is placed in the external environment i.e. in the railway track.

*B. TIC [Train Identification Chip]*

The TIC module is placed in the train. The tracking of the train can be done by the scratch reader which is placed just below the train. The TIC module gets the information about the track and the checkpoint from the Scratch pad when the scratch reader scratches the scratch pad. The identified information is to be collected and to be transmitted by micro controller with GSM module to the TTCS. The PIC microcontroller is used for this purpose. This micro controller gets the control signals to the scratch reader and transfers the data to the control station by GSM.

*1) GSM [Global System for Mobile Communication]:*

\ GSM is a cellular and wireless network, which means that cell phones connect to it by searching for cells in the immediate vicinity the coverage area of each location varies according to the implementation of the environment. The base station antenna is installed on a rooftop level. The GSM module creates connection between the train and the control station. The GSM is used to transmit and receive the information between the TTCS and TIC. The microcontroller is connected with the GSM module, so that the information from the TIC is transferred to control station. The working of the module is simple. That is, the scratch reader gets the information when scratches the scratch pad. This information is get to the PIC controller PIC16F877A, and this controls the GSM and scratch reader through control signal. The GSM coding is implemented in the PIC16F877A controller.

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile perspective, a GSM modem looks just like a mobile phone without the display and the keyboard.

The Fig. 3 shows the GSM Module used in Project. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

*C. TRAIN TRAFFIC CONTROL STATION*

The Train Traffic Control Station is the main base station which predicts and controls the flow of traffics of the train. The Train Traffic Control Station is build using LabVIEW. The TTCS is very much essential to train collision avoidance. The control station consists of GSM module and it has the display to view the information regarding trains. The TIC sends the information to the TTCS through GSM. The TTCS will do the calculation between the trains and predict the collision between the trains. The TTCS can predict the both kind of collisions (Rear end collision and Head on collision).

The TTCS receives the train number, track number, check point and direction. From the train number, track number, check point and by using the specialized algorithm it can predict the collisions between the trains. Then from the predicted results the train collision will be avoided.

## V. SOFTWARE IMPLEMENTATION

The TTCS module was built using GSM and a PC. The PC system has software specially built to detect the collision.

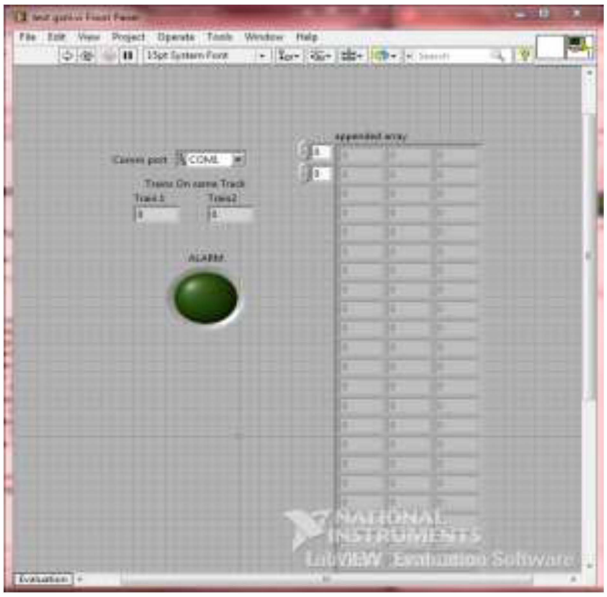


Fig. 4 TTCS using LabVIEW

In the fig.4 TTCS using LabVIEW, shows the front panel of TTCS. We use the LabVIEW software for the implementation of the control station. LabVIEW get together the creation of user interfaces into the development cycle. LabVIEW programs are called virtual instruments (VIs).in the LabVIEW Controls are inputs, they allow a user to supply information to the VI. Indicators are outputs, they indicate, or display, the results based on the inputs given to the VI. The structures and functions are found on the Functions palette and can be placed on the back panel. Collectively controls, indicators, structures and functions will be referred based upon the block used. A key feature of LabVIEW is the extensive support for interfacing to devices such as instruments, cameras, and other devices. Users typically interface to hardware by either writing direct bus commands (USB, GPIB, Serial...) or using high-level, device-specific, drivers that provide native LabVIEW function nodes for controlling the device

## VI. PERFORMANCE EVALUTION

In this project, train collision avoidance system has been designed ,simulated and tested. The simulation has been done using the LabVIEW and testing has been carried out using the developed prototye. The communication between the microcontroller and GSM Module is tested. The flow of LabVIEW which is used in the TTCS is also tested for the respective messages from the TIC.

## CONCLUSION

It has been estimated that if the system is implemented in the railaway networks, train accidents can be prevented. This collision between trains is calculated and colliding trains were alerted. By this project train collision is stoped. Many human lives and many properties can be saved if this system is implemented. The scenario of accident in Trains due to collision will be controlled with the help of this project.

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