AUTOMATIC RAILWAY GATE CONTROLLER USING ZIGBEE

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ABSTRACT:This project is about ZigBee technology. The concept of ZigBee is applied to an Automatic system. Wireless sensor network has good function of data collection, transmission and processing. The principle objective of this project was to design an Automatic Railway Gate Controller using ZigBee. This project deals to develop a prototype of railway gate that function automatically by using ZigBee. Besides that, the interfacing program also had been developing for the integration part. The operation using ZigBee that integrated with other circuits involved such as microcontroller (PIC16F877A), power supply, IR sensor, light and buzzer, gate motor and LCD display. All the circuits will be combining to demonstrate the operation of ZigBee. This system will make improvement towards the manually operation before this. Human supervision will be considered if there are problems occurred while this system was operated.

I. INTRODUCTION

In general, this project utilizes the importance of ZigBee Technology as a main design. It used to provide improvement into manual system that exist nowadays. This project is designed using ZigBee to prevent train accident occurred in the train door unattended. This project utilized microcontroller (PIC16F877A), two powerful IR transmitter and two receivers, one pair of transmitter and receiver is fixed up side (from where the train comes) and the other pair is fixed at down side of the train direction. This Automatic Railway Gate Controller system was operated after signal received from the ZigBee Transmitter then the ZigBee Receiver will remain train is coming at LCD. When IR sensor detect the train, then it will send to trigger the PIC16F877A for operating the gate motor, alarm indicator and LCD display by instruction programmed. Electronic application used to enable this system operated in automatic mode. The computer usage to building up a system that encourage implementing of the technology.

Nowadays, the railway gate is operating by manual operation. The railway gate management has to employ workers to be on duty for control the operation. Due to this, the worker will manually open and close the gate when the train arrived. This project will improve the system by the automatic railway gate operation. This system will make improvements to the previous manual operation. Human supervision will be considered if there are problems occurred while this system was operated. This is an idea to perform computer integration with mechanical structure to simulate what the system can do. Control system with computer applications

will make the management or consumer become more effective. Therefore, this is the best example in develop railway gate management system become more efficient.

The aim of this project is to design and develop the Automatic Railway Gate Controller using ZigBee. In order to make this project successful, the objectives have been declared must be achieved in completing this project. The objectives are to design an Automatic Railway Gate Control by using ZigBee, to develop a prototype of Automatic Railway Gate by using ZigBee, to design an interfacing program for the integration part of microcontroller operation.

This project covered the operation of Automatic Railway Gate Controller by using ZigBee. The circuits involved such as microcontroller (PIC16F877A), power supply, IR sensor, light and buzzer, gate motor and LCD display. All of these operations will be combining to demonstrate the operation of ZigBee technology. The operations of ZigBee works follow the instruction when ZigBee Transmitter receives the signal data from ZigBee Receiver. The combining circuits were constructed on Proteus software to seen whether that circuits was right or not. After that, the hardware part was constructed after all the simulation being done. IR sensor circuit is providing signal to triggered the PIC16F877A. The sensed signal wills active the gate motor and LCD display. The buzzer and indication light circuit was provided as additional part of this system. Additional elements can be added without affecting the remaining elements. This allows the flexibility of the developed system.

II. PROJECT METHODOLOGY

The methodologies of project regarding the project title are divided into two parts which is Hardware and Software. For the Hardware part, the design of the infrared and motor system for the Automatic Railway Gate Controller using ZigBee and need to understand how the system will be functioning. As far as hardware is concerned, open hardware designs will be created for various railway gate automation components. These could then be assembled by users. For the Software part, design the Automatic Railway Gate Controller system, on the software side, a stack of software would run on a single server. This software stack would include software for interfacing with devices, software for aggregating, analysing, and acting upon these data.
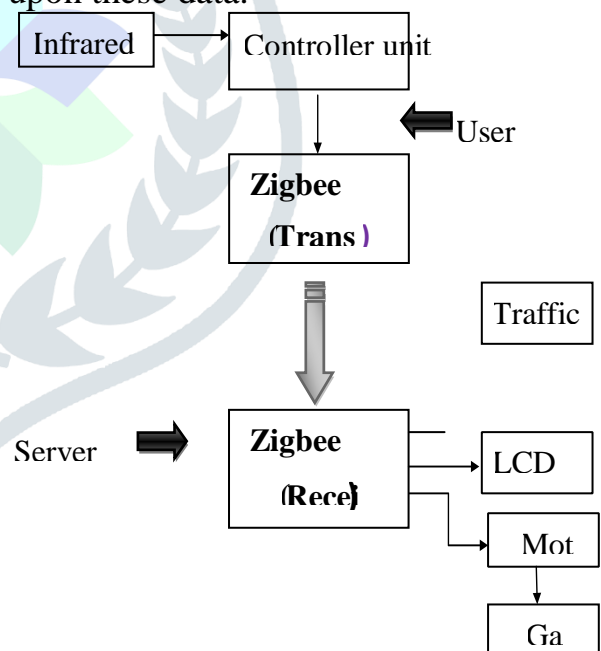

Fig: 1.1 Block diagram

The Figure 1.1 shows the block diagram of the project. The operations of ZigBee works follow the instruction when ZigBee Transmitter receives the signal data from ZigBee Receiver. The IR sensor circuit is providing signal to triggered the PIC16F877A. The sensed signal wills active the gate motor and

LCD display. The buzzer and indication light circuit also active when their get the signal.

Zig-bee Architecture

The architecture of zig-bee is closely related with OSI model. Zig-bee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4(2003 version) for low rate WPANs.
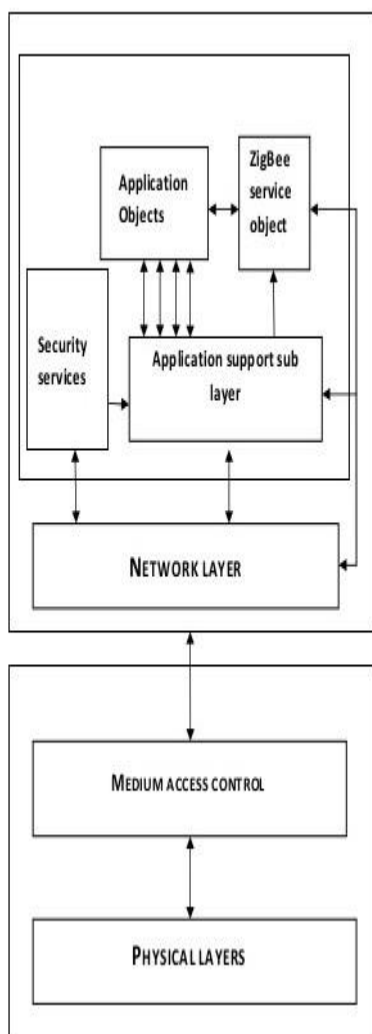

Fig:1.2 Zigbee Architecture

The specification goes on to complete the standard by adding four main components: network layer, application layer, zig-bee device objects(ZDO) and manufacturer-application objects which allow for customization and favour total integration.

Besides adding two high-level network layers to the underlying structure, the most significant improvement is the introduction of ZDOs. These are responsible for a number of tasks, which include keeping of device roles, management of requests to join a network, device discovery and security.

Zig-bee is not intended to support power line networking but to interface with it at least for smart metering and smart appliance purposes. Because zig-bee nodes can go from sleep to active mode in 30 ms or less, the latency can be low and devices can be responsive, particularly compared to Bluetooth wake-up delays, which are typically around three seconds. Because zigbee nodes can sleep most of the time, average power consumption can be low, resulting in long battery.

Disadvantages
- Short range
- Low capacity
- Low data speed

Applications

- Home automation
- Wireless sensor networks
- Industrial control
- Embedded sensing
- Medical data collection
- Smoke and intruder warning
- Building automation
- Smart energy 1.0
- Telecommunication Services
- Health care
- Remote control
- Light link

Hardware Implementation

One of the main objective of this project is to control the unmanned railway gate automatically using embedded platform to reduce maintenance expenditure, human mistakes, and accidents. An Embedded system is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function.

Existing system:-

- Manual/physical gate opening and closing.
- Manual switch based gate closing &opening.

Limitations of existing systems:-

- Chances of human error.
- Time consuming.
- A lot of human resource is required.

Using simple electronics components we can try to automate the control of railway gates. For that it uses PIC microcontroller PIC16F877A, Zig-bee module, motor, buzzer etc. As a train approaches a railway crossing the sensor placed will sense the vibrations and give the measured values to the base station which is controlled by the microcontroller. The zig-bee transceiver connected to the microcontroller will send the signal to the zig-bee transceiver which is placed over the train.
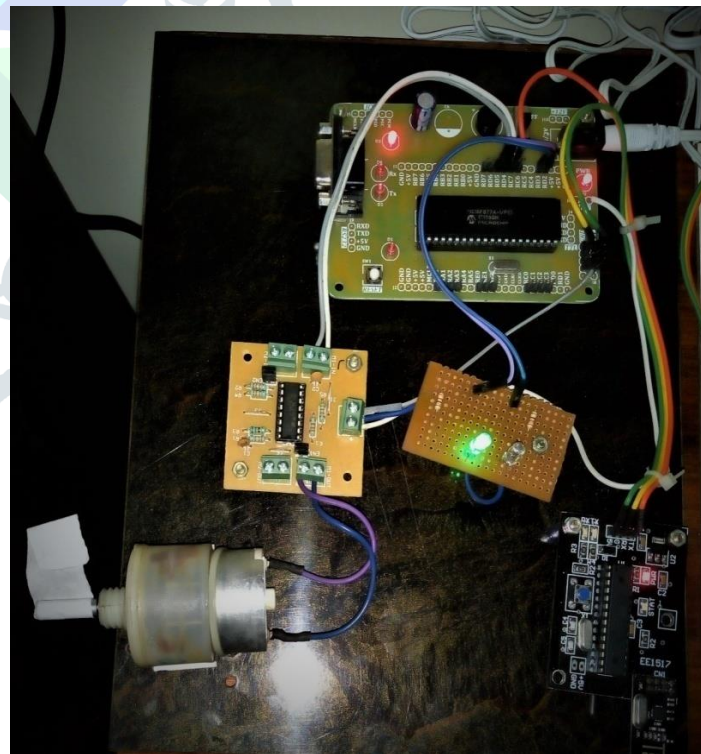

Fig 1.1: Input in Transmission end

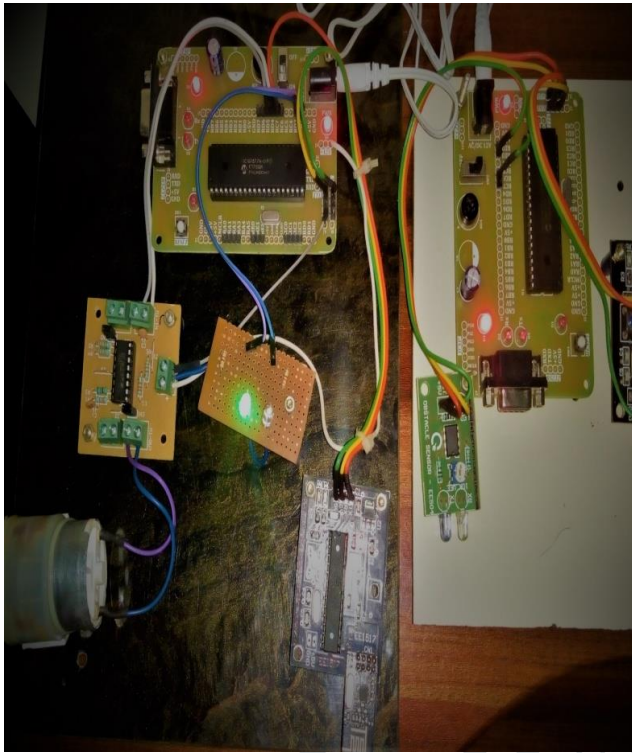**Fig: 1.4 Output in the Receiver end**

Fig: 1.5 Final result

IV. Conclusion and Future work

In this paper, a design for automatically averting train collisions and accidents at level crossing gate have been designed, simulated and tested.

- It uses advanced features of pic microcontroller with sensor and zig-bee communication technique, proves to be effective in achieving the objects.
- It is applicable at every aspect of the railways for uninterruptable service.
- Saving human life, protection against accidents and the communicable electronic systems are the salient features and the added advantage of this project.

From the above discussion and information of this system we, up to now surely come to know that it is highly reliable effective and economical at dense traffic area, sub urban area and the route where the frequency of the train is more. As it saves some auxiliary structure as well as the expenditure on attendant it is more economical at above mentioned places than traditional railway crossing gate system. We know that though it is very beneficial but it is also impossible to install such system at each and every place, but it gives certainly a considerable benefit to us, thereby to our nation.

5.2 Future Enhancement

As future enhancement it is proposed that licensing procedures of satellite communication may be initiated so as to implement a system upgrade whereby real time data of moving trains like speed and location may be tracked and monitored at the control station. Such real-time information cab be utilized for system upgrade so as to avert accidents due to natural calamities such as land slide and cyclone. An additional geographic and interface with geographic information system may be required for the same. Panic buttons may be provided in all the compartments of the train which may be used by passengers in case of danger and alert the control station. Algorithm of the proposed system may also be altered so as to incorporate a cruise control such that whenever speed of the train is detected to be higher than the rated level, automatic brake may be applied. Automatic slowdown of trains when approaching stations without stops may also be implemented as per requirements from the Indian Railways.

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