"Railway Anti-Collision System, Auto Track changing and Phis Plate removal Sensing"

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ABSTRACT

Indian Railways is one of the world's largest railway networks in the world, transporting over 18 million passengers and more than 2 million tonnes of freight daily. Hence, the security of Indian railways becomes indispensable . The illegal removal of fish plates and collision on the same track leads to crash. The objective of our paper is to develop a radical system for continuous monitor of fish plates using power relays and immediate signalling on said fish plates removal. In our proposed system we record the trains on the same track using the GPS module. GPS module interfaced with an ARDUINO board reads the geographical coordinates of the train's position so that the trains can be halted by applying emergency brakes and sending signals to both the train brake and train control rooms. Should such a case occur the train starts applying the brakes at a distance of 1 Km from the incident location? It is expected that if this system is implemented widely, train collisions and accidents can be avoided and amount of losses could be negated. Keywords: Power relays, GPS module, ARDUINO Board

I.   INTRODUCTION

Transport is very important to carry the passengers and goods from one place to another. Better transport leads To increased rate of trade. Economic level is highly dependent on increasing the capacity and quality of transport. In recent years, many passenger and goods train have derailed or suffered from collisions due to damages in rails .The damages to tracks are predominantly due to missing fish plate's accounts for the maximum number of such cases. People illegally remove fish plates for monetary benefits. Various terrorist outfits have also been involved in such detrimental activities. In other cases trains collide each other and leading to huge loss of life and trade goods.

Head-On & Rear-End Collisions:
A head-on collision is one where the front ends of two vehicles hit each other, as opposed to aside-collision or rear end collision. With rail, a head-on collision often implies a collision on a single line railway. In this paper we concentrate on detection of fish plate removal and collision of trains on same track using power relays, ARDUINO board and GPS sensor

II.   MOTIVATION

Reliability -
As the data is saved one can add, modify and delete data as and when required. Processing is done by the computers are accurate provided that user is accurate and the reports generated as appropriate, attractive and more readable so users may rely on the computer.
Speed/Communication -
Being electronic device, the computer processing is faster and that increase the speed of work and within few seconds the record of previous year can also be processed. It affects the communication and decision making also. Security -
As the data stored and doesn't get damaged unless the physical device is not proper. The part
of the data can be viewed and can be taken on printers as and when.

III.   Existing System

The existing system uses sensors and GSM technology that provide security and collision avoidance. This system has been designed and simulated using protest real time simulation software. Various models for the railway traffic systems has also been generated and tested. Various sub modules communicate with each other and with a central monitoring station where entire data is stored and monitored

IV.   Proposed System

The proposed train anti- collision system consists of detection of missing fish plates and/or cracks occurring in the tracks using power relays . signal produced by power relays is sensed by the Arduino board and halts the train automatically as per the program that has been preprogrammed
on said board. GPS sensor is also proposed in this system in order to locate the
trains on the same Track which is interfaced with the Arduino board in order to avoid any collisions that may occur

V.   Software and Hardware Requirement

Hardware Requirement –
 · Arduino Board
 . Power Relay
   GPS Module
Software Requirement –

 · GPS with Arduino

VI.   Detailed Design

Data Flow Diagram-

A data flow diagram is a graphical representation of the flow of data through an information system. Often they are preliminary step used to create an overview of the system which can later be elaborated. DFD's can also be used for visualization of data processing.
A DFD shows what type of data will be imputed to and output from the system, where the data will come and go to, and where the data will be stored.

Following are the symbols with their purpose used to draw DFD-

Function

File / Database

Flow Lines

Input/output

```
┌──────────────────┐          ╭──────────────╮          ┌──────────────────┐
│                  │          │ Detection of │          │                  │
│   Power Realy    │ ───────▶ │    Craks     │ ──────▶  │  Arduino Board   │
│                  │          │              │          │                  │
└──────────────────┘          ╰──────────────╯          └──────────────────┘
                                                                  │
                                                                  ▼
                                                        ╭──────────────────╮
                                                        │  Sensing missing │
                                                        │  plate And Halting│
                                                        │  Train and halting│
                                                        ╰──────────────────╯
                 ┌──────────────────┐
                 │                  │◀───────────────────────┘
                 │   GPS Module     │
                 │                  │
                 └──────────────────┘
                          │
                          ▼
                 ╭──────────────────╮
                 │   Locate the     │
                 │  train on same   │
                 │  track To avoid  │
                 │    collision     │
                 ╰──────────────────╯
                          │
                          ▼
                  GPS With Arduino
```
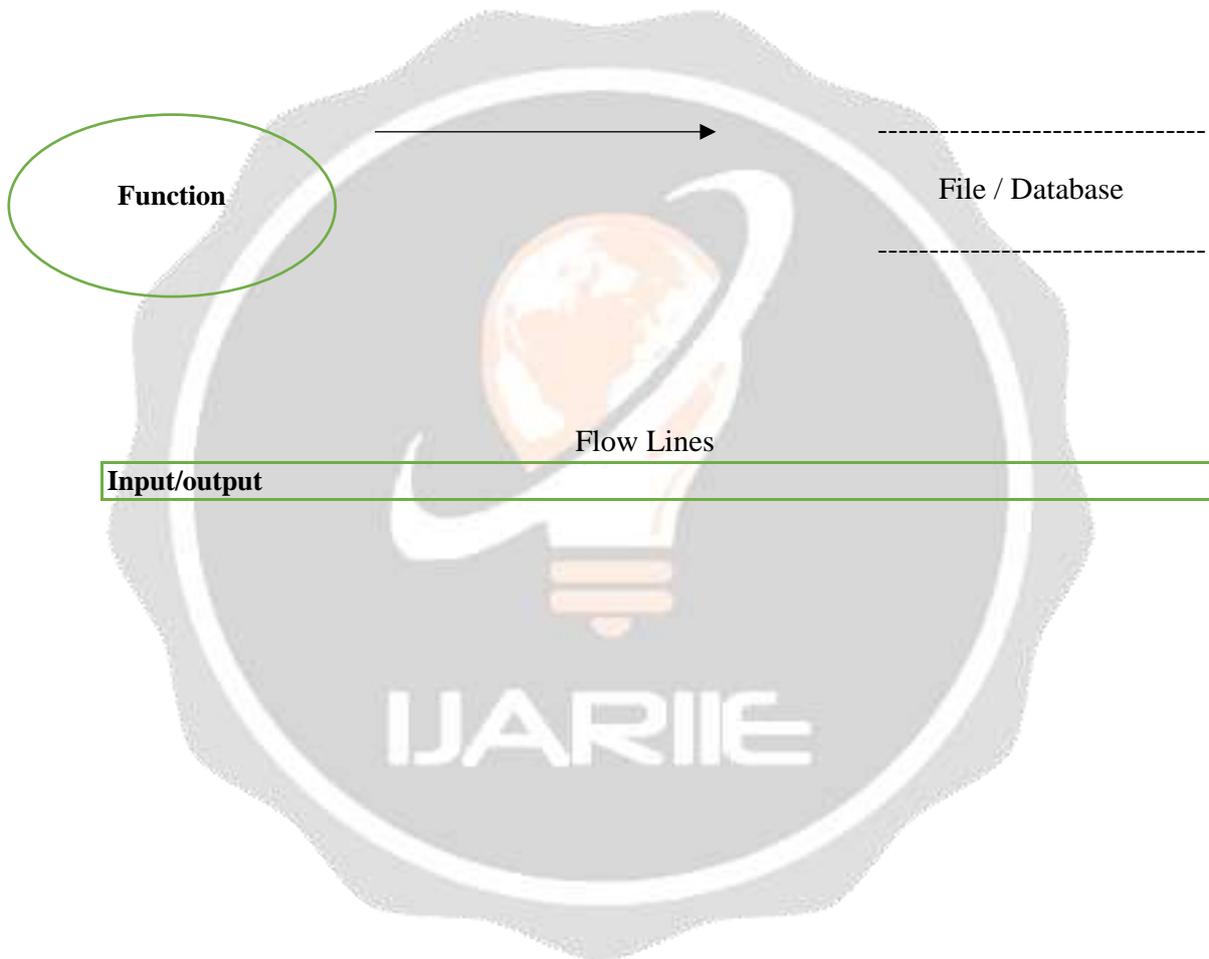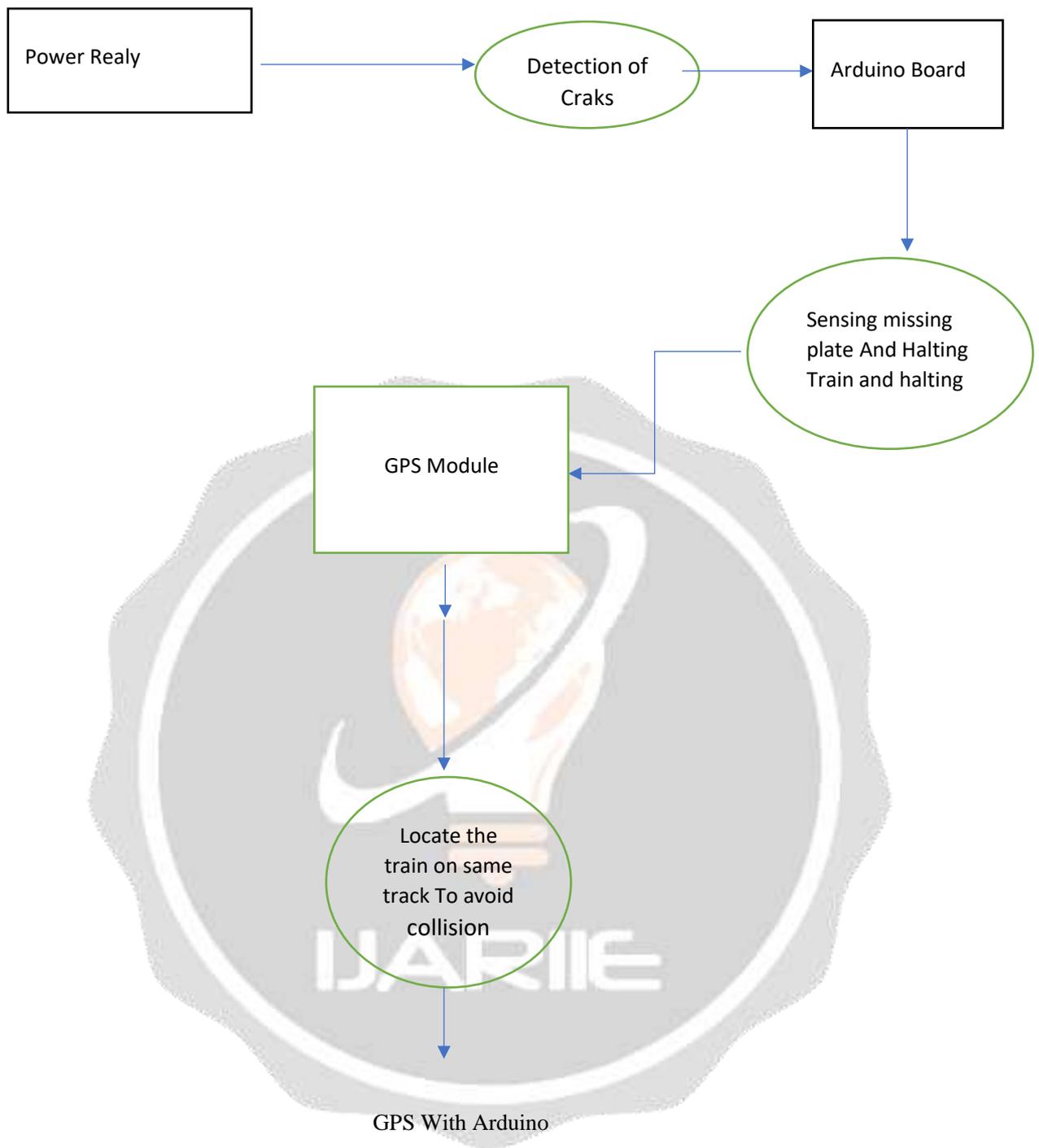
Fig. Data Flow Diagram

ER Diagram Notations :-

```
   ( Low          )                                    ( Digital      )
   ( Voltage      )                                    ( Input        )
        |                                                    |
        v                                                    v
   [ Power Realy ] --> < Detecting >  --> [ Ardino Board ]
                       <  Craks    >                         |
                                                             v
   ( Sensor )                                           < Halting >
        ^                                               < Trains  >
        |                                                    |
        +------ [ GPS Board ] <---------------------------- +
   ( Satellite ) <----    |
                          v
                   < Locating    >
                   < Same Track  >
                   < Train       >
                          |
                          v
                   [ Ardino With GPS ]
                                  |
                                  v
                           ( Pre-        )
                           ( Programmed  )
                           ( Board       )
```
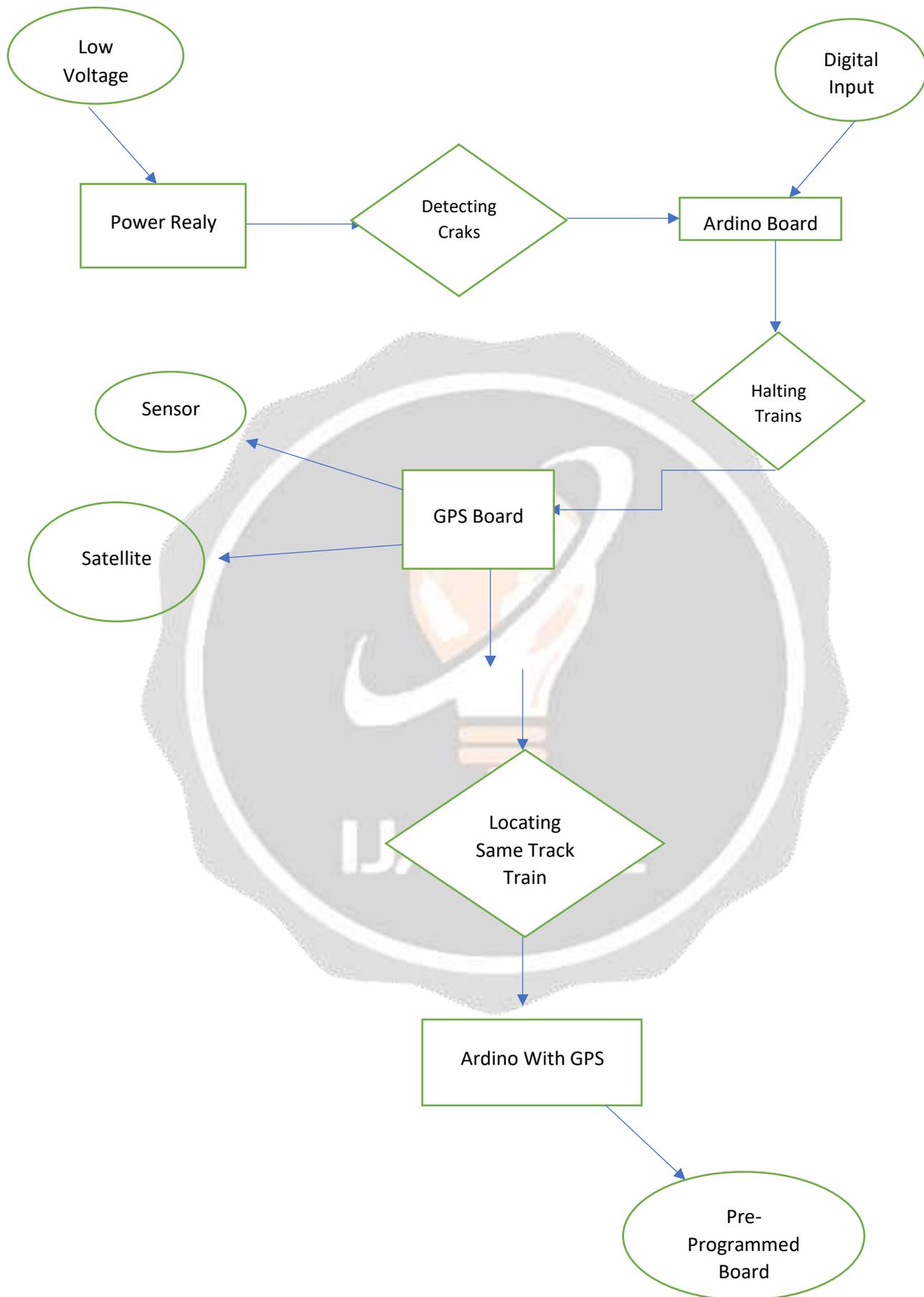
<center>**VII.   Implementation**</center>

Software and Hardware Used for Implementation-
   • Power Relay :
A power relay is a switch which is used to open or close a circuit using electromagnetic coils. Power relays also contain an armature, a spring and one or several contacts.

   • If the power relay is normally designed to be open, when power is supplied, the electromagnet attracts the armature, which is then pulled in the coil's direction until it reaches a contact, therefore closing the circuit. If the relay is normally designed to be closed, the electromagnetic coil pulls the armature away from the contact, therefore opening the circuit.

   • Power relays are used for many different applications, including:
1.Automotive electronics
2. Audio amplification
3. Telephone systems
4. Home appliances
5. Vending machines

In our paper we use power relays for supply of low voltage high ampere current (which is equivalent to range of the battery) to the tracks to detect the removal of fish plates or any cracks leading to the emergency braking protocol being executed

   •   **Arduino Board :**

   Arduino is a hardware or software microcomputer project, user community that are used to design and manufacture microcontroller kits for developing digital devices and interactive objects that can sense and control objects in the real world. The project's products are distributed as open source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), allowing the producer of Arduino boards and software distribution by anyone. These systems provide sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansion boards or shields and other circuits.

- **GPS Module:-**

Global Positioning System (GPS) sensors are receivers with antennas that use a satellite-based navigation system with a network of 24 satellites in orbit around the earth to provide position, velocity, and timing information. Receiver position is calculated from the position of satellites and the distances to them. Distance is calculated from the time a radio signal travels between satellite and receiver. Indian Railways have made an announcement that the trains may soon get real time GPS tracking system to avoid accidents. According to The sources, the real time GPS tracking system will be integrated with Google Maps so that it will be accessible through range of mobile devices & computers.

The technology arm of the Indian Railways, the Centre for Railway Information Systems (CRIS), has developed a GPS-based solution with help of Indian Space Research Organization (ISRO), which can provide exact location of a train with an accuracy of 10metres, and latency of 2 minutes, on a real-time basis. As per reports, the price of GPS devices will be approximately Rs 75,000 – 1, 00,000 per train, would be fitted in about 100 trains, which may help avert collisions and avoid loss of lives. In effect, trains in future will be aware of each other's location, and start breaking, in case of anger ahead.
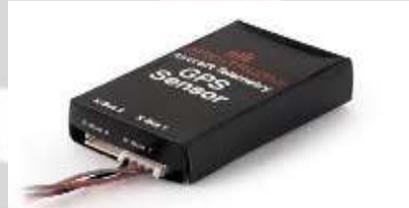

- **Integration of Power Relays and Arduino Board :**

Power relay supply low volt high ampere current (which is same as range of battery) through tracks. If any removal of fish plates or cracks occurs the signal passing through the tracks gets halted .In that case power relay gets a message that no more signals are passing further. Then Arduino board which is fitted in the control room of the each train, receive signals from the power relays and halt the train according to the program that has been designed in the board.
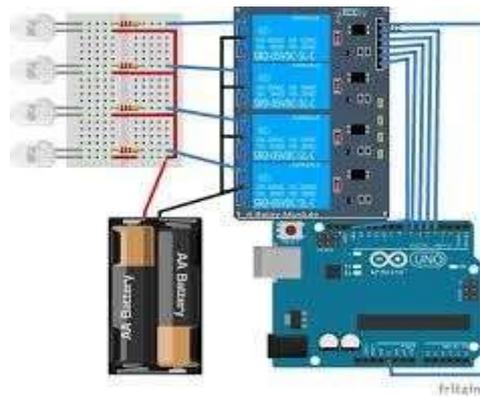
- **GPS with Arduino :**

The GPS navigates the direction of each train, and sense the location of surrounding train. If the two trains travel on same meridians (same longitudinal and latitudinal direction) collisions may occur. To prevent such cases the GPS senses and pass the information to the Arduino board interfaced with it. A program is pre-programmed in the Arduino board which neither makes the train choose another path nor halt the train.
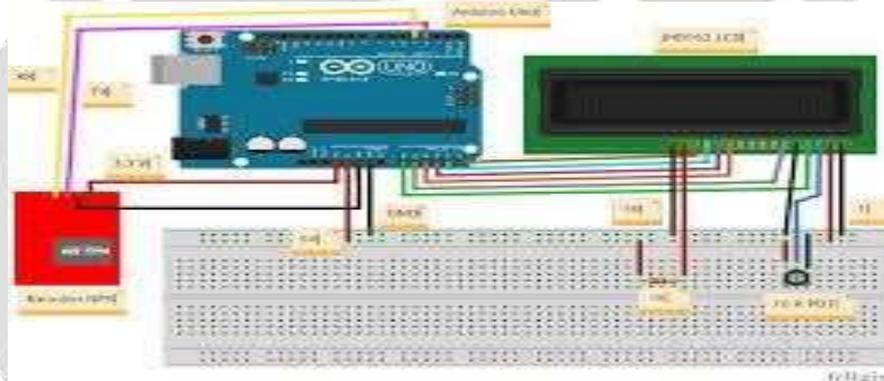
VIII.   Conclusion

- The main intension of the project is to prevent train collisions. By using this project many human lives can be saved. This project can work in any atmospheric conditions. Without any human involvement the trains will automatically stops. Through this innovative technique of early sensing of any possible collision scenario and avoiding it thereof, we demonstrate that it is a possible way to improve the overall safety of the railway system in India. We believe that success depends on both the railway industry.

- While coming to automatic railroad switching system it will reduce the errors of switching two trains on same track and anti-collision system reduces the Collisions of train with obstacles.

IX.   Future Enhancement

In Future Enhancement inspite of this topic is having huge scope. The proposed system can be further upgraded in future to make a centralised control system for all trains. Prediction algorithm can also be launched in the system to prevent collisions.

X. REFERENCES

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- Author : Somprakash Bandhopadhyay, Pradeep Ghosh, Anural D, 'GPS based Vehicular Collision Warning System using IEEE 802.15.4 MAC/PHY Standard'.

www.indianrail.gov.in / https://indianrailinfo.com.