DESIGN OF AUTOMATIC RAIL BARRIER OPERATING SYSTEM USING IOT.

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Abstract
The study and analysis of the Design and Development of the automated barrier at Railway crossing and their rectification needed the study of the smart hardware using IOT systems. Major defects of human error and the causes can be rectified in the prevalent system and the feedback will be tracked by the IOT systems to enrich the efficiency of the operation. A prototype has been built using Arduino and GSM and IR sensors, when a train encounters the sensor a pop-up message will come to the operator mobile, and the operator can control the barricades from remote location. Hence a Human error can be prevailed by the designated staff. It will be cost effective solution where the cost of constructing a flyover and underpasses will be expensive.

Introduction
The railways barriers are being used to control the movement of pedestrians and vehicles from the level crossing where the train moves. Already we have electric opening and closing systems which have replaced the mechanical models. But the outgoing model in India only helps the operator to in easy operation of gates or barriers but not smart way of operating the same. This semi-automatic gates will not operate without human intervention that may lead to catastrophe and delay in the train movements as per the current technology in Indian Railways. Our system is going to make complete automatic railway gate to operate on the closed feedback system with IOT technology and which helps the operator or station master to monitor the system from remote locations with accuracy. This system has set of smart hardware's which uses Internet and operate the signals to trains near the gates automatically without human intervention and replace the methods of building underpasses and flyovers which may be not suitable in terms of finance as the constructions may cost huge for a simple process.

Statement of the Problem
Opening and closing of train barriers: Currently, the Indian railway system uses manpower to handle the opening and closing of the train barrier. We are handling this objective in the following three ways: Detection of the train: When the train will come into the NRF coverage area the NRF is placed in the Barrier control system placed near the barrier. The NRF placed on the train shares the information of the approaching train with the barrier control system. The closing of barriers is handled by the servo motor moving from 0 to 90 or 90 to 0 degrees slowly.
Stopping of the train on Obstacle detection: Many train casualties include someone accidentally coming in front of the moving train, considering the case like someone getting stuck while crossing the level crossing as his car fails to start or some other unavoidable situation or if someone accidentally comes under the closing barrier. If an object gets detected, the IR sensor sends a signal to the Arduino Mega placed in the data box near the train barrier which on receiving the signal in turn sends the signal to the train with the help of NRF connection between the train and the approaching crossing barrier data box. The train on receiving the signal from the data box via NRF passes the information to the Arduino Nano placed on the moving train, which based on the information received passes a variable voltage to the trains motor with the help of Motor driver board, and in turns slows down the train.
Object detection in front of the moving train: With the application use of Ultrasonic sensor, we are detecting an object in front of the moving train. The minimum deceleration will be set because we are also preventing any inside train accidents caused due to sudden deceleration.
Uploading Train's Information on SERVER: When the train's information (train's ID, Next Station ID, Speed, Water Level) is transferred to Arduino MEGA in the barrier control node via NRF communication, it is then forwarded to Raspberry Pi using I2C (Inter-Integrated Communication),

which then verify the Data and then uploads it on the Internet Server Using Python. We are handling this objective in the following two ways:

Getting Data from Train and Verifying It: When the Train reaches a near barrier it transfers Train's vital information to the Barrier control Node containing ARDUINO MEGA. This Data is verified in Raspberry To know whether it is actually from a verified source (i.e., Train).

Uploading Verified data on Server: A client request application is running on each individual Barrier node, as the verified data is passed, a POST request is sent to the centralized server which posts train information on that centralized server instantly.

Creating an Application and a Web Server for Passengers and Station Master: For the Real-time location detection of Trains and for the convenience of the passengers and station master, an app is created which fetches its data from the centralized server, where data is updated in real-time.

Objectives of the study

- To conceptualize the automatic operation of railway barriers.
- To eliminate the human error of operating the gates for safer operation.
- To rule out the construction cost of the flyovers and bridges.
- To analyze the failsafe design using IoT.

Review of Literature

K. Ajith Theja et. al. [2] focused on preventing skilled workers to operate the railway crossing and established a model to open and close railway gate automatically using Wireless Sensor network (WSN) and thus avoiding accidents caused by human errors.

Any M. Kottalil et. al. [3] proposed a tested circuit to control the opening and closing of railway gate precisely using ATMEGA 16 to reduce the problem of longer wait time for road passengers while waiting for passage of train.

In [4], the authors proposed a model which provides the means for real time inspection and automatic gate control using IR sensors which lessens the manual interference to avoid accidents occurring due to human negligence. Our paper also proposes this as a solution and adds more safety features with the inclusion of IOT.

Sheikh Shahnawaz Mostafa et. al. [5] proposed a method for avoiding collision by using radio links in order to transfer identification, information of approaching and outgoing trains faster to avoid accidents at railway crossing.

In [6], authors did a comparison of Level crossings used across the world and aimed to embed railway crossing with automated platform bridges to provide automatic level crossing and reducing the wait time which wastes due to opening and closing of gate irrespective of train arrival

In "Improving Railway Safety with Obstacle Detection and Tracking System using GPS-GSM Model" [8] the authors proposed a solution encompassing GSM and GPS technologies to provide train tracking and pinpointing location of obstacles using GPS.

D. Karthiga Devi et. al. [9] implemented an autonomous system that uses image processing techniques to identify obstacle movement along the tracks and thus focusing on preventing accidents caused due to obstacle collision.

Research Methodology

If the sensor near the barrier senses the train, the barrier is opened or closed. If there is a possibility of collision, a message is sent to the responsible authorities and a webpage is updated about the position of the train according to the input from the sensors.

IR Sensors -IR sensor is an electronic device, that emits the light to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR

light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength used as infrared sources.

Servo Motor –

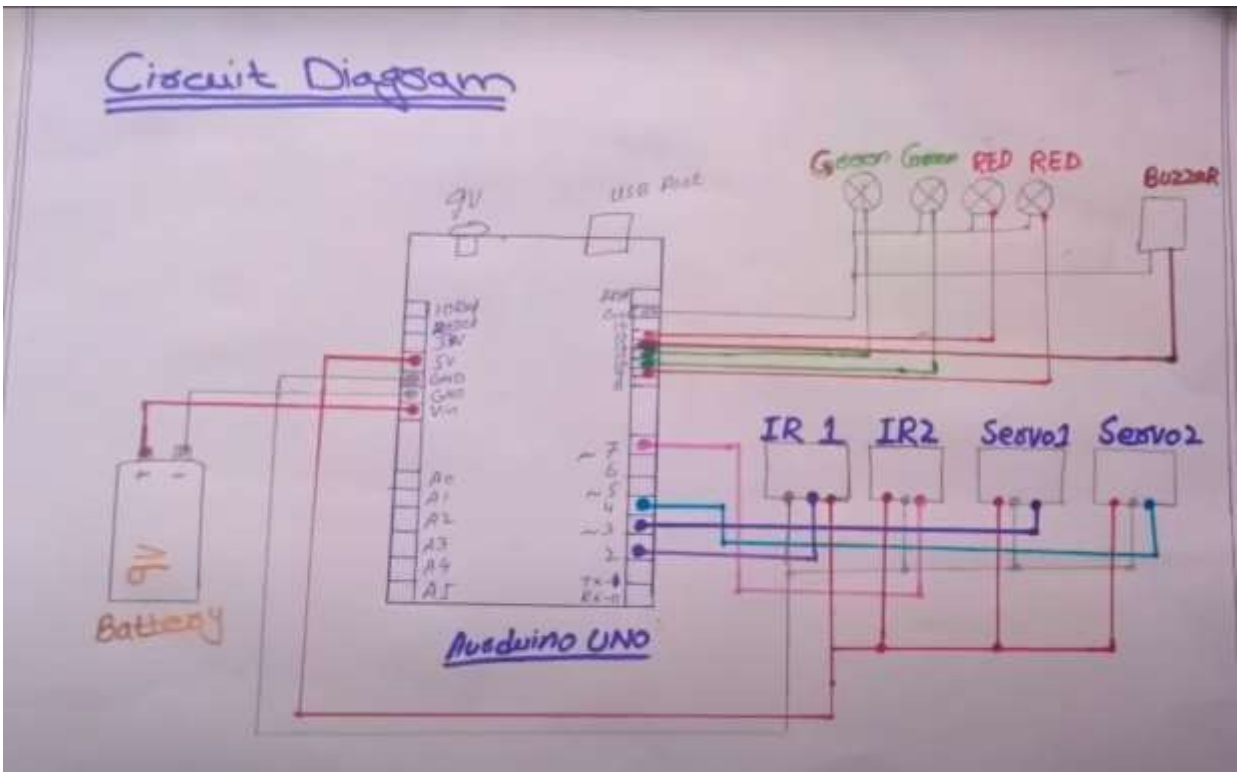
A servo motor is a motor whose shaft turns to position something based off a control signal. They are typically used to steer remote control airplanes by adjusting the wing flaps, flight position for drones, controlling valves used in flow control or continuous drive of wheels for robots. They can be used to position or adjust almost anything you can think of. They consist of a plastic housing which contains a DC motor, a control circuit and a few gears for torque

Servo motor control of the shaft position comes from using a pulse width modulation signal (PWM) to turn the shaft clockwise or counter-clockwise, depending on the pulse width of the signal. Typically, a pulse width of 1 Ms will rotate the shaft clockwise and a 2 Ms pulse will rotate the shaft counter-clockwise.

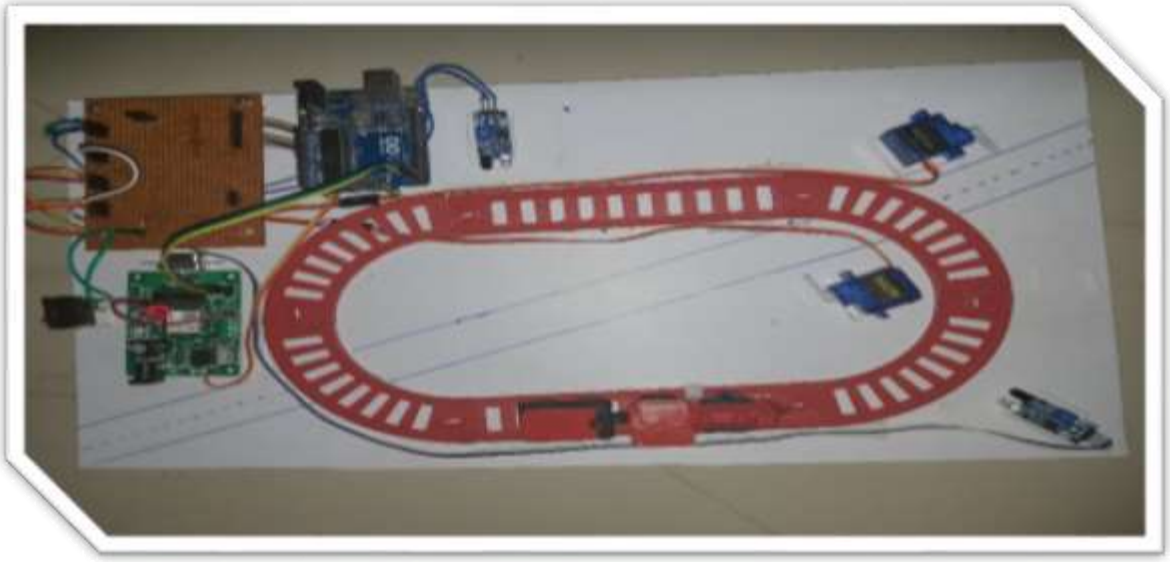
Arduino -

Arduino is a prototype platform (open source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.



Flow Diagram



Final Model

Conclusions

The conclusions of the project work are as follows:

• Uploading Train's Information on to server to save the data for the loop response.
• Getting Data from Train and Verified and fed across the machine to operate as per the instructions.
• Uploading Verified data on Server to process for the next processes accurately.
• Creation of an application and local web server to ensuring the accuracy of the operation with the verified data.

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