# Wireless Communication System For Railway Signal Automation At Unmanned Level

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**Abstract—** The accidents at unmanned level crossings and collision of trains running on same track are the major accidents in railways which cause heavy human causality and damage to train. Hence it is proposed to develop a fail proof system to avoid such accidents.

In this project, it is proposed to develop automatic railway gate operation to prevent accidents at unmanned gate and automatic closure of unmanned gate. It is also developed to prevent collision of trains running on same track.

Automatic closure of unmanned gate reduces the time for which the gate is being kept closed and provides safety to the road users by reducing the accidents. 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 to a master control room via Zigbee / GSM MODEM. The operation is automatic and error due to manual operation is prevented and safety is assured.

**Keywords:** Zigbee/ GSM MODEM, IR Transmitter-Receiver.

## I. INTRODUCTION

The aim of the project is to develop an efficient train monitoring and protection system. A classification of accidents by their effects (consequences); e.g., head-on collisions, rear-end collisions, derailments. Head on collision; one type of train accident is when two trains collide front face with each other or train colliding on the same track from opposite ends called head on collision. Rear end collision; the other kind is when a train collides into the other that is in front of it, called a rear end collision. Derailments plain track; a train may derail on a simply straight track that may cause the train accident. Curves; derailment of a train is more common when there is a curve on the track causing an accident. Junctions; a train may also get derailed on a junction, which is the place where two tracks converge into one, or one diverges into two.

Accident contributors such as train visibility advance signs, active warning, driver behavior, driver distraction and risk taking have been identified as common human factors contributors to vehicle train grade crossing accident. Factor includes highway and railway characteristic are contributing factor to accident at RLC. The environmental factors are snow, heavy rain, fog, or blowing snow, which collision the train. The three main factors contributing to accidents at RLC is basic safety engineering studies, human factor, engineering factor, and environment factor. The taxonomy of railway intersection accident contributors was created to generate hypotheses and deduction about specific cases and common patterns of accident contributors.

## II. EXISTING SYSTEM

The status of the present Indian Railway is as follows:

- Presently railway-crossing gates are operated manually. At present scenario, in level crossings, a gatekeeper operates the railway gate normally after receiving the information about the train's arrival. When a train starts to leave a station, stationmaster of the particular station delivers the information to the nearby gate. The above said procedures are followed for operating the railway gates.

Sometimes the road traffic is so busy that it becomes impossible for the gatekeeper to shut down the gates in correct time In many remote areas, railway-crossing gates are open and no person is located for the operation of gates and hence leading to

accidents. Many times gates are shut down too early leading to wastage of time of people stuck at crossing.

• Presently as such no centralized system is there through which we can track the location of trains from any canter point. As trains cannot be centrally located, often more than one train runs on the same track in opposite direction leading to accidents.

• Presently in Indian Railway only semi automatic railway gate operation is followed in certain areas. Signals are located in the vicinity of the railway gate along with gate master board and a marker light. If barriers remain closed for excessive periods on crossings carrying a high volume of road and rail traffic, the build-up of road traffic will exceed the capacity of the crossing to safely discharge this build-up before the next train arrival at the crossing. A number of train accidents happened due to a manual system of signals between stations.

• Presently signals are controlled by means of interlocking system and for this system require regular maintenance and upgrading.

Hence here we proposed an automatic railway gate control (i.e., railway gate operated without gate keepers system in this project.

### III. PROPOSED SYSTEM:

The accidents at unmanned level crossings and collision of trains running on same track are the major accidents in railways which cause heavy human causality and damage to train. Hence it is proposed to develop a fail proof system to avoid such accidents. The unmanned level crossing is fitted with obstacle sensor and automatic gate closing mechanisms and Zigbee. The PC in the master control room will receive information via Zigbee from the train and continuously estimate the distance between the train and the unmanned gate.

When the train is nearing an unmanned gate, server will monitor the status of obstacle in the gate. If an obstacle is sensed then command will be issued to stop the train at a safe distance. If no obstacle is sensed then the server will issue command to close the gate with an alarm/siren. In addition to automatic unmanned gate closing, the prevention of collision between two trains running on same track will also be implemented. The PC in the master control room will receive information via Zigbee from all the trains running on

the same track and estimate the distance between two consecutive trains running on same track and transmit this information to corresponding train.

Upon receiving the information regarding the distance of previous train, the speed of the train is automatically decreased or increased or if the distance is very less the train is stopped.

### IV. HARDWARE REQUIREMENTS

A micro controller is an embedded chip consisting of a powerful CPU tightly coupled with fixed amount of memory (RAM, ROM or EPROM), various devices such as serial port, parallel port, timer/counter, interrupt controller, ADC, DAC, everything integrated on to a single silicon chip. It does not mean that any micro controller should have all the above said features on chip. Depending on the area of application for which it is designed, the on chip may not include some of the sections.
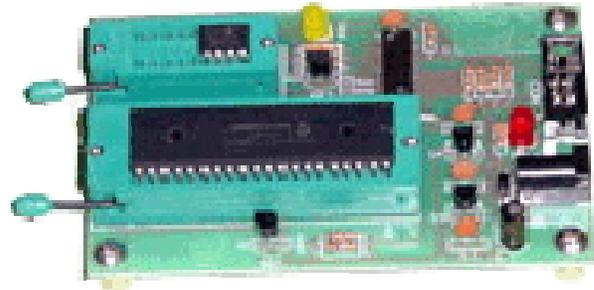
**Software Requirements**

**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 microcontroller's internal and external architecture; this includes:
  ▪ Interrupt Service Routines
  ▪ Reading from and writing to internal and external memories
  ▪ Bit manipulation
  ▪ Implementation of timers / counters
  ▪ Examination of internal registers

Standard C compiler communicates with the hardware components via the operating system of the machine but the C compiler for the embedded system must communicate directly with the processor and its components.

**CCS-C compiler**

- The CCS C Compiler was developed exclusively for the PIC® MCU - making it the most optimized compiler for Microchip parts.
- The compiler has a generous library of built-in functions, pre-processor commands, and ready-to run example programs to quickly jump-start any project. Drivers for real-time clocks, LCDs, A/D converters, and many more are innate features to the CCS C Compiler.
- The 24-bit compiler - PCD makes for easy migration from 8- bit processors up to 24-bit processors with minimal user interaction. PCD has a generous CCS math function library, Flash access functions and the full range of common built-in functions and preprocessor commands that emphasize the need for a C compiler.



Figure 1 CCS C Compiler developed by Custom Computer Services, Inc

There are several versions of compilers that represent the compatible families of Microchip ranging from 12-bit to 24-bit. Figure 2 shows the corresponding versions with the supported IC.



Figure 2 Versions Available for CCS C Compiler

This is a PIC programmer for programming PIC Microcontroller devices via PC parallel port which support several software such as EPIC Win, WinPic800, P18 etc. There are two indicators LED on PCB.



**Software that support this programmer**

There is several software that support this PIC programmer such as Epic Win, WinPic800, ProPIC18 etc. For each software can support different devices. For example Epic Win support PIC12F, PIC16F and some PIC18F and can be run on all windows.

But, Winpic800 support PIC12F,PIC16F, PIC18F including dsPic (when setting up hardware as ProPIC2) and ProPIC18 support PIC18F only and run on all window
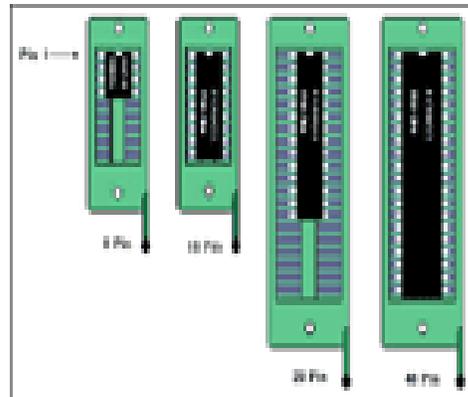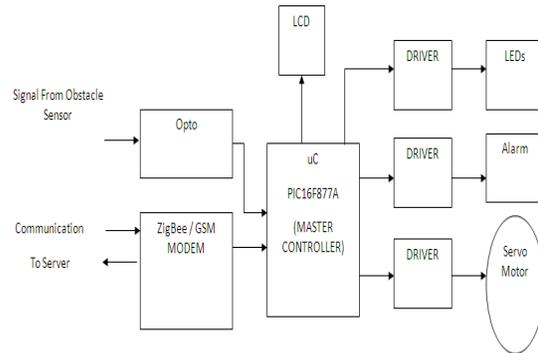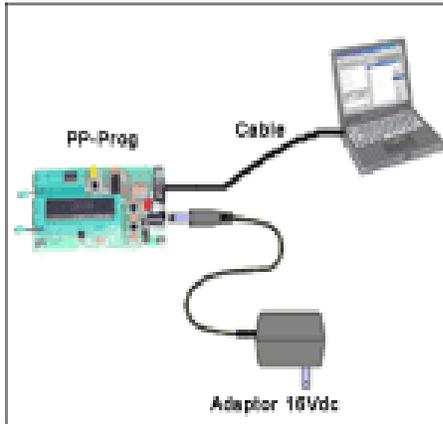
## V. PROJECT DESCRIPTION





Fig 6.1 : Block Diagram of the Hardware to Control Unmanned Gate

To use this project with winPic800 you must setting hardware as the following picture



The Power supply unit plays an important role in the device. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device. It is used to give the required voltage to IC for operating the device.

The unmanned level crossing is fitted with obstacle sensor and automatic gate closing mechanisms and Zigbee / GSM MODEM. Obstacle Sensor detects any hindrance on the level crossing of the moving train. After detecting the hindrance, the signal is passed to the adc of the microcontroller. Wireless communication is provided to pass the level crossing information to the train and the monitoring station.

HARDWARE OUTPUT AT UNMANNED LEVEL
CROSSING
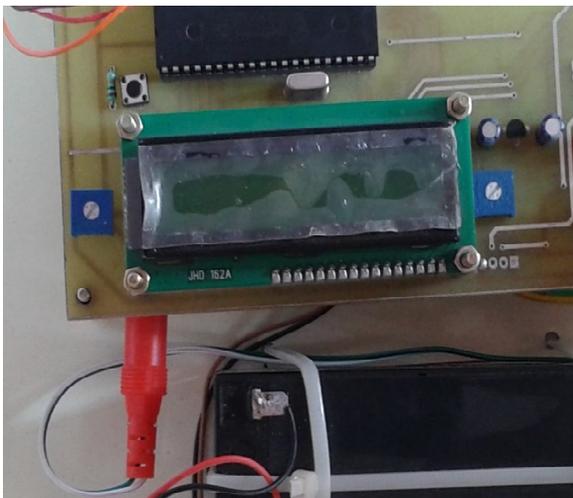


## VI. RESULTS AND DISCUSSION

The present existing system is manually and human controlled system, once the train leaves the station, the station master informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the depending on the timing at which the train arrives. Hence, if the train is late due to certain reasons, then gate remain closed for a long time causing traffic near the gates. No centralized system is available, presently signals are control by mean of interlocking and warning signs and signal device, which is totally semiautomatic system.

By employing the automatic railway gate control at the level crossing, the time for which it is closed is less compared to the manually operated gates and also reduces the human labor. This type of gates can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required. Since, the operation is automatic; error due to manual operation is prevented. And implementing the work railway system can be centralized which can control the accidents.

### Advantages

- Fast response
- Very economical and cost effective
- Does not degrade the existing safety level
- No cabling on the track required (which is more expensive and cumbersome)
- Health of the gate system is monitored by the Loco unit and any malfunction is noticed. Loco unit logs this information and downloads this information to the Station.
- Brings about improvement in rail traffic

## VII. CONCLUSION

Level Crossing protection systems is developed using microcontroller to give additional safety shield at manned and unmanned level crossings, through an audio-visual indication to road users. The automatic railway gate controller thus can be used in unmanned level crossings to reduce the occurrence of accidents. Since the design is completely automated 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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