IOT Based Android Controlled Railway Level Gate Crossing

[1]R Kannamma, [2]V Mathangi, [3]R Nandhini Devi

[1]Assistant professor II, [2,3]Research Scholars
Prathyusha engineering college,Thiruvallur , India

Abstract—: **In the fastly developing country like ours, accidents in the railway level crossings are increasing day by day. No efficient steps have been taken so far in these areas and our paper deals with automatic railway gate operation through the Android application (I.e.,) the railway gate control at the level crossing replaces the gate operated by the lever it mainly deals with two things, firstly, it reduces the time for which the gate use being kept close and secondly, to provide safety to the road user. The arrival of the train is detected by the motion sensor placed on the side of the tracks. Hence, the time for which it is closed is less compared to manually operated gates. This railway gate control is performed by the Arduino.The operation is automatic so error due to manual operation is prevented…**

Index Terms—**Arduino, IR sensor, motor, led.**

1. Introduction

Indian railways are in operation for more than 160 years and it covers the whole of India. The entire network covers 64,000 km of rail route. Safety is the main objective of our system. While analysing the daily newspapers, most of the accidents are occurred in railways that too in level crossing because of the carelessness of the human who are involved in controlling of gates. This is because, in the existing system, hand lever pulley is used to close and open gates.

To avoid such accidents by carelessness and to reduce the work load of gatekeepers, the gate can be controlled using Android device. The android device is connected with the microcontroller (here we used Arduino UNO) by means of a Bluetooth module embedded with the Arduino.

The embedded C language is used to write up the logic in the Arduino microcontroller. Infra-Red sensors are used to sense the arrival and departure of the train. Relay sensors are used to control the motor of gates. The android application in the android device controls the working of gates.

The Android application named **"Train Gate Control System"** is used to control the gates. The application contains Bluetooth connectivity, status of Bluetooth, command buttons such as open, close, train data(to display the arrival and departure of trains).

2. System Analysis
2.1 Existing system
The existing system of the railway gate control system is controlling the gate manually i.e. the human who is involved in controlling of gate has to lift the hand pulley using the lever. As days went on hand lever pulley is being replaced with automated switches. But this leads to several errorless.

Due to power cut or some other technical issues, gate could not be opened or closed which leads to lots of accidents. In the current system, the signal to the gate keeper is being sent by the station master who is controlling the train. In some cases, the signal being sent by station master could not be understood by gate keeper which also leads to accidents.

In second case, that is usage of switches to control the railway gates experiences lots of disadvantages such as power issues, signal issues etc., which leads to accidents.
Some existing system are:
- Intelligent level crossing safety control system
- Automated unmanned railway level crossing system
- Anti-collision and secured level crossing system

The following are the some disadvantages of existing system:

2.1.1 Disadavantages
- Lots of accidents
- Increased workload for gatekeeper since hand pulley is used
- High cost required to implement
- Power supply should be constant

2.2 Proposed system
In proposed system, the signal being sent by the station master will be replaced with IR sensors which in turn senses the train arrival and departure by buzzers. This in turn sends a notification message of train arrival and departure to the android application which controls the operation. The android application is controlled only by the railway authorities of the concerned railway station. The Arduino microcontroller which is connected to the android application by the help of Bluetooth module helps the system to attain its efficiency in controlling the operation of gates. The relay switches are used to control the motion of gates. The signal will be red until the train crosses the particular distance. On reaching the other surpassing end the LED will be switched to green as it denotes the train departure. An LCD is also interfaced with arduino microcontroller which is used to display the status of the gate whether it is opened or closed.

2.2.1 ADVANTAGES
- Higher reliability as it is not subjected to manual errors
- Highly economical than manual railway crossing system
- Communication between railway authority and railway track is effective
- Saving human life with miserable train accidents

3. Software Description:

3.1 Application created using app inventor

App inventor is the open source which helps you to develop app for your mobile phones using a web browser and either a connected phone or emulator. The app inventor environment is supported for Mac, os, linux and several popular android phone models .

The app which we have created has "**bluetooth** status" button which shows whether the Bluetooth is connected or not "**open and close**" gate button ,it also contain the "**train data**" in which it gives the information that when the train will arrive and when it is departed .
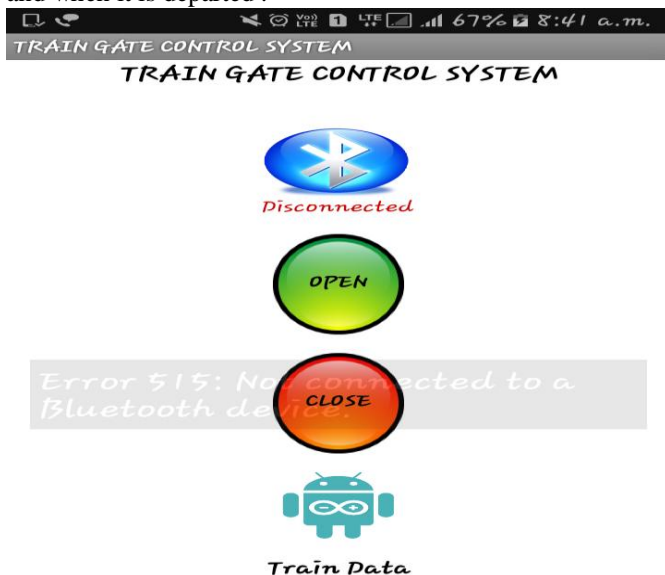
Fig 1: *The above screenshot is the app created using app inventor*

3.2 Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based onWiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts
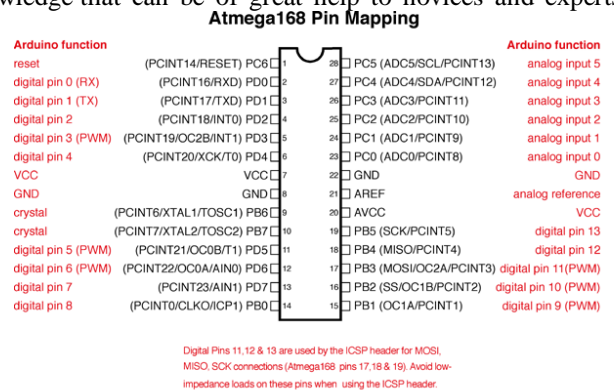
Fig 1.1 arduino pin configuration

- **Input and Output**
- Each of the 14 digital pins on the UNO R3 can be used as an input or output (thay operate at 5 Volts and provide/receive a maximum of 40mA and has an internal pull-up resistor(disconnected by default) of 20-50 Kohms.), we can using functions as below:
- – **pinMode()**
- – **digtialWrite()**
- – **digitalRead()**
- In addition, some pins also have specialized finctions:
- – Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- – External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- – PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite () function.
- – SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- – LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- The UNO R3 has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:
- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- There are a couple of other pins on the board:
- AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset butt

3.3 Embedded c

Embedded C is a set of language extensions for the C programming language by the c standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic's, multiple distinct memory banks, and basic I/O operations.

4. System Architecture

The system architecture establishes the basic structure of the system, defining the essential core design features and elements that provide the framework. The systems architect provides the architects view of the user's vision.
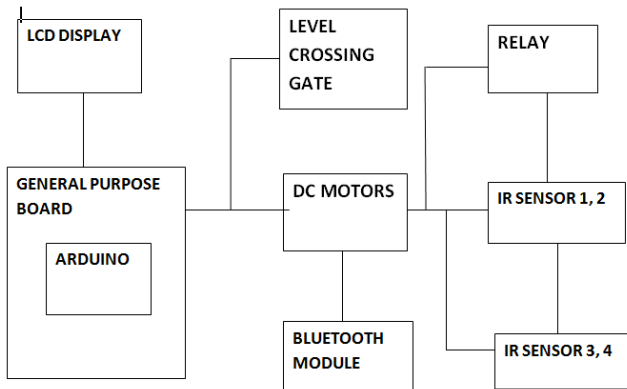

fig 1.2 Architecture diagram

In the architecture diagram we can see four sensor which are kept at certain distance ,it senses the arrival of the train and sends the notification to the android application and the gate is closed by the app operated by the respective person .similarly the departure of the train is also notified by the sensor through the app and the gate is opened .this operation is performed by the arduino software which is embedded in general purpose board for the convenience. Motor which helps the gate to open and close .

5. System Implementation
5.1 Implementation

The system consists of three modules: User Interface with Bluetooth, Commanding arduino with Mobile application, Operation of gates. Each module specifically enhances the level gate crossing provides distinct feature of crossing.

5.2 List Of Modules
- User interface with Bluetooth module
- Commanding arduino with mobile application
- Operation of gates

5.3 Module description
5.3.1 User interface with Bluetooth module
The Bluetooth in the system module is connected with user's smart phone by which total system can be controlled. For security purposes, the Bluetooth connection is secured with passcode so that unauthorised persons couldn't control. The Bluetooth module which is embedded in the system is con

5.3.2 Commanding Arduino with Mobile Application
In this module, the user commands are sent to the arduino microcontroller from mobile application with the help of Bluetooth connectivity. The mobile application which is installed in user's smart phone controls the total operation of gate. Based on the IR sensor's notification to the application, the arduino is controlled.

5.3.3 Operation of gates
When the train crosses the sensors 1,2 the notification message of train arrival is been sent to user's smart phone. On receiving the notification of train arrival, the user commands the close operation to the arduino using mobile application.
Similarly, when the train crosses IR sensors 3,4, the notification message of train departure is sent, so that the user commands open operation..

Fig 1.3 Final implementation

6. Result and Conclusion
At present the existing system is manually controlled by the gate keeper, Who gets the signal from the guard through the telephone after getting the alert from the guard the gate keeper closes the gate .sometimes the train may arrive late and the gate remains closed for long time which leads to traffic near the gate .
Thus, in our project we proposed a system which uses android application for effective analysis for train arrival and departure notification. For sensing the train arrival and departure, IR sensors are being used. The notification alert is sent in the form of a text by which user can understand. At the same time, the LED lights in the system also blinks. Each and every movement of train is sensed by the IR sensor and the notification is sent to user's smart phone. Our system overcomes most of the failures that are faced by existing systems. It is applicable for large scale environment.

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R Kannamma : Assistant prof. of computer engineering department of Prathyusha college Specialized in microcontroller

V Mathangi: UG student of Prathyusha College interested in internet of things.

R Nandhini Devi: UG student of Prathyusha College interested in internet of thing.