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A SENSOR BASED TRAIN TRAFFIC CONTROL STATION (TTCS)

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ABSTRACT

The Transportation of train always depends on railway tracks (rails) only. If there is a crack in these rails, it creates a major problem. Most of the accidents in the train are caused due to obstacle coming in front, which cannot be easily identified. In order to avoid this problem, we are using the robot, which detects the faults on railway track and gives an alarm.

A robot is an apparently human automation, intelligent and obedient but impersonal machine. It is relatively, that robots have started to employ a degree of Artificial Intelligence (AI) in their work and many robots required human operators, or precise guidance throughout their missions. Slowly, robots are becoming more and more autonomous.

Index Terms: ***ARM-7, GPS, GSM. ZIGBEE Technology.***

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 Ii ves 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. 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. The main aim of the project is to prevent the train's collision and provide safety for human lives and many properties. The project is to develop and design a low-cost navigation system with high integrity and reliability for enhancing to prevent the train's collision in adverse weather situations, such as a foggy or rainy weather and prevent collision from train passing on same track and most of the accidents in the train are caused due to obstacle coming in front, which cannot be easily identified. In order to avoid this problem, we are using the robot, which detects the faults on railway track and gives an alarm.

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Zigbee covers up to a distance of 1km whereas by using Wi-Fi we can cover over long distances, so that we can easily avoid the accidents and can have the safest mode of transportation.

EXISTING SYSTEM

The existing system focuses on the use of magneto resistive and sonar sensors for imminent collision detection in cars. The magneto resistive sensors are used to measure the magnetic field from another train in close proximity, to estimate relative position, velocity, and orientation of the train from the measurements.

PROPOSED SYSTEM

In this project a navigation system that calculates the state of each train is proposed. The whole set up is placed in the backside of the train. Using Zigbee transceivers, the state of the train is continuously transmitted to neighboring trains. A low cost GPS is used to calculate the latitude and longitudinal positions of the train.

An ultrasonic sensor continuously emits the rays from the train and if any obstacle occurs the rays revert back and this is used to calculate the distance from the neighboring trains. The Zigbee transceiver is use to transmit and receive the information about the state of the neighboring train and this information is displayed on the LCD and an alert system is used to alert the drive of the train.

The two sensors in front and rare ends calculate the obstacles reaching nearby if any train approaching from back side then it will checks the front end obstacle clearance and speed will be increased if any obstacle from front end then train will be slowed down. If obstacles present in both sides means train will be stopped with buzzer alert and led indication and cat location will be transmitted to all the trains nearby.

HARDWARE DESIGN

BLOCK DIAGRAMOF TRAIN 1 SECTION

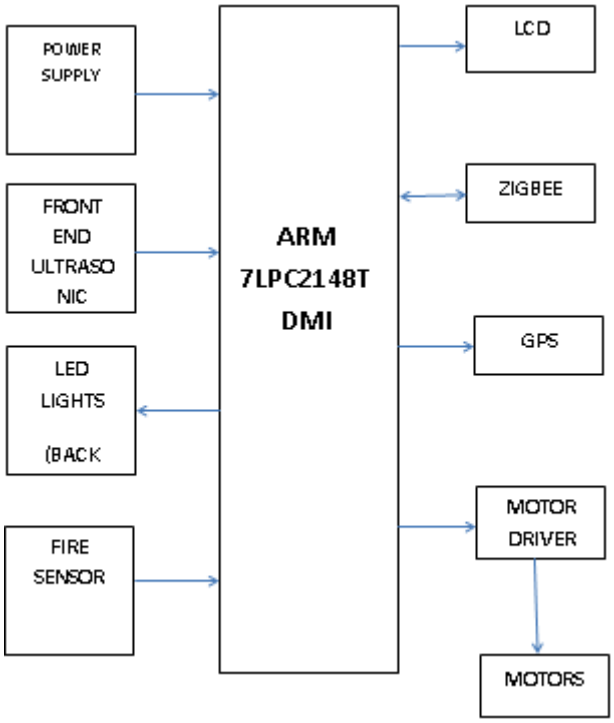

Fig1 : Train 1 Block Diagram

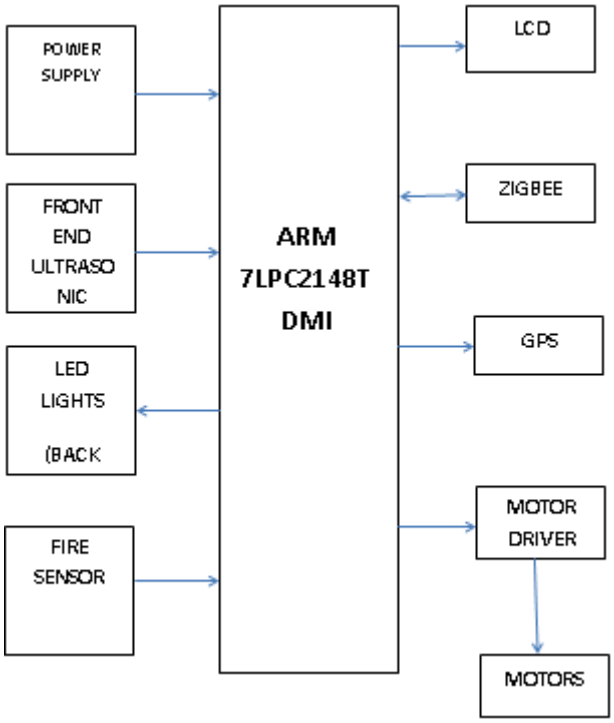

Fig 2 : Train 2 Block Diagram

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DESCRIPTION

Prediction of train's dangerous driving conditions or maneuvers can help prevent- ing accidents from taking place .One of the major causes of traffic accidents is a result of keeping no safe distance from neighboring trains while driving. If a system that warns drivers if they are heading too close and dangerously towards other trains is available, that would help reducing trains' accidents significantly. This system would be particularly useful in low visibility conditions, like fog and rain, which are also a cause of a large number of accidents. In this system, each train can calculate its relative position and velocity to other trains when the transmitted position and velocity of nearby trains are available.

So, even if the driver has low visibility of other trains or if he loses concentration, then the system can issue a warning to alert the driver of possible unsafe driving conditions.

In this project a navigation system that calculates the state of each train is proposed. The whole set up is placed in the backside of the train. Using Zigbee transceivers, the state of the train is continuously transmitted to neighboring trains. A low cost GPS is used to calculate the latitude and longitudinal positions of the train.

An ultrasonic sensor continuously emits the rays from the train and if any obstacle occurs the rays revert back and this is used to calculate the distance from the neighboring trains. The Zigbee transceiver is use to transmit and receive the information about the state of the neighboring train and this information is displayed on the LCD and an alert system is used to alert the driver of the train.

LPC2148 CONTROLLER

ARM7 LPC2148 is ARM7TDMI-S Core Board Microcontroller that uses 16/32-Bit 64 Pin (LQFP) Microcontroller No.LPC2148 from Philips (NXP). All resources inside LPC2148 is quite perfect, so it is the most suitable to learn and study because if user can learn and understand the applications of all resources inside MCU well, it makes user can modify, apply and develop many excellent applications in the future. Because Hardware system of LPC2148 includes the necessary devices within only one MCU such as USB, ADC, DAC, Timer/Counter, PWM, Capture, I2C, SPI, UART, and etc.

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

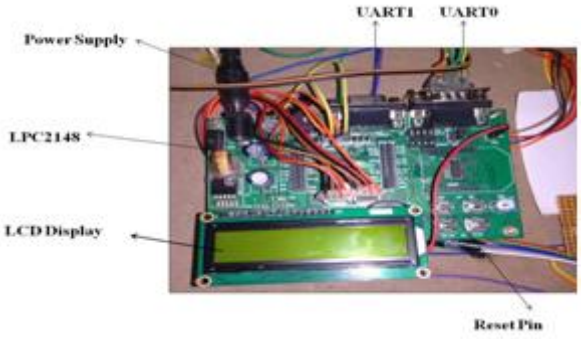

Fig 3: LPC2148 Board

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ZIGBEE TECHNOLOGY

The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. As an answer to this dilemma, many companies forged an alliance to create a standard which would be accepted worldwide. It was this Zigbee Alliance that created Zigbee Both Bluetooth and Wi-Fi have been developed for communication of large amount of data with complex structure like the media files, software etc.

Fig 4: ZigBee Module

Zigbee is a low power spin off of Wi-Fi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. The specification was accepted and ratified by the Zigbee alliance in December 2004. Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard. The alliance is responsible for publishing and maintaining the Zigbee specification and has updated it time and again after making it public for the first time in 2005.

Many years ago, when Bluetooth technology was introduced, it was thought that Bluetooth would make Wi-Fi redundant. But the two coexist quite well today, so do many other Wireless standards like Wireless HART and ISA100.11a. Then why would we need another WPAN standard like Zigbee? The answer is, the application focus of Zigbee Alliance - low cost and low power for energy efficient and cost effective intelligent devices. Moreover, Zigbee and Bluetooth have different application focus.

Zigbee Networks

Zigbee devices can form networks with Mesh, Star and Generic Mesh topologies among themselves. The network can be expanded as a cluster of smaller networks. A Zigbee network can have three types of nodes: Zigbee Coordinator (ZBC), Zigbee router (ZBR) and Zigbee End Device (ZBE) each having some unique property.

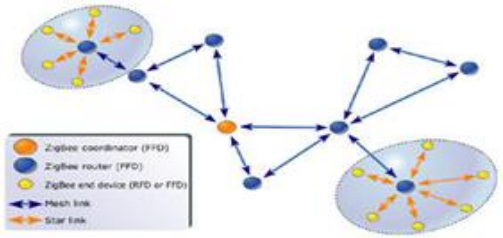

Fig 5: Structure of Zigbee Network

Zigbee understand through a typical usage scenario in a home automation system. There can be only one ZBC in a network, the one that initiates the network in the first place and stores the information about the network. This would be the main control panel or remote control in the living room of each storey. All the devices in the network communicate with this ZBC.

In a network, data traffic can be periodic, intermittent or repetitive. When data is periodic, the application determines the rate of transfer. Intermittent data needs optimum power savings and hence the data rate is stimulus dependent.

Technical specifications of zigbee

- Frequency band2.400 — 2.483 GHz
- Number of channels16
- Data rate250 kbps
- Supply voltage1.8 – 3.6 V
- Flash memory128 kB
- RAM8 kB
- EEPROM4 Kb Operating
- Temperature-40 — +85 °C

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LED(Light Emitting Diode)

Here the IR transmitter is nothing but the IR LED. It just looks like a normal LED but transmits the IR signals. Since the IR rays are out of the visible range we cannot observe the rays from the transmitter. These are infrared LEDs; the light output is not visible by our eyes.

Fig6 :IR LED

They can be used as replacement LEDs for remote controls, night vision for amcorders, invisible beam sensors, etc.

ULTRASONIC SENSOR

The sensor is primarily intended to be used in security systems for detection of moving objects, but can be effectively involved in intelligent children's toys, automatic door opening devices, and sports training and contact-less-speed measurement equipment.

Modern security systems utilize various types of sensors to detect unauthorized object access attempts. The sensor collection includes infrared, microwave and ultrasound devices, which are intended to detect moving objects. Each type of sensor is characterized by its own advantages and drawbacks.

Fig 7: ultrasonic sensor

Microwave sensors are effective in large apartments because microwaves pass through dielectric materials. But these sensors consist of expensive super-high frequency components and their radiation is unhealthy for living organisms. Infrared sensors are characterized by high sensitivity, low cost and are widely used. But, these sensors can generate false alarm signals if heating systems are active or temperature change speed exceeds some threshold level. The ultrasound transmitter TX is emitting ultrasound waves into sensor ambient space continuously. These waves are reflecting from various objects and are reaching ultrasound receiver RX.

BUZZER

The piezo buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits. The buzzer produces a same noisy sound irrespective of the voltage variation applied to it.

Fig 8: Buzzer

DC MOTOR

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear

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and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings, solenoids, springs.

Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

GPS

Global Positioning System was developed by the United States' Department of Defense. It uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The GPS satellites are maintained by the United States Air Force.

GPS is often used by civilians as a navigation system. On the ground, any GPS receiver contains a computer that "triangulates" its own position by getting bearings from at least three satellites. The result is provided in the form of a geographic position - longitude and latitude - to, for most receivers, within an accuracy of 10 to 100 meters. Software applications can then use those coordinates to provide driving or walking instructions.Getting a lock on by the GPS receivers on the ground usually takes some time especially where the receiver is in a moving vehicle or in dense urban areas. The initial time needed for a GPS lock is usually dependent on how the GPS receiver starts. There are three types of start - hot, warm and cold.

The hot start is when the GPS device remembers its last calculated position and the satellites in view, the almanac used (information about all the satellites in the constellation), the UTC Time and makes an attempt to lock onto the same satellites and calculate a new position based upon the previous information. This is the quickest GPS lock but it only works if you are generally in the same location as you were when the GPS was last turned off.Thewarm start is when the GPS device remembers its last calculated position, almanac used, and UTC Time, but not which satellites were in view. It then performs a reset and attempts to obtain the satellite signals and calculates a new position.The receiver has a general idea of which satellites to look for because it knows its last position and the almanac data helps identify which satellites are visible in the sky. This takes longer than a hot start but not as long as a cold start.And finally – the cold start is when the GPS device dumps all the information, attempts to locate satellites and then calculates a GPS lock. This takes the longest because there is no known information.The GPS receiver has to attempt to lock onto a satellite signal from any available satellites, basically like polling, which takes a lot longer than knowing which satellites to look for. This GPS lock takes the longest.

SOFT WARE DESIGN TOOLS

KEIL SOFTWARE

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

PROLOAD

Proload is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. As this programmer kit requires power supply to be operated, this power supply is given from the power supply circuit designed above. It should be noted that this programmer kit contains a

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power supply section in the board itself but in order to switch on that power supply, a source is required. Thus this is accomplished from the power supply board with an output of 12volts or from an adapter connected to 230 V AC.

EXPERIMENTAL RESULTS

TRAIN 1 SECTION

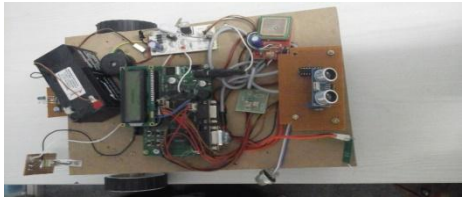

Fig 9: Train 1 Section With Power OFF

TRAIN 2 SECTION

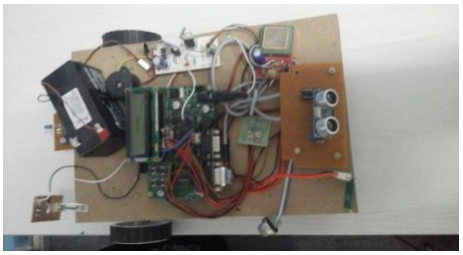

Fig 10: Train2 Section with Power OFF

After that poweron the system

TRAIN 1 SYSTEM ON

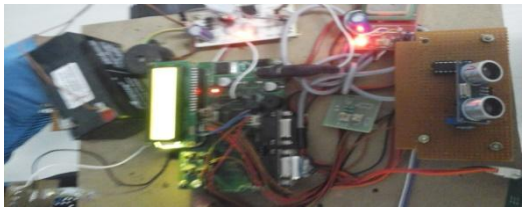

Fig 11:Train System Power ON

TRAIN 2 SYSTEM ON

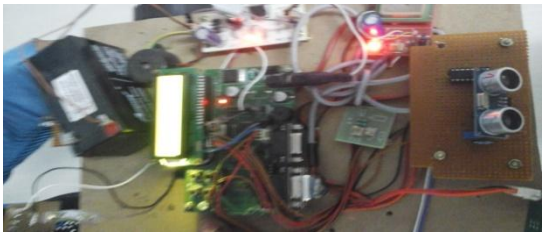

Fig 12: Train 2 System Power ON

Enter into the Project.

Fig 13: Enter the Project

Let It be Initializing the Project.

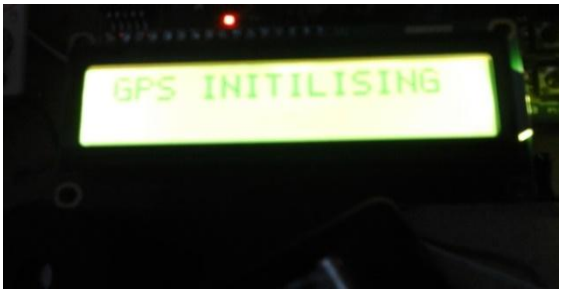

Fig 14: GPS Intialising

It Shows the Latitude and Longitude of the Train Regions.

Fig 15:Latitude and Longitude

It Shows the Sourrounding Temperature.

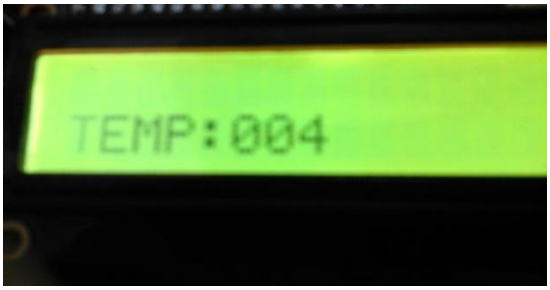

Fig 16: Temperature

so if the Train1 is front then the Train 2 system will be slow.

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Fig 17: Front Distance

After crossing the Train 1 in that time the Train 2 will be stop.

Fig 18: Train 2 STOP

Suppose another train is came back into the same track then the GPS intialising and it shows the train will be in critical position.

Fig 19: Back Distance Critical

In the above figure the train is critical situation then the system is STOP.

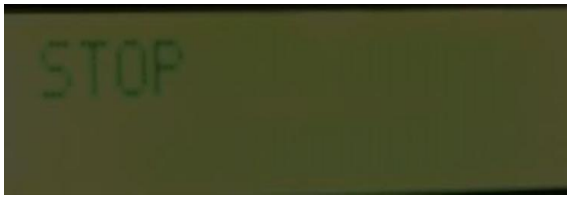

Fig 20: Train stop

Suppose one of the compartment has fired ,and the Fire Sensor activate and it produces the buzzer . Intialising the GPS the train will be stopped.

Applications:

- Train Accidents can be prevented.
- This collision between trains is calculated and colliding trains were alerted.
- It is useful in low visibility conditions.

CONCLUSION

The Project " SENSOR BASED TRAIN TRAFFIC CONTROL STATION has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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