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RAILWAY ELECTRIC LOCOMOTIVE WITHOUT LOCO PILOT AND CONTROLLED BY CENTRAL UNIT USING WIRELESS COMMUNICATION

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***Abstract*— The development and use of Driver Advisory Systems (DAS) is a topic of growing importance in research and industry today as railways face continuous pressure and challenge to reduce operating costs, improve energy efficiency, increase capacity and minimize environmental impact. DAS provide advice to driver aiming for optimized traffic flow and energy efficient driving. A centralized train control (CTC) unit is developed and a fast, reliable and loss less wireless communication system called Zigbee is used to establish interface between train and CTC. Here several numbers of trains can be connected and also can be monitored, controlled simultaneously without any data collisions. Another short range wireless communication is used between train and unmanned railway gate area, which closes the gate automatically with a buzzer alert while train arrives at a distant and opens automatically after train leaves from that area. Along with this technique, an ultrasonic wave based sensor is used to detect if any obstacle or human exists in front of the train. If happens, the sensor circuit detects it and stops the train step by step very quickly to save lives.**

Keywords*— Zigbee; IR sensor; Ultrasonic sensor ;L293d

I. INTRODUCTION OF ELECTRIC LOCOMOTIVE

An electric locomotive is a locomotive powered by electricity from overhead lines, a third rail or on-board energy storage such as a battery or fuel cell. Electric locomotives with on-board fuelled prime movers, such as diesel engines or gas turbines, are classed as diesel-electric or gasturbine-electric locomotives because the electric generator/motor combination serves only as a power transmission system. Electricity is used to eliminate smoke and take advantage of the high efficiency of electric motors, but the cost of electrification means that usually only heavily used lines can be electrified.

II. PROPOSED SYSYEM

The Embedded Technology is now in its prime and the wealth of knowledge available is mind-blowing. Embedded technology plays a major role in integrating the various functions associated with it. The proposed system greatly reduces the manpower, saves time and operates efficiently without human interference. The Train Section consists of two sensors. They are, IR Sensor, Ultrasonic Sensor, All the parameters to the nearby controlling area transmitted through a wireless transmission in the proposed system. In this project zigbee is used for monitoring the data from a remote computer. Centralized train control unit is developed and a fast, reliable and loss less wireless communication called Zigbee is used to establish interface between train and CTC. Here several numbers of trains can be connected and also can be monitored, controlled simultaneously without any data collisions. Another short range wireless communication is used between train and unmanned railway gate area, which closes the gate automatically with a buzzer alert while train arrives at a distant and opens automatically after train leaves from that area. This avoids (reduces) the accident percentage. Along with this technique, an ultrasonic wave based sensor is used to detect if any obstacle or human exists in front of the train. If happens, the sensor circuit detects it and stops the train step by step very quickly to save lives. The main thing is to transmit all the parameters to the nearby controlling area through a wireless transmission.

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A. BLOCK DIAGRAM OF CENTRALIZED TRAIN CONTROL

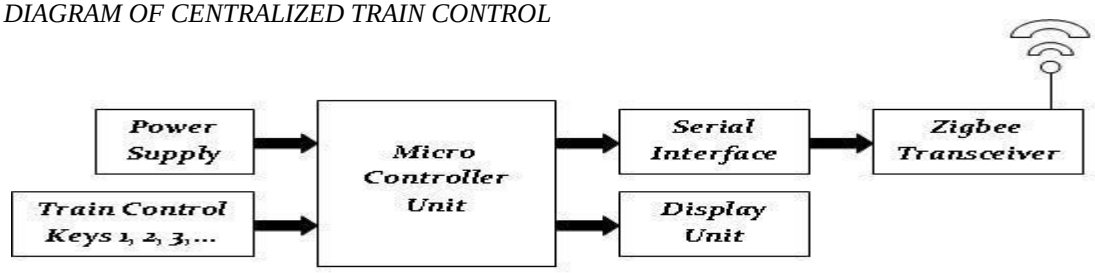

Figure 1 Block Diagram Of Centralized Train Control

B. BLOCK DIAGRAM OF TRAIN SECTION

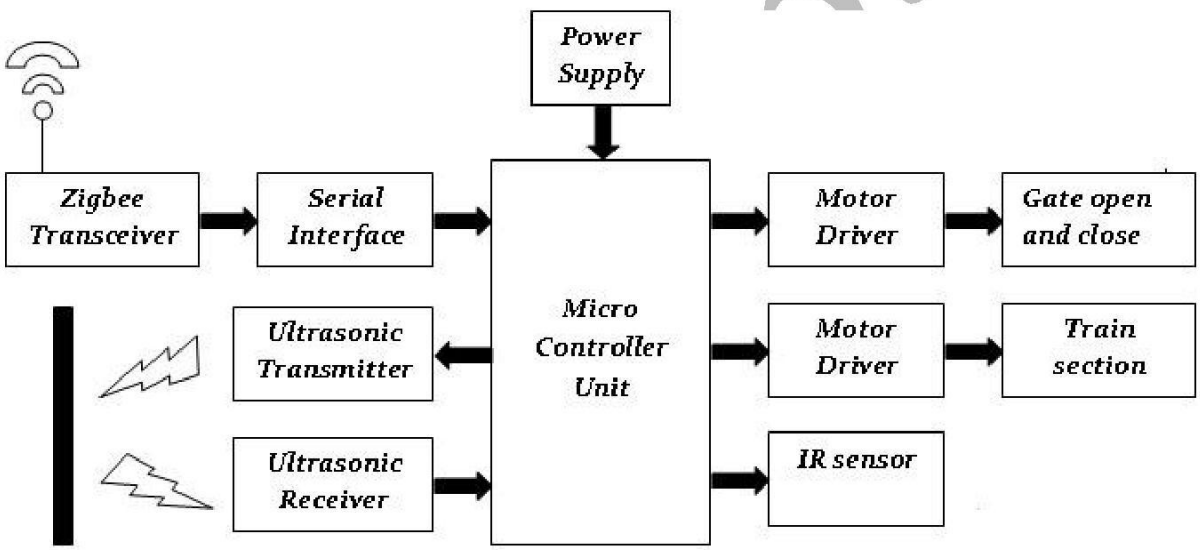

Figure 2 Block Diagram Of Train Section

C. BLOCK DIAGRAM OF AUTOMATIC RAILWAY GATE CONTROL

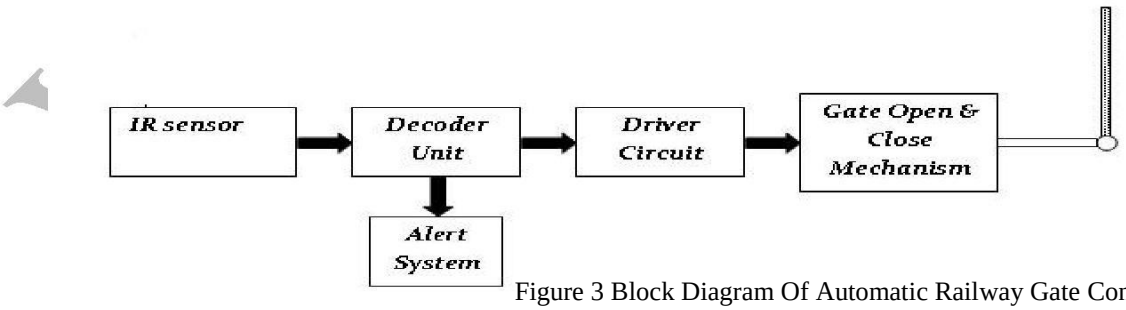

Figure 3 Block Diagram Of Automatic Railway Gate Control

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III. HARDWARE DESCRIPTION

A. 89S52 MICROCONTROLLER

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable

Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory pro-grammar. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

B. ZIGBEE DEVICE OVERVIEW

The MRF24J40MA is a 2.4 GHz IEEE Std. 802.15.4™ compliant, surface mount module with integrated crystal, internal voltage regulator, matching circuitry and PCB antenna. The MRF24J40MA module operates in the non-licensed 2.4 GHz frequency band and is FCC, IC and ETSI compliant. The integrated module design frees the integrator from extensive RF and antenna design, and regulatory compliance testing, allowing quicker time to market. The MRF24J40MA module is compatible with Microchip's ZigBee®, MiWi™ and MiWi P2P software stacks. Each software stack is available as a free download, including source code, from the Microchip web site http://www.microchip.com/wireless.The MRF24J40MA module has received regulatory approvals for modular devices in the United States (FCC), Canada (IC) and Europe (ETSI). Modular approval removes the need for expensive RF and antenna design and allows the end user to place the MRF24J40MA module inside a finished product and not require regulatory testing for an intentional radiator (RF transmitter).

C. UART

A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232.A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART or DUART combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously; these devices are called USARTs.Figure4.6 shows circuit diagram of MAX232.

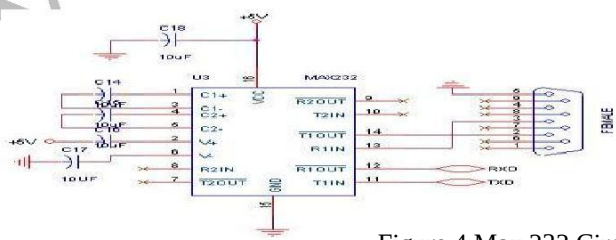

Figure 4 Max 232 Circuit Diagram

D. MAX 232

The **MAX232** is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible

digital logic circuits. TheMAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to +

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5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V. The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 µF in place of the 1.0 µF capacitors used with the original device.

E. IR SENSOR

Infrared (IR) radiation is electromagnetic radiation whose wavelength is longer than that of visible light (400–700 nm), but shorter than that of terahertz radiation (100 µm – 1 mm) and microwaves. Infrared radiation spans more than three orders of magnitude (roughly 700 nm to 300 µm). The IR range falls between the visible portion of the spectrum and radio waves. IR wavelengths are usually expressed in microns, with the lR spectrum extending from 0.7 to 1000 microns. Only the 0.7 -14 micron band is used for IR temperature measurement.

F. ULTRASONIC SENSOR

Ultrasonic sensors (also known as transceivers when they both send and receive) 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. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing.

G. L293D MOTOR DRIVER

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. The L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heat

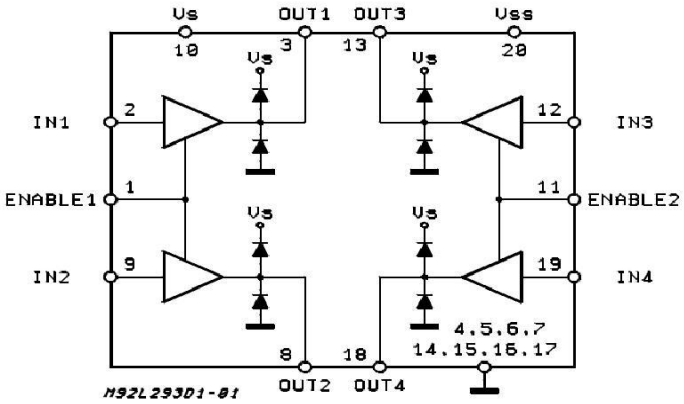

Figure 5 Block Diagram Of L293d

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IV. SOFTWARE DESCRIPTION

A. PROTEUS 8

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Labcenter Electronics, Proteus PCB design combines the ISIS schematic capture and ARES PCB layout programs to provide a powerful, integrated and easy to use suite of tools for professional PCB Design. All Proteus PCB design products include an integrated shape based auto router and a basic SPICE simulation capability as standard. More advanced routing modes are included in Proteus PCB Design Level 2 and higher whilst simulation capabilities can be enhanced by purchasing the Advanced Simulation option and/or micro-controller simulation capabilities. Proteus is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

B. KEIL CROSS COMPILER

The Keil Development Tools are designed for the professional software developer, however programmers of all levels can use them to get the most out of the embedded microcontroller architectures that are supported. Tools developed by Keil endorse the most popular microcontrollers and are distributed in several packages and configurations, dependent on the architecture.

In addition to the software packages, Keil offers a variety of evaluation boards, USB-JTAG adapters, emulators, and third-party tools, which completes the range of products. The following illustrations show the generic component blocks of µVision in conjunction with tools provided by Keil, or tools from other vendors, and the way the components relate.

C. SOFTWARE DEVELOPMENT TOOLS

Like all software based on Keil's µVision IDE, the toolsets provide a powerful, easy to use and easy to learn environment for developing embedded applications. They include the components you need to create, debug, and assemble your C/C++ source files, and incorporate simulation for microcontrollers and related peripherals.

The RTX RTOS Kernel helps you to implement complex and time-critical software. RTOS and Middleware Components These components are designed to solve communication and real-time challenges of embedded systems. While it is possible to implement embedded applications without using a real-time kernel, a proven kernel saves time and shortens the development cycle. This component also includes the source code files for the operating system.

D. HARDWARE DEBUG ADAPTERS

The µVision Debugger fully supports several emulators provided by Keil, and other vendors. The Keil ULINK USB-JTAG

family of adapters connects the USB port of a PC to the target hardware. They enable you to download, test, and debug your embedded application on real hardware. Development Tool Support the Keil C51 Compiler and the Keil Linker/Locator provide optimum 8051 architecture support with the following features and C language extensions.

Interrupt functions with register bank support are written directly in C Bit and bit-addressable variables for optimal Boolean data type support Compile-time stack with data overlaying uses direct memory access and gives high-speed code with little overhead compared to assembly programming Re-entrant functions for usage by multiple interrupt or task threats Generic and memory-specific pointers provide flexible memory access Linker Code Packing gives utmost code density by reusing identical program sequences Code and Variable Banking expand the physical memory address space Absolute Variable Locating enables peripheral access and memory sharing.

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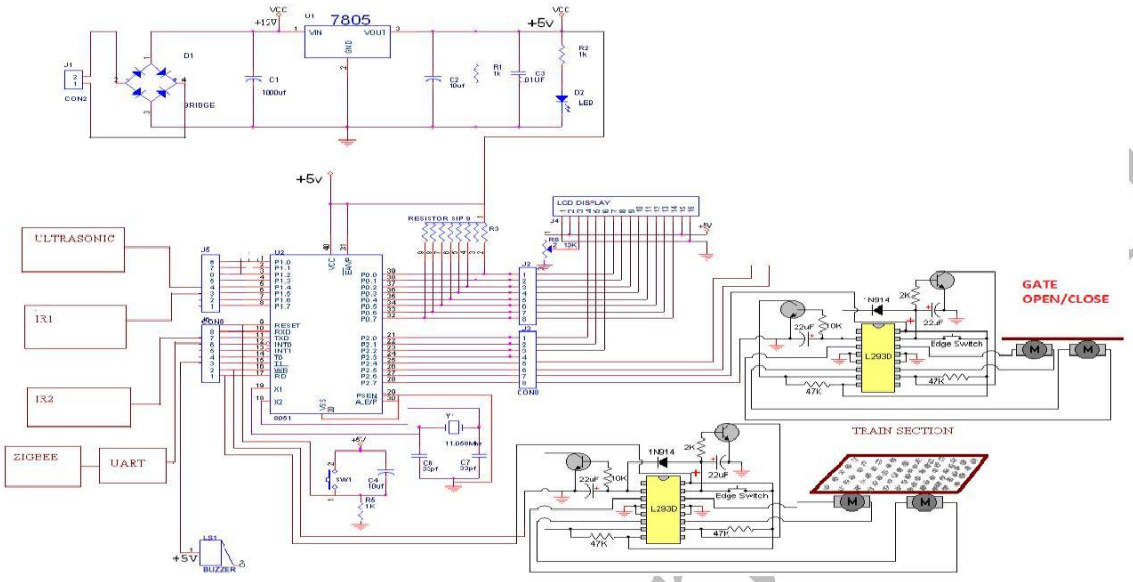
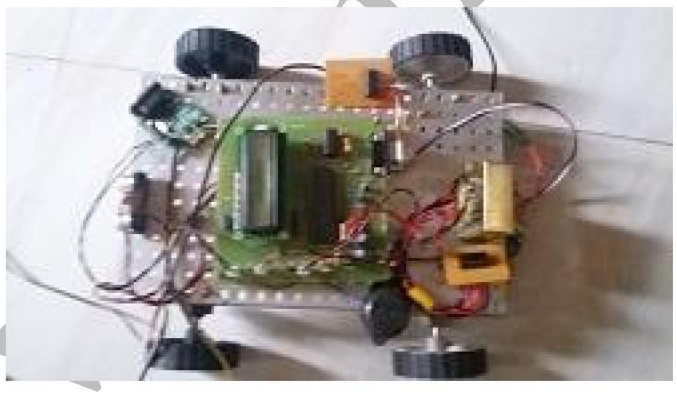
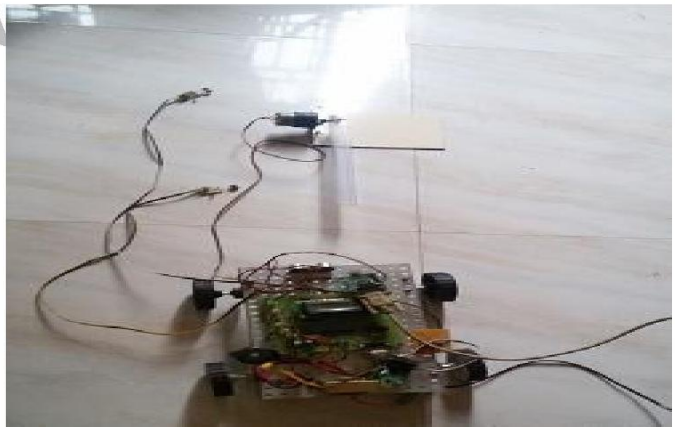
V. CIRCUIT DIAGRAM OF PROPOSED SYSTEM



VI. SNAPSHOT FOR PROPOSED SYSTEM





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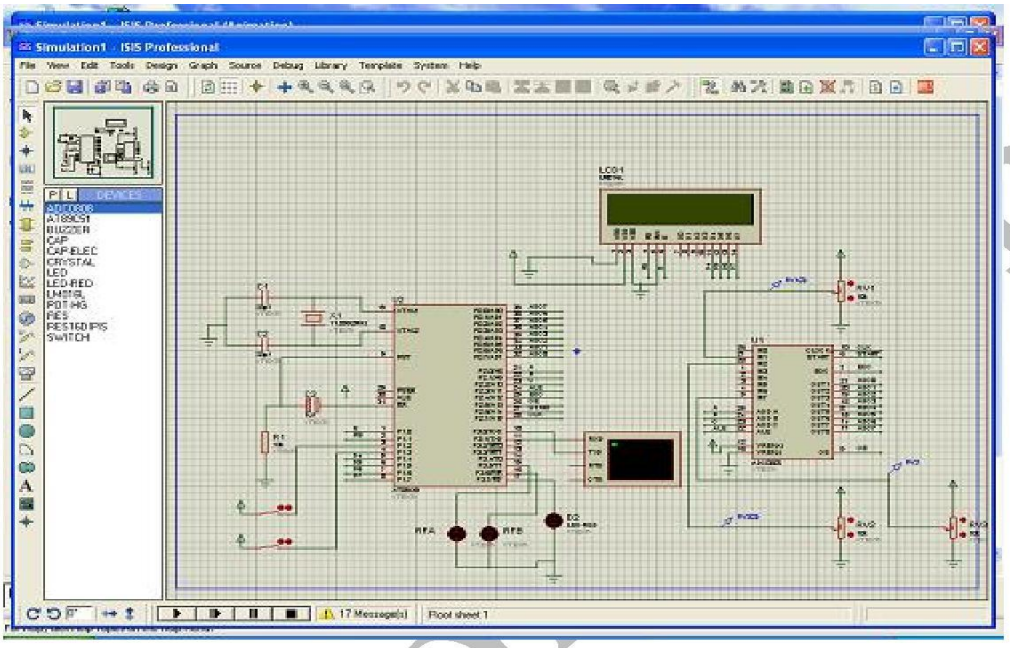
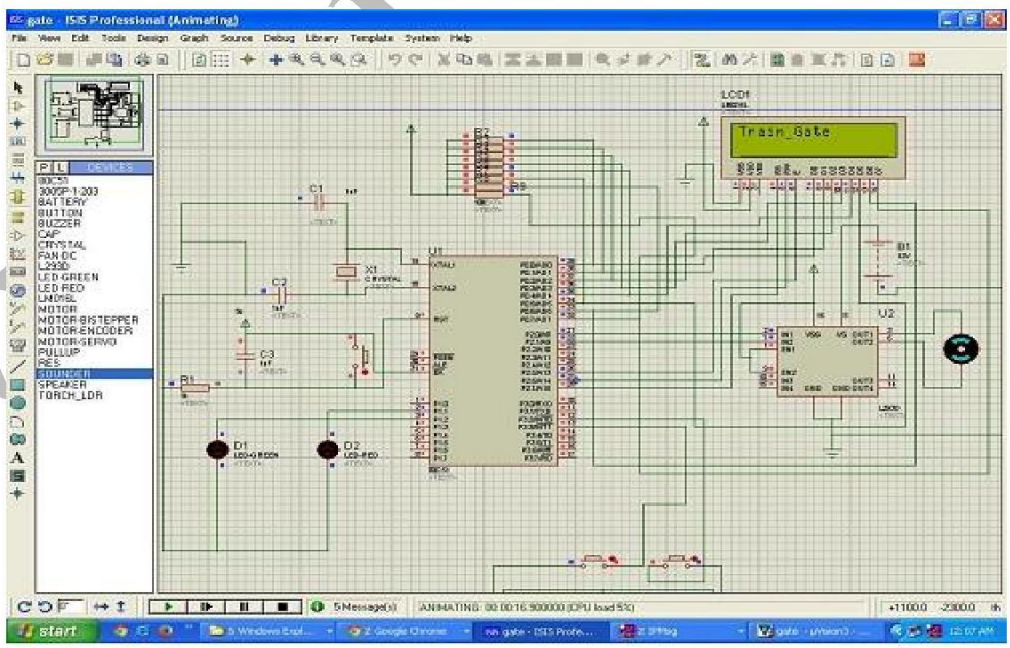
VII. SIMULATION RESULTS

A. RAILWAY ELECTRIC LOCOMOTIVE WITHOUT LOCOPILOT AND CONTROLLED BY CENRAL UNIT



B. AUTOMATIC RAILWAY GATE CONTROL



VIII. CONCLUSION

This Railway Electric Locomotive Without loco pilot and controlled by central unit using Zigbee module. The Design has been carried out using 89s52 microcontroller as control centre and with the careful design of the modules has implemented the centralized train control. The work shows that the system can accurately send the data with good performance. The main thing is to transmit all the parameters to the nearby controlling area through a wireless transmission (Zigbee). This proposal greatly reduces the manpower, saves time and operates efficiently without human interference. Moreover, multiple data can be detected and calculated simultaneously and it involves a wide range (1.5km) of measurement and simulation done using Isis simulator. The simulated and hardware implementation results are presented in previous chapters in which the flame by using the values has been controlled and monitored. In future it can be implemented kinetx box in this centralized train control.

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