ZIGBEE BASED RAILWAY AUTOMATION SYSTEM WITH ADVANCED APPLICATIONS

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ABSTRACT:

The increased growth in the railway sector has resulted in an increase in the train traffic density across the world. This has resulted in the increase in the number of accidents involving trains. In our project, the proposed system includes several features which prevent train accidents. The project consists of a microcontroller which is interfaced fire sensors. Once the sensors attached in the compartments of train senses the fire detection, it assumes a fire accident. The controller assumes it as an emergency and starts the buzzer, LCD display and separate the compartment. Thermistor is used as fire sensor and gear motor has been used to separate the compartment.

The aim of our project is to control the speed of dc fan or AC based on compartment temperature using pulse width modulation technique with microcontroller. Our project emphasizes on automatic toilet locking of railway lavatories. Plenty of dirt and pollution occur due to use of lavatories at stations. So, here we have mentioned some problems and solutions in our project. Toilet pipe locking systems is in use with various techniques. We have proposed to use motorized system. When the station arrives, driver has to press the key to close the toilet pipe and all dirt is stored in toilet pipe. And after going out from the city again he has to press the key to open locked toilet pipe.

INTRODUCTION:

The increased growth in the railway sector has resulted in an increase in the train traffic density across the world. This has resulted in the increase in the number of accidents involving trains. In our project, we have proposed system that includes several applications. They are Collision detection system, Passenger seat vibration system, automatic coach separation when fire occurs, automatic lavatory (toilet) pipe locking system and temperature control in air conditioner coach.

In our project ZIGBEE technology is used to avoid the train accidents. ZIGBEE, a state of the art technology of high level communication protocols, is used to create personal area networks build from small, low power digital radios. ZIGBEE is based on an ieee802.15 standard. Through low powered, ZIGBEE devices often transmit data over longer distances by passing data through intermediate devices to reach more distances, creating a mesh network. ZIGBEE has defined a rate of 250k bits/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. ZIGBEE transmission distances range from 10 to 100m line of site, depending on power output and environmental characteristics.

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separate the compartment. Thermistor is used as fire sensor and gear motor has been used to separate the compartment.

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BLOCK DIAGRAMS:

ANTICOLLISSION SYSTEM:

The collision system consists of a ZIGBEE module for each train. And loco pilot (driver) has to enter the track number before starting the train, this track number has been stored in the buffer of a microcontroller and once the train starts the microcontroller gives the input to ZIGBEE module through UART(Universal asynchronous receiver-transmitter) to send the data to air. The data consists of a track number.

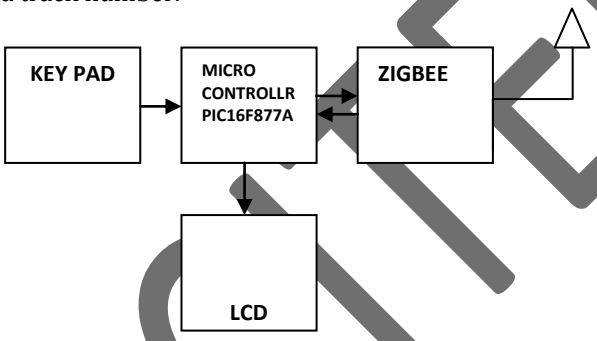

Fig. no.1. Block Diagram of anti collision system

Whenever the trains are moving on the same track within ZIGBEE covered area the ZIGBEE transmitted signal will be received to each other train. This received signal from ZIGBEE is fed to microcontroller and displays the track name. If both train tracks are same, the microcontroller will turns on the buzzer to stop the train.

SEAT VIBRATION TECHNIQUE:

The passenger seat vibration system consists of a keypad and vibrator. Usually at the time of passenger sleep in the train they can't come to know about their destination

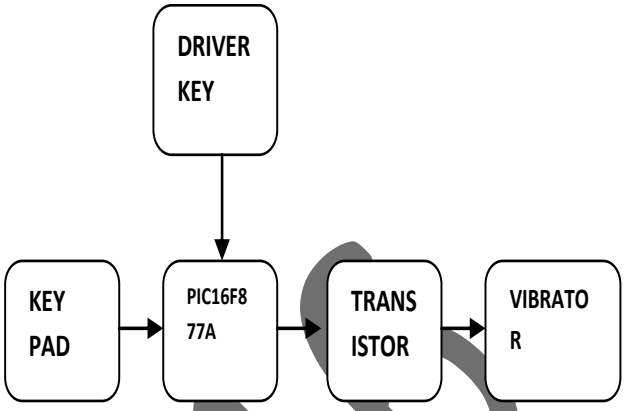

Fig. no.2. Block diagram of seat vibration

Here we have proposed a system that at the time of sitting on the seat, passenger has to press the destination key. Once the destination reaches the train driver will press the key then the particular seat will start to vibrate so that the passenger will come to know their destination. Here all the pressed key data will be stored in the buffer of the microcontroller, when the driver press the key the program will execute and gives the signal to vibrator through transistor

FIRE SECURITY SYSTEM and LAVATORIES PIPE LOCKING SYSTEM:

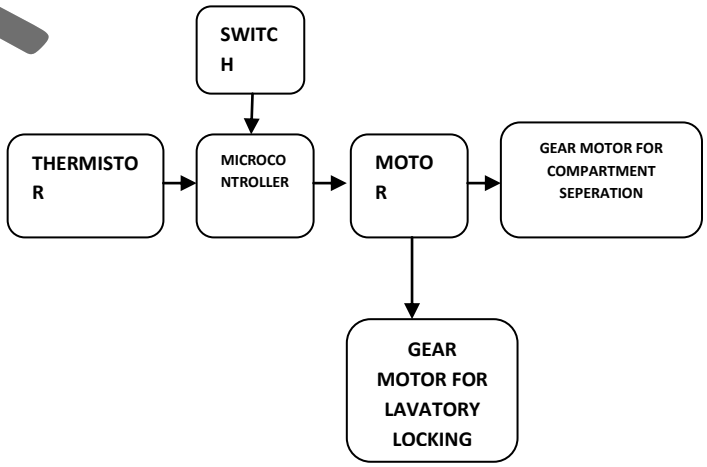

Fig. no.3 Block diagram of fire security system and lavatory pipe locking system

This time delay is causing heavier damage. Thus, eliminating the time between when an accident occurs and when first responders are dispatched to the scene decreases the damage. This projects help in notifying the passengers and emergency services. The project consists of a microcontroller which is interfaced fire sensors. Once the sensors attached in the compartments of train senses the fire detection, the controller starts the buzzer

and gives the signal to motor driver circuit to separate the compartment from each other.

Over the last few years, we are facing big issues related to public hygiene and health matters. Cleanliness for personal as well as social is a required measure in today's world. Different NGO's are taking step towards the awareness of personal/social cleanliness. Although some people are habitual to cleanliness, still it remains as a problem in various areas (work area or living area). Our project is an effort to bring this movement alive in most crowded zone, ever rushed zone Indian Railways. This will bring a solution for problem of using toilet at stations. Though the notice has been kept by the Rail Board that one should not use the lavatory while train is on station, it is found that the notice is not followed by many. So for the solution on this, automatic toilet pipe lock for lavatories when train is on station can be done.

POWER MANAGEMENT IN AC COACHES:

To get rid of the problem of Obscurity to control temperature in Air conditioner coaches, microcontroller based controller has been proposed.

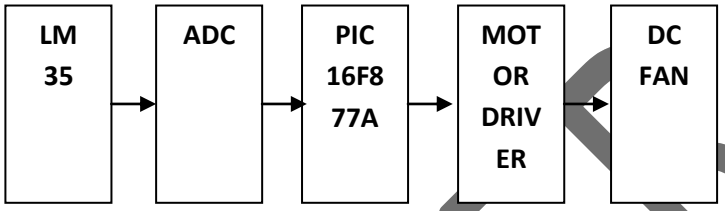

Fig .no.4 Block diagram of temperature control

A temperature sensor has been used to measure the temperature of the coach and the speed of the fan is varied according to the room temperature using pulse width modulation technique. Controller is used to control the speed of dc fan and temperature is varied through the temperature sensor and data is sent to microcontroller using analog to digital converter

CIRCUIT DIAGRAMS:
TRANSISTORS AS A SWITCH CIRCUITS:

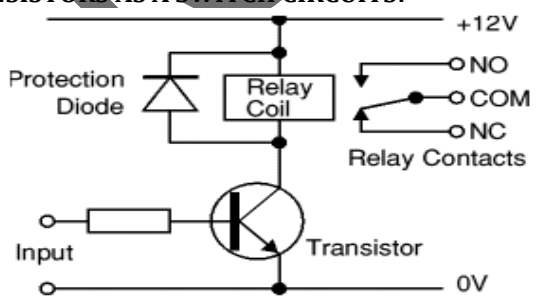

Fig .no .5 transistors As a Switch Circuit

A transistor switch is used to allow a 12 volt relay to be operated (turned on and off) by a small input voltage, Ein. The voltage level of the input can be changed by sliding the black arrow- head up and down on this vertical scale

Changing the input voltage causes changes in the base current, collector current, and in the collector voltage. When the current in the relay coil (i.e. the collector current) exceeds a certain value, the relay switches on. The diode reduces the large transient voltages that are produced when the current through an inductor (the relay coil) is changed quickly by switching (called "inductive kick"). You can change the input (base) resistor, the relay coil resistance, and the power supply voltage (Vcc). Just click on the number with the mouse pointer and edit like any text field. You can also inspect and modify the specifications of the transistor - click on the "Show specs" button on the left, this display a table of several specifications (such as the transistor's current gain, beta) that you can modify.

CIRCUIT DIAGRAM FOR SEAT VIBRATION, FIRE, LAVATORY CONTROL AND HIGH TEMP INDICATION:

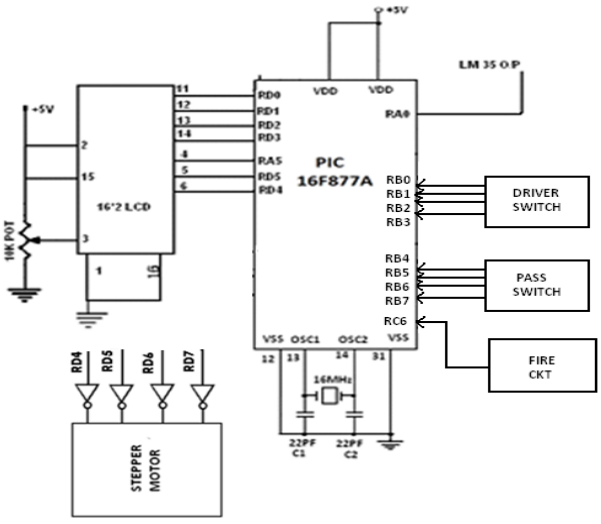

Fig .no.6 Circuit Diagram For Seat Vibration, Fire, Lavatory Control And High Temp Indication

The fire indication system consists of Op-amp, thermistor and resistors. +5V is applied to one end of thermistor and another end 440ohm resistors and Non inverting terminal of Op-amp and another point of resistors is to ground. The two resistors 1KΩ are connected in series two maintain a constant 2.5V to the Non-inverting terminal of OP-AMP. When the fire occurs the resistance of the LDR decreases and the normal condition the resistance of the thermistor increases

Here the Op-amp is used as a comparator. The inverting terminal as constant +2.5v. During fire occurred time the voltage is low at the non inverting terminal compare to inverting terminal. Then voltage reaches to –ve saturation region. That is ground, the output is 0v then the LED will not glow. And in the normal condition the thermistor resistance very high so that the all voltage is at the point non inverting terminal up to 4.5v that is oltage is high at the non inverting terminal then the voltage reaches to +ve saturation region. Then the output of op-amp is 5v then Lights will get ON.

RESULTS AND DISCUSSION:

The proposed system involves various advanced applications which will help to reduce the accidents of train, can maintain railway stations clean, can save the fuel, can save the people with huge amount of losses and giving awareness to the passengers about their destination.

The project consists of microcontroller programmed using assembly language due to its simplicity and speed. After the program had been written it was run using MP LAB software and complier.

COLLISION DETECTION SYSTEM:

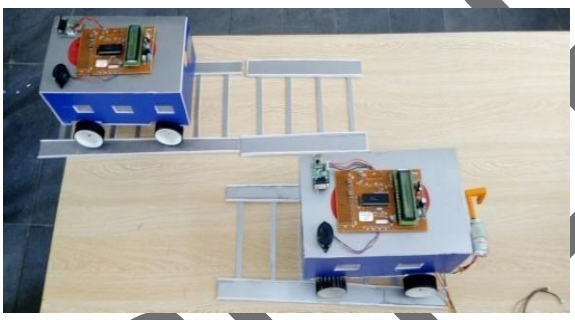

Fig. no 7. Trains on the different track

The collision system consists of a ZIGBEE module for each train. And loco pilot(driver) has to give enter the track no before starting the train, this track number has been stored in the buffer of a microcontroller and once the train starts the microcontroller gives the input to ZIGBEE module through UART to send the data to air. The data consist of a track number.

This system should be having each and every train. Whenever the trains are moving if the train comes within ZIGBEE covered area the ZIGBEE transmitted signal will be received by from each other train. This received signal from ZIGBEE is fed to microcontroller and displays the track name. If both trains are on the same, the microcontroller will turns ON the buzzer, to stop the train for both train.

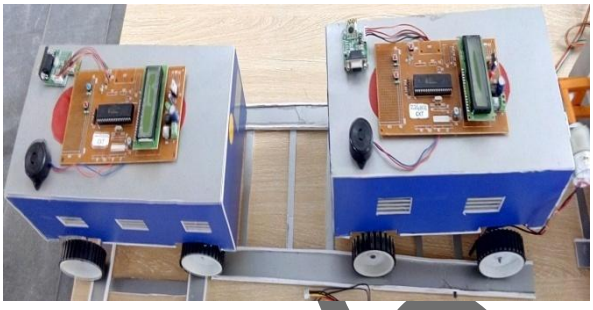

Fig .no.8.Trains on the same track

PASSENGER SEAT VIBRATION SYSTEM:

The passenger seat vibration system consists of a keypad and vibrator. Usually at night, passenger will sleep in the train; therefore they can't come to know about their stop. Here we have made system that is at the time of sitting on the seat, passenger has to press the destination key. Once the destination reaches the train driver will press the key then the particular seat will get start to vibrate so that passenger will come to know their destination. Here the all pressed key data will be stored in the BUFFER of the microcontroller, when the driver press the key the program will execute and gives the signal to vibrator through transistor.

Fig .no .9.Seat under normal condition

Fig . no 10. Seat under vibration condition

AUTOMATIC COACH SEPARATION WHEN FIRE OCCURS:

Fig .no.11. Compartment position under normal operation

Fig .no.12. Separated compartment when fire is detected

Fire on a running train is more dangerous than on a stationary one, since fanning by winds helps spread the fire to other coaches. When these accidents are occurring in remote areas or during night times the loss or damage being caused is at higher rates. The damage is heavier due to improper reach of service at right time due to improper communication. This time delay is causing heavier damage. Thus, eliminating the time between when an accident occurs and when first responders are dispatched to the scene decreases the damage. This projects help in notifying the passengers and emergency services. The project consists of a microcontroller which is interfaced fire sensors. Once the sensors attached in the compartments of train senses the fire detection, The controller starts the buzzer and gives the signal to motor driver circuit to separate the compartment from each one of the each other.

Fig .no.13.open position of lavatory pipe

Over the last few years, we are facing big issues related to public hygiene and health matters. Cleanliness for personal as well as social is a required measure in today's world. Different NGO's are taking step towards the awareness of personal/social cleanliness. Although some people are habitual to cleanliness, still it remains as a problem in various areas (work area or living area).The idea regarding this project came up in our mind from the same tendency, a step to add solution for this cleanliness issue. Same as our Hon. Prime Minister Mr. Narendra Modi's mission works on "Clean India" (commonly known as "Swacha Bharat"), the part of this project is an effort to bring this movement alive in most crowded zone, ever rushed zone Indian Railways (Railways). This will bring a solution for problem of using toilet at stations. Though the notice has been kept by the Rail Board that one should not use the lavatory while train is on station, it is found that the notice is not followed by many. So for the solution on this, automatic door lock for lavatories when train is on station can be done.

Fig .no.14. locked position of lavatory pipe

TEMPERATURE CONTROL IN AC COACHES:

Fig .no.15. Prototype model of temperature control device

To get rid of the problem of Obscurity to control temperature in AC coaches, a microcontroller based controller has been proposed. A temperature sensor has been used to measure the temperature of the coach and the speed of the AC/fan is varied according to the room

temperature using pulse width modulation technique. Controller is used to control the speed of DC Fan and temperature is varied through the Temperature sensor and data is sent to PIC16F877A microcontroller using analog to digital converter. The duty cycle has been varied from 0 to 100% to control the fan speed depending upon the room temperature, which is displayed on liquid crystal display. Duty cycle values between 25% and 95% allow smooth control of the fan. It is easier, reliable and accurate

CONCLUSION:

The project has been studied and implemented a complete working model using PIC16F877A microcontroller. In present days every passengers need a clean, comfort and safe journey. So we proposed advanced applications in railway system to meet their needs. In our project, a design for automatically averting train collisions has been designed and this innovative technique of early sensing of any possible collision scenario and avoiding it thereof, we demonstrate that it is possible to improve.

It is well known that offering better services is essential for the growth of the Indian Railways. It is also equally important to make the passengers aware of their services. Still, Indian railways has to take more possible steps to enhance the level of awareness of the passengers on the basis of the findings of the present study, some constructive and viable suggestions have been made. If the suggestive measurements have been considered earnestly by the Indian railways and the policy makers, it is hope that the Indian railways will shine and bring grandeur to our country in the near future.

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