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Automatic Braking System for Trains using Radio Frequency

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Abstract: In Indian railway one of the most problems is the accident. These problems regarding the trains and their corresponding tracks can be solved very easily. In this model, we have used two RF based sender and receiver kits to provide the necessary functions to the train locomotives. So now when the two trains are anywhere near, the paddle brakes provided stops either of the two locomotives without causing accidents. The project implemented by us is actually very much possible to be implemented on a larger and real scale.

I. INTRODUCTION

Radio frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves and the alternating currents which carry radio signals. RF usually refers to electrical rather than mechanical oscillations, although mechanical RF systems do exist.

In this model, we have used two RF based sender and receiver kits to provide the necessary functions to the train locomotives So regarding the setup and the design to construct and successfully imply, we consider three main objectives to our project. They are

a) To design a pair of RF transmitter and receiver circuit working as train sensor at a common TRACK.

b) To construct a DC motor operated breaking system working as paddle brake at wheels.

c) To interface both to work as automatic braking system for trains by limit switch arrangement for creating and releasing brakes.

The objectives mentioned here are regarding two locomotives destined on two rail tracks. The RF sender/receiver kit provides necessary range detection and application for the paddle brakes.

Moreover, the motor system to be applicable, we need the proper designation to the train model we have put up. So, the trains we have equipped with this braking system are functional based on the range of the RF based sender/receiver kits.

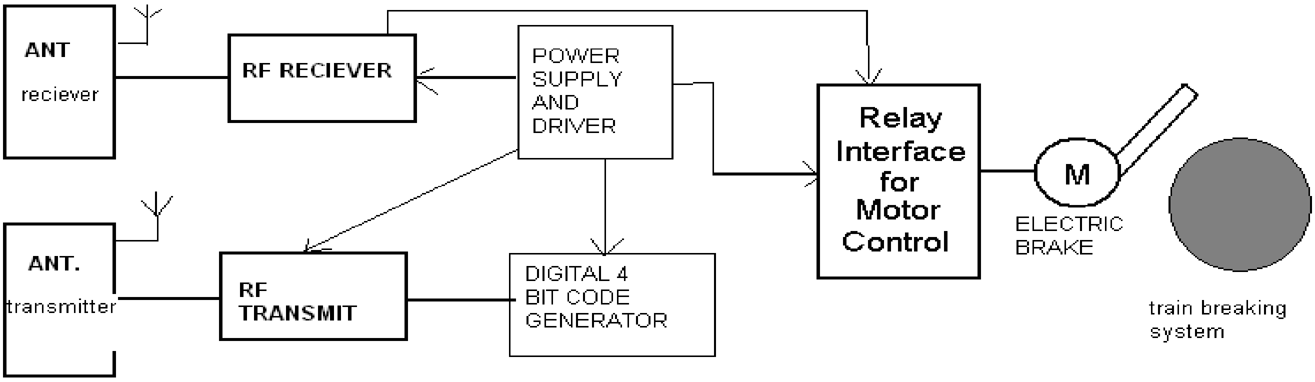

Fig 1.1 Block Diagram of RF kit and the whole setup

Now, as we see the block diagram suggests the components required for the implementation of our project, we show the connection based upon the diagram suggested above.
The most important and integral parts or components being the Transmitter and receiver kits we align the power supply and the relay circuit to support the setup.

1.1 View of Working

The RF frequencies transmitted and received by the corresponding kits are the integral part, hence if we consider two trains approaching on the same track they trains can be stopped by the setup installed. The range say is 2kms then any two trains on the Same track in either directions come within this range specified they are forced to stop by an automatic brake. The trains are fitted with the arrangement as seen below.

As seen in the diagram above each train locomotive is fitted with both the RF transmitter and receivers for the sake of detecting the signal. Now as soon as the range is breached the motor controlling the brake is powered and the paddle brakes are applied. The range suggested in the diagram is just an example.

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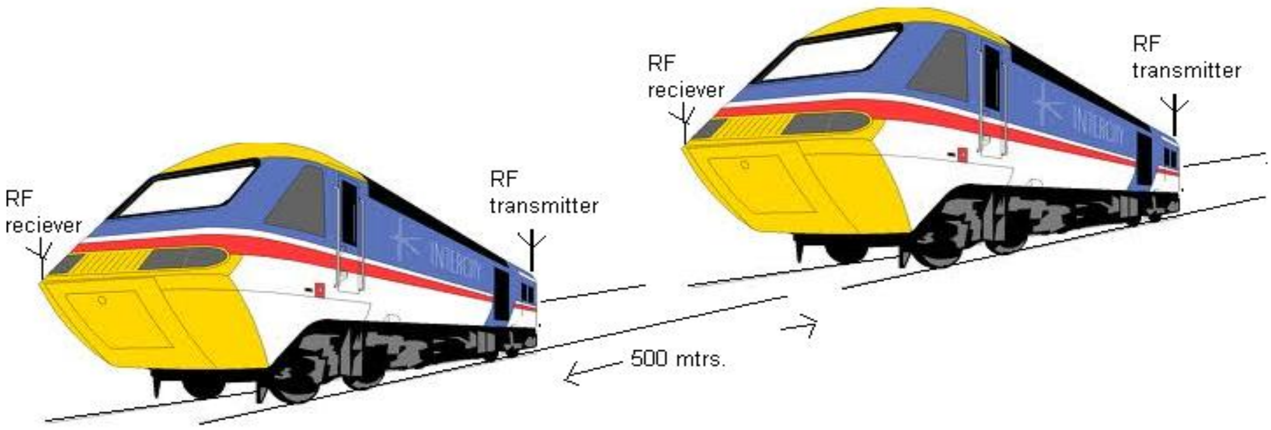

Fig. 1.2 Train Setup

1. RF REMOTE TRANSMITTER UNIT

In the project the RF remote transmitter contain an oscillator comprises one BF-194 (radio frequency modulator transistor). This transistor is coupled with CE configuration with other NPN 548 transistor for biasing. The basic oscillator is formed by transistor T3 working under CE configuration. From the collector an LC circuit is generating the source oscillation that super imposes to the T-2 base from its emitter follower circuit. R2 provides biasing Vcc to T3. R1 and LED indicate the power 'on' while pressing the key. The basic modulation circuit comprises T-1, R-6, C-2 and a trimmer variable capacitor. By changing the IFT at the T3 collector (LC circuit) we can change frequency for transmission. Varying trimmer
at collector of T-1 can do the range and alignment between transmitter and receiver.
A 9V portable battery powers the whole unit.

COMPONENTS USED

RESISTANCE:-

R1	-	100Ω
R2	-	330K
R3, R4, R5	-	2K7
R6	-	47K

CAPACITORS:-

C1	-	.022
C2, C3	-	.001

TRANSISTOR:-

T1	-	***BF494***
T2	-	BC548

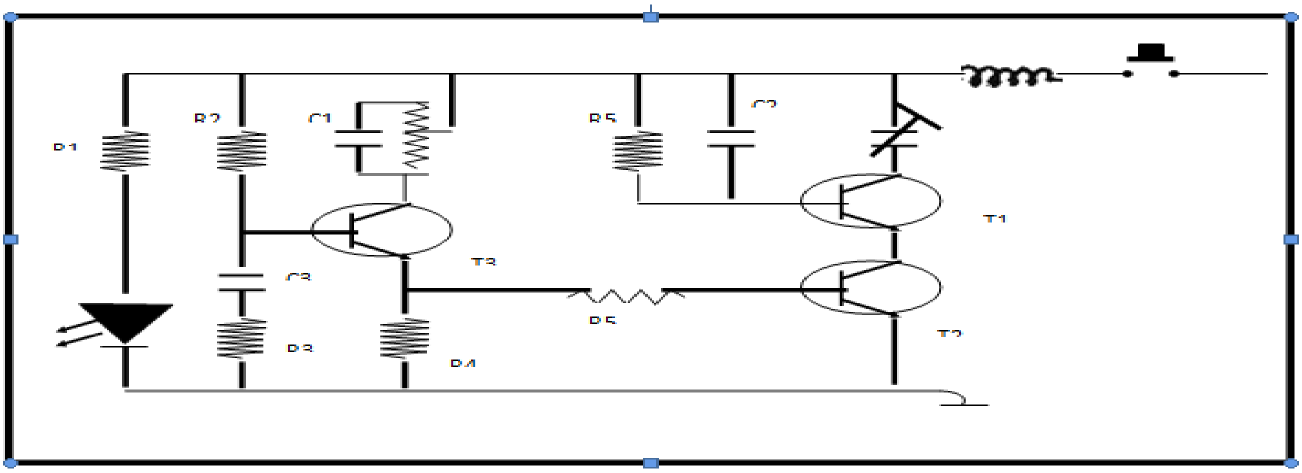

Fig 2.1RF Remote Transmitter Unit Circuit Diagram

II. RF REMOTE RECEIVER UNIT

In the receiver circuit the transmitter Q1 also working as LC tank circuit basic oscillator that receives the variable frequencies Q2, Q3 are two basic low power amplifier provides amplification to all frequencies. L2 coil (IFT) selects the specific frequency to further amplifiers and fed at the base of Q4 via R-14 resistor.

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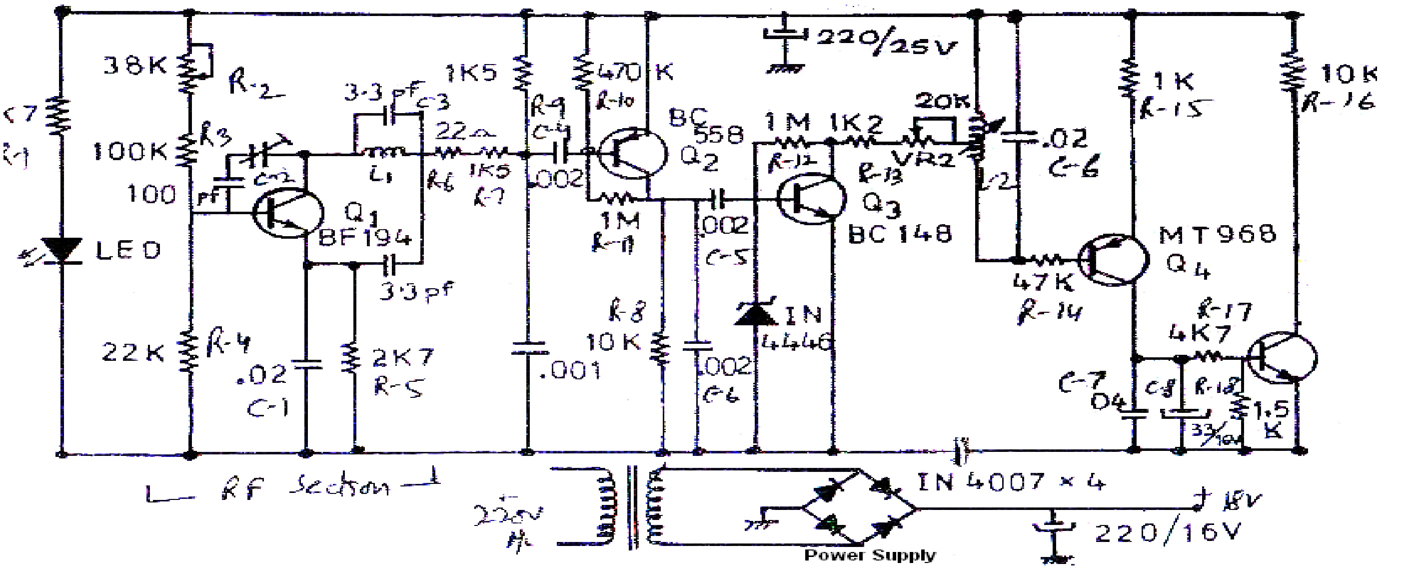

Fig 3.1 Receiver Circuit

The power amplification is provided by Q5 transistor. In the circuit R2 and R3 provides biasing Vcc to Q1 same as R10 provides biasing Vcc+ to Q2 transistors. C1 and R5 give CE follower circuit for Q1 and same as for Q2 as R8 and C6 doing the same function. Rest other resistor and capacitor provides necessary basing Vc and frequency cut off function at different stages of the circuit. Finally from Q5 the driver unit gave output to the buzzer or any other connected device to operate that unit.

3.1 Braking System

A drum brake is a brake in which the friction is caused by a set of shoes or pads that press against the inner surface of a rotating drum. The drum is connected to a rotating wheel.
A drum brake with the drum removed as used on the rear wheel of a car or truck. Note that in this installation, a cable-operated parking brake uses the service shoes.

3.1.1 Servo design

Drum brakes, depending on the way the shoes are hinged, can have a "self-servo" characteristic. this increases stopping power without any additional effort by the driver because the rotation of the drum drags the shoes around with it, increasing the force holding them together. in rear brakes (as illustrated above) only one shoe will have this characteristic. front drum brakes may use two actuating cylinders which allow both shoes to utilize the servo characteristic and which also increase the front axle braking force, required to compensate for forward weight shift and also to avoid premature rear-wheel locking. Servo action can be used to make a very powerful brake (as on the rear axles of large commercial vehicles), but it does reduce the ability of the driver to modulate the brakes sensitively. (The disc brake has no self-servo effect because the pads act perpendicularly to the rotating disc.)

3.1.2 Advantages

Drum brakes are still used in modern cars. There can be engineering and cost advantages. drum brakes allow simple incorporation of a parking brake. They are often applied to the rear wheels since most of the stopping happens in the front of the vehicle and therefore the heat generated in the rear is significantly less. Drum brakes are also occasionally fitted as the parking (and emergency) brake even when the rear wheels use disk brakes as the main brakes. in this situation, a small drum is usually fitted within or as part of the brake disk. An advanced technology hybrid car using drum rear brakes is the Toyota prius. (4-wheel discs are used in certain markets - hybrid vehicles greatly reduces everyday wear on braking systems owing to their energy recovery motor-generators, see regenerative braking).

III. CONCLUSION

The project RF based Automatic Braking system for trains we attempted is a success as we have projected a quit clear and satisfactory model of the put forth idea. The RF Transceiver Circuit has a sufficient range which can be further increased as the kit can be tuned as per our desired frequency range. The Setup we have prepared is as per our requirement and has a range of about 8 metres. This range and frequency has been tuned and selected for our choice of working.

The Drum brake used has a brake shoe used to stop the automotive. This effectively defines the main cause of our project that is Automatic Braking. The Overall result is that this idea can definitely be definitely implemented and hopefully applied for further security.

The project has been chosen and implemented successfully and hence the model has been successfully projected. The automotives we have created are only for illustrative purposes and the main idea or say the theme of our project is to have it applied on a practical scale to actual trains.

IV. FUTURE SCOPE

The project implemented by us is actually very much possible to be implemented on a larger and real scale. Hence the RF transceiver of larger range and power can be opted to be planted in train locomotives to provide a better and safer railway network across the country.

The chances are very much definite as to how they implement the idea to prepare a larger scale product of this idea and so the future of this model implementation is very much possible.

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