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AN INTELLIGENT CONTROLLER FOR UNMANNED RAILWAY GATE CONTROL SYSTEMS

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ABSTRACT

The main objective of this proposed work is to provide an automatic railway gate operations at a level crossings instead of manually operated gate. The proposed prototype model has been designed using microcontroller (89C52) to avoid railway accidents occurring at unattended railway gates. By the implementation of such system, detection of train approaching the gate can be sensed by means of two reed sensors placed on either side of the gate. By employing the automatic railway gate operation control at the level crossings, the arrival and departure of the train is detected by the reed sensors placed before the gate and gate will be closed and opened respectively using geared DC motors through programmed microcontroller. Hence, the time duration for which gate is closed is less as compared to the manually operated gates and also reduces the human involvement and error. This work also proposes the detection of obstacles between the gates at the time of train arrival using IR LED and oscillator circuit. Rail track cut detection is also carried out in this work using metallic conductivity and squire wave generator circuit, which could avoid major railway accidents as such.

Keywords: Microcontroller, Rectifiers, Relays, Voltage Regulators, Reed Sensors, Transformers, Dc Motors

I. INTRODUCTION

World's largest railway network exists in India, hence over crowded railways running is on the track is being observed causally. It is impossible to stop, the running train at instant during some critical situation or emergency arises. Train accidents having serious repercussion in terms of loss of human life, injury, damage to railway property. These consequential train accidents include collision, derailments and collisions of train at level crossings. As India is developing country, it has already enough economical problems, which are ever been unsolved. To avoid such things some sort of automatic and independent system could be planed. Therefore keeping all these aspects in consideration, there is a need of such system which could avoid train accidents. This proposed work tries to make such a system by using various electrical, electronic and mechanical components [1-3].

This unmanned railway gate control system at level crossings could replace the gates operated by gate keepers and also it detects the stucking of any vehicle or human being or animal on the track at the time of train arrival.

Also this work proposes track cut detection by which the nearby stations will be informed automatically. This could avoid major accidents due to track cut. Implementation of such system will reduce the time duration for which the gate is being kept closed, also provides safety to the road users by reducing the accidents that usually occur due to carelessness of road users and avoid errors made by the gatekeepers. By employing the unmanned railway gate control at the level crossings, the arrival of train is detected by the reed sensor placed on either side of the gate at about 3km from the level crossing. Once the arrival is sensed, the sensed signal is sent to the microcontroller and it checks for presence of vehicle between the gates on the track, again using sensors. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closing of gates [2-6].

Once, no vehicle is sensed in between the gate the motor is activated and the gates are closed. But, for the worst case if any obstacle is sensed at the arrival of train, it gives indication to the train driver by signals (RED light) placed at about 1km far from the gate ,so as to bring the train to halt well before the level crossing. When no obstacle is sensed GREEN light is indicated, and the train is free to move. The departure of the train is detected by sensors placed at about 2 km away from the gate [2-4]. The signal is sent to the microcontroller after the departure of train, which in turn operates the motor and opens the gate. Thus, the time duration for which the gate is closed is less as compared to the manually operated gates.

II. LITERATURE SURVEY

The major issue that takes place in the railway transport system is that, railway gate control at level crossings, unmanned railway gate control are still in the development stage. Now a days there are many rail way crossings where there is no protection for road users, as a result a number of accidents are occurring. The main purpose of this proposed work is that, to avoid accidents due to many reasons such as human errors, lack of awareness in the traffic rules and inability to utilize the advanced technologies.

Consequently to overcome this problem, there is a necessity of safe and secured railway gates which is being operated without man power to avoid human involvement and errors. In this proposed work, the train arrival and departure is being sensed by means of magnetic field techniques where the IR sensor drawback could be eliminated, the reed sensor activates when the magnetic field created in a engine cabin this acts as a signal to microcontroller (89C52) indicating train arrival and gate is closed by operating geared DC motor, similarly when the engine reaches the second reed sensor, this acts as a signal to micro controller indicating train departure and gate is opened using geared DC motor. Red colour indication appears along with the buzzer as a precautionary measure for the road user once the train reaches the first reed sensor placed before the gate i.e when the gate is closed. The track protection is achieved by providing closed loop along the track. If any track cut is occurred, this gives the signal to the controller to the both nearby stations by which major railway accidents could be avoided.

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III. METHODOLOGY

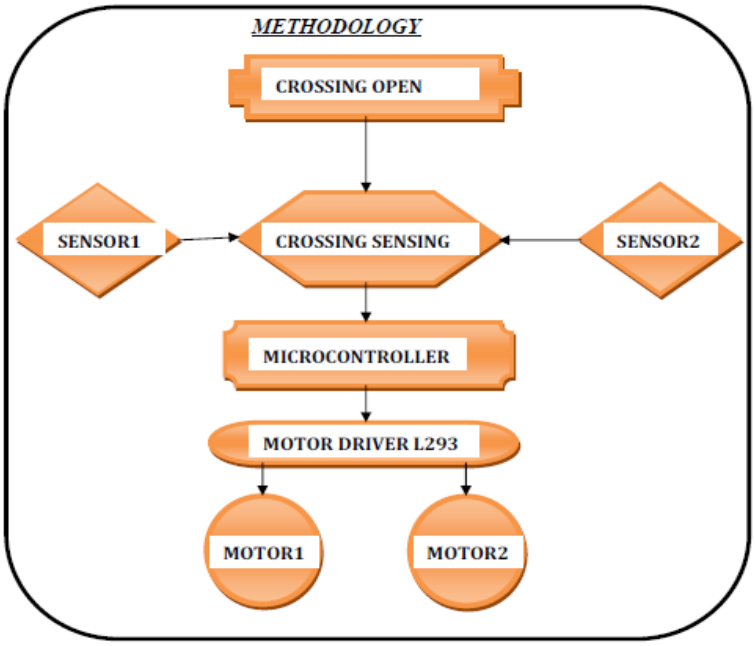

Fig.1. Process Chart for Railway Gate Control.

The complete process chart for railway gate control is shown in Fig.1. When there is no train moving before the gate, all the sensors are inactive and the railway crossing is open. the train arrival and departure sensing can be achieved by means of magnetic field techniques where the reed sensor activates for the magnetic field created in a engine cabin this acts as a signal to microcontroller (89C52) indicating train arrival and the microcontroller gives the input signal to the motor driver L293 IC, geared DC motor is operated and gate is closed, similarly when the engine reaches the second reed sensor at other end, this acts as a signal to micro controller indicating train departure and the microcontroller gives the input signal to the motor driver L293 IC, now geared DC motor is operated and gate is opened.

IV. BLOCK AND CIRCUIT DIAGRAMS

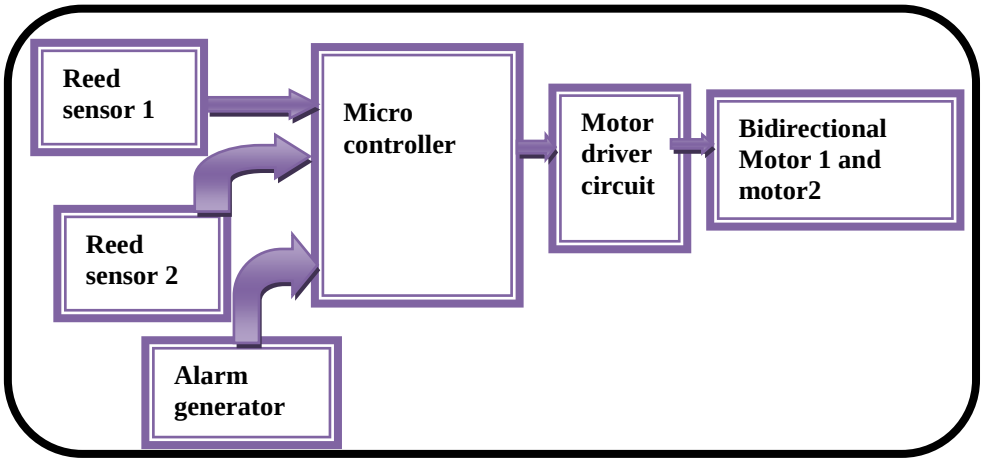

Fig.2 Block Diagram of Railway gate operation.

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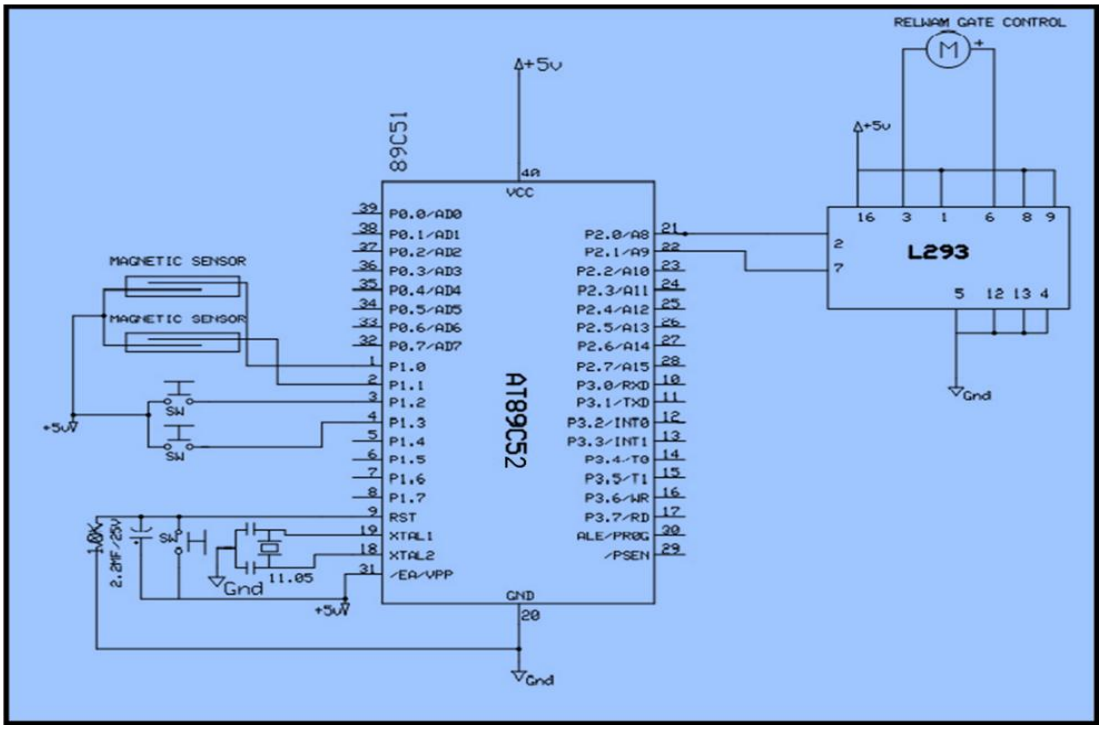

Fig.3 Circuit Diagram of Gate Control[7]

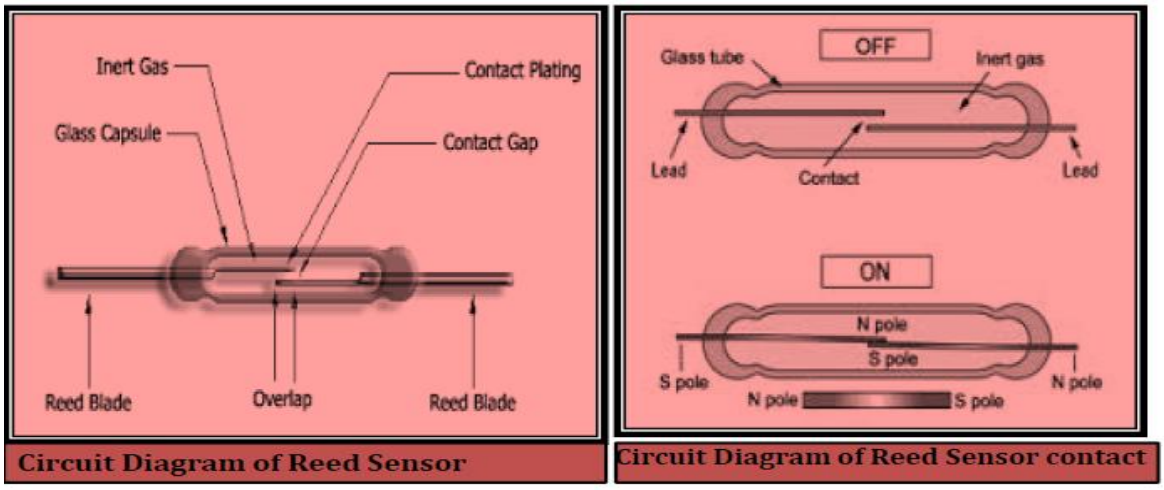

Fig.4 Circuit Diagram of reed sensors and its operations[9].

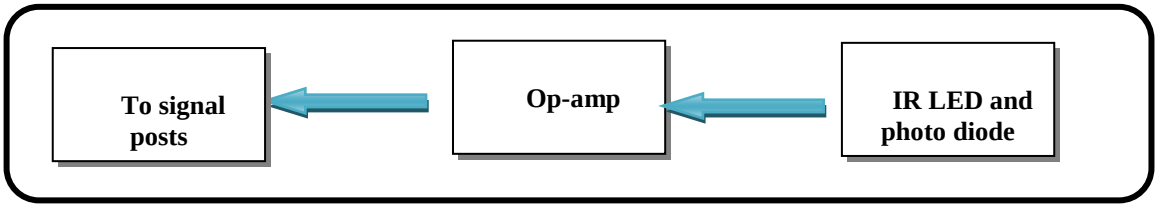

Fig.5 Block Diagram of Obstacle detection.

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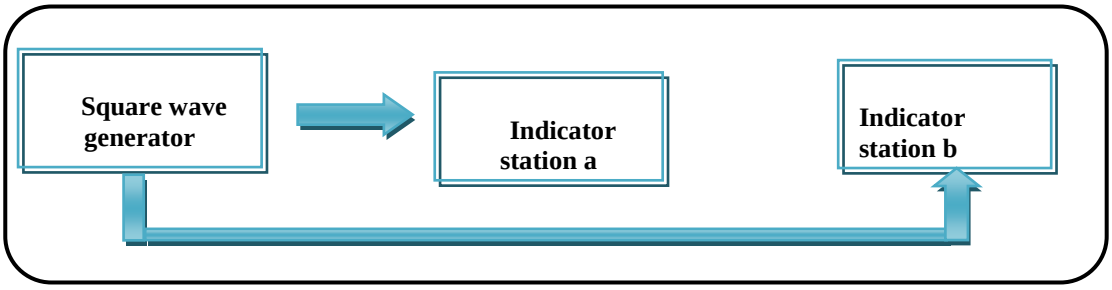

Fig.6 Block Diagram of Track break detection.

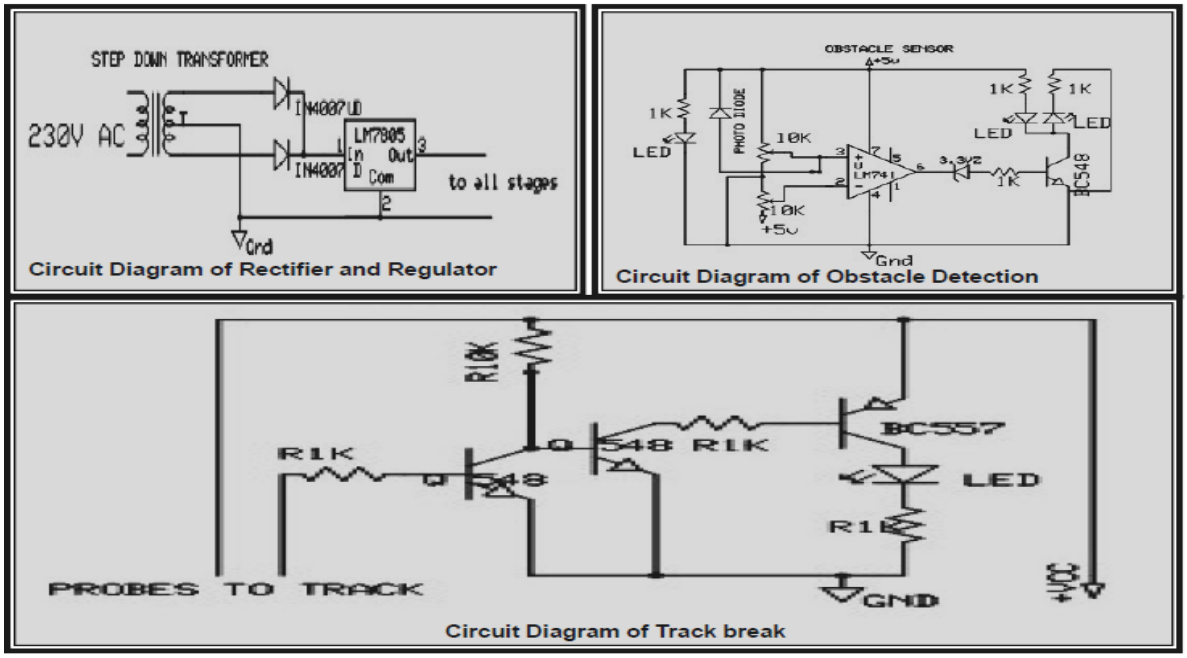

Fig.7.Circuit Diagrams of regulated power supply, obstacle detection and rail track cut detection [8].

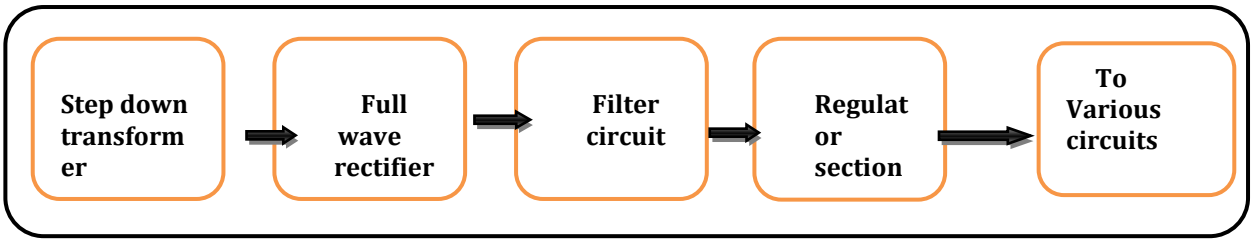

Fig.8 Block Diagram of Regulated Power Supply.

The figures.2, 3 and 4 indicates block and circuit diagrams for the modern railway gate control system and reed sensors operations respectively without any manual operations, there are different kinds of sensors are used and execute the operation without man power the method shown here is man less gate operation. The existing method uses a man power which may leads to negligence and not possible to implement in all places. In this work, reed sensors which are placed before and after the gate will sense the train arrival and departure, accordingly closing and opening action of gate takes place using geared DC motors through motor driver L293 IC.

The road gates on the railway tracks can be controlled without manpower with greater accuracy and in efficient way, the system requires magnetic sensors which are placed on the tracks before and after gates at a particular distance. The magnetic sensor or reed sensor operates with magnetic field and in the engine cabin a high magnetic field is generated which activates the reed sensors sends signal to the programmed microcontroller, now microcontroller will give signal to the motor driver IC L293, by this geared DC motors will be operated to close and open the gates.

The above figures 5,6,7 and 8 represents the overall block diagrams and necessary circuits for present wok. The power supplies are designed to convert high voltage AC supply to a suitable low voltage DC supply for electronic circuits and other devices by using single phase step down transformer, rectifier circuit and filter circuit. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations, therefore it is known as regulated D.C power supply.

If any obstacle found on railway track near the gate at the time of train arrival could be detected and this information will be sent to arrival trains with wireless technique. A IR LED and photo diode combination the IR LED emits the IR beams with the help of oscillator circuit which is designed with 555 timer IC arranged in astable mode and generate a continues square wave pulses at 8KHZ frequency and this output now connect to IR LED. The photodiode is arranged beside IR LED and the light beam falls on photodiode received and convert in to logical signal. This arrangement now placed on the track where the gate is mounted, if any vehicle or obstacles abstract this beam for long time, the control signal generates from the circuit which now connects the nearest signal post of both the sides of gate which gives alert signal to the trains which moves on that track, thus the train could be stopped until the removal of obstacle from the track.

Rail track cut due to earth quack or any other reasons can be detected with simple technique of sending a data which is generated from a transistorized circuit. The metallic conductivity property of the track is used as wire to send the signal, if the tracks are continued without any damages no signal flow takes place through the tracks and no indications are provided in between two stations. In case the tracks breaks or damaged by any kind of reasons like terrorism activities the signal flows through the tracks and LED starts blinking and gives the indications of alert condition through buzzer to the nearby stations on either side. Trains are sopped until the completion of track repair.

V. APPLICATIONS

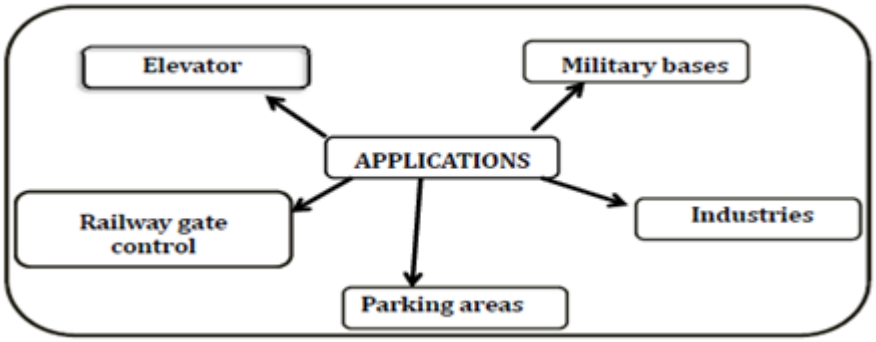

Fig.9 Typical applications of Microcontroller

1. **Railway gate control**

It is used for the automatic operation of railway gate control reduces the man power and with accuracy and reliability, further accidents can be avoided.

2. **Parking areas**

It can be most commonly used in parking areas initially the gate will be closed when the vehicle reaches the parking area the gate will be open and the gate will be open as soon as the vehicle enter the parking area the gate will be closed.

3. **Industries**

The operation in industry is similar as that of the parking areas as soon as the vehicle in the industry carrying goods enters the the gate opens and as soon the vehicle passes the gate closes.

4. **Military bases**

In military base the authorized persons can enter the base using the track id in the base as the base will be automatic open close panel door which opens when the track Id is inserted and closes when the person leaves the bases**.**

5. **Elevator**

When the person reaches near elevator the door of the elevator will be opened and when the person leaves the elevator the door will be closed.

VI. FUTURE SCOPE

This work provides basic concepts and information to undertake safety and security concerned measures to protect railway properties and human lives by adopting advanced technologies. But still the power supply for the motor operation, signal and lights indicators for large scale implementation should be planed properly. This can be achieved by tapping renewable energy sources such as wind, solar, tidal and many other sources. This project is developed in order to help the Indian Railways in making its present working system a better one. This proposed work can be further extended to meet the demands according to the future situations. The automation in the railway transportation leads major energy savings, as it has large scope for energy conservation, which in turn provides safety and security to the mankind and railway properties.

VII. CONCLUSION

This proposed work is highly reliable, effective and efficient to control railway gate operation automatically without man power at road crossings. By this mechanism, accidents can be reduced, more secured and safe journey could be ensured, which will protect the costliest railway properties and precious human lives by adopting electrical, electronic and mechanical components in the proposed work.

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