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Vehicular Ad-Hoc Network and Wireless Power Transfer for Vehicles

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Abstract: Vehicular Ad Hoc network (VANETS) uses the principle of mobile Ad Hoc network (MANET). It is an approach for the intelligent transportation system (ITS). It provides communication between vehicles and also between vehicles and roadside base station. A vehicle in VANET is considered to be an intelligent mobile node capable of communicating with its neighbour and other vehicles in the network. In this paper the concept of wireless power transmission is also explained using the inductive coupling. Its future application is charging of the electric vehicles without any direct conductive wire. Using the inductive coupling electrical energy is transmitted between source (i.e. transmitter coil) and electrical load (i.e. receiver coil). This paper provides focus on the various applications of VANET like Horn control, real time traffic update and WPT for charging electric vehicles.

Keywords: Vehicular Ad hoc Network, Intelligent transportation system (ITS), Wireless Power Transfer (WPT), applications, Electrical Vehicle (EV) , Horn Control System, Traffic management system.

I. INTRODUCTION

Transport system is a mirror of economic development. In developing countries like India, without an efficient transport system no dream of economic development and self-reliance can be achieved. The transport system is sluggish, poorly maintained and time consuming. The stage of environmental pollution is alarming. Thus introduction of new technology to enhance the system is mandatory. This project will be the first step towards such a technological development.

With increasing standard of living, the requirement of people is also increasing. Now, owing a car has become a status symbol in the society. This has increased the number of vehicles on the road leading to frequent traffic jams and a lot of honking resulting in noise pollution. This asks for such a system that can combat these obstacles in order to make the movement on the road more convenient.

The major contributor to air pollution are the vehicles we drive. It also adds to the ever increasing global warming. To control this alarming situation a lot of vehicle manufacturing companies are striving towards introducing efficient electrical cars. But the major challenge faced by them is the mileage of these cars as they can run only to a few hundred kilometers at a single charge.

Thus in this paper we have discussed about system which can resolve the above-mentioned problems. This paper is organized as follows. In the first section we discuss about "Horn control Unit" which will help reduce noise pollution caused by honking of the vehicles. Then in the next section we talk about " Traffic control unit" which helps in efficient management of traffic so as to avoid Jams. After that, we discuss about " Wireless Power Transfer" which will help charge electrical vehicles wirelessly anywhere as per convenience. Then finally, we conclude this paper by talking about the future aspects in which the prototypes can be implemented.

II. HORN CONTROL UNIT

Traffic rules are meant to make people's lives easier. Even though these are meant for the safety of the vehicles travelling and also for the general public, it is hardly practiced by the vehicle drivers. This introduces the concept of "Horn Blowing". Blowing of Horn increases the noise pollution in our surrounding. To overcome this problem we have come up with a Horn control unit. Horn Control unit is a system that blows horn inside the car and can be heard only by the vehicle driver and no one outside the car. When a driver in front gear wants to move forward and has an obstacle car in front of him, he can blow a horn which will be heard only by the car in front of him and in case the same car driver wants to go back and has an obstacle car behind him then he can blow horn and the sound will be heard just by the car behind his car. The horn control unit consists of Infrared transceivers, which is the principle behind the working of the whole system.

Working: Every Car has its own IR Transceiver. The IR Transmitter is used to send IR signal to the desired car where the horn has to be blown and the IR Receiver is used to receive the IR signals, which triggers the horn.

IR Transmitter

The IR LEDs emit IR signals only when it gets power from the power source regulator and a signal from the gear. When the car is in front gear only front IR led can work and when the car is in back gear only the back IR led

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can work. As soon as the driver presses the horn, power is given to an IR led depending on the gear the car is on.

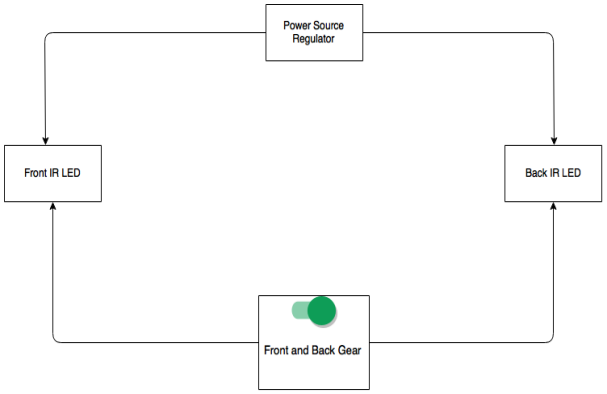

Fig 1: Block Diagram IR Transmitter

IR Receiver

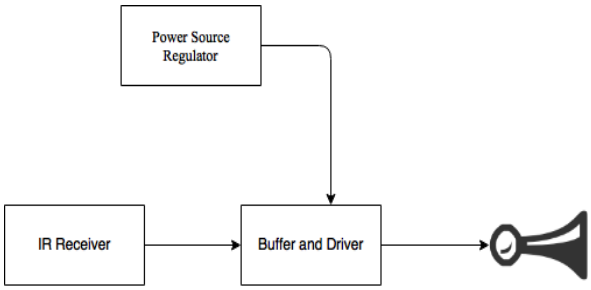

Fig 2: Block Diagram IR Receiver

The receiver end has an IR receiver, which receives the IR signal. The signal from the IR receiver triggers the Buffer and driver to work. To blow the horn the required voltage is supplied from the power source regulator.

Prototype

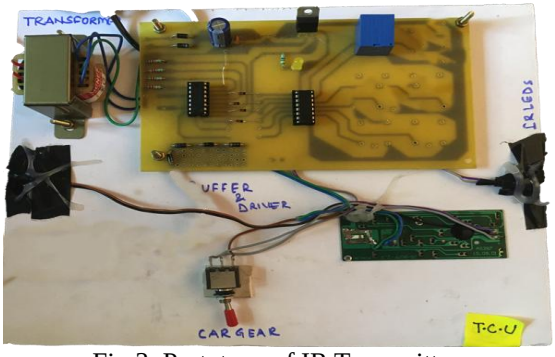

Fig 3: Prototype of IR Transmitter

The above system is a prototype of an IR Transmitter. The transformer is used to step down the voltage, which it gets, from the AC mains.

The voltage from the transformer is fed to the voltage regulator, which in turn drives the buffer and driver circuit. The buffer and driver help in switching the relay. The relay helps in triggering the front and back IR LEDs depending on the direction of car gears.

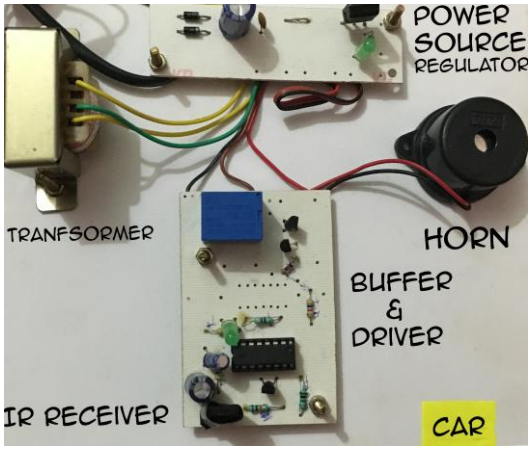

Fig 4: Prototype of IR Receiver

The above prototype is a small circuit for IR receiver to blow the horn. The IR receiver receives the IR signal transmitted from a different car. In this prototype the IR receiver is a TSOP sensor, which opens a gate for the buffer and driver to work whenever it receives and IR signal. The buffer and driver circuit receives the required power to blow the horn from the power source regulator.

III. TRAFFIC MANAGEMENT SYSTEM

Traffic researchers have the goal to optimize traffic flow of people and goods. As the number of vehicles on the road increases and resources provided by current infrastructure are limited, intelligent control of traffic will become very important issue. Avoiding traffic jams for example is throughout to be beneficial to both environment and economy.

Traffic congestion is a severe problem across the world. The proposed system helps in solving congestion problems. This system contains IR transmitter, IR receiver, RF transmitter and RF receiver. The IR transmitters and IR receivers are mounted on either sides of the road respectively which gets activated whenever any vehicle passes on road between the poles.

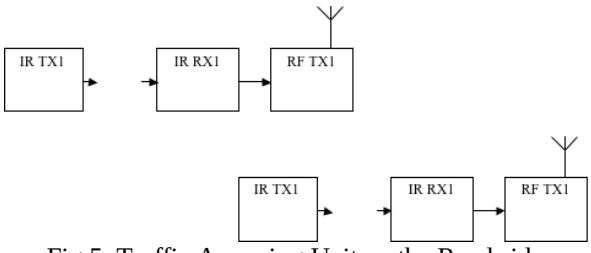

Fig 5: Traffic Assessing Unit on the Road side

There are sensors on the roadside, which consists of IR transmitters, IR receivers and RF transmitters. The IR transmitter transmits the signal to the IR receiver. There are continuous sets of such transceivers installed on the roadside at an interval of certain distance. Any car between these transceivers blocks the connection between them and upon such disconnection in the transceivers, triggers the RF Transmitter, which then transmits RF

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signals to be received by RF receiver installed in all other cars.

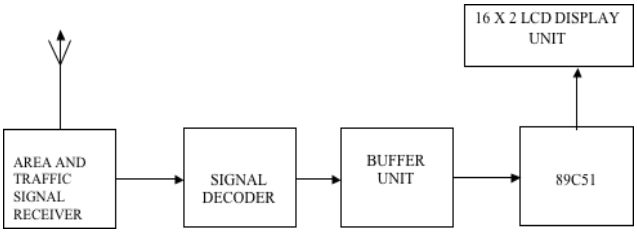

Fig 6: System on Vehicular unit

In the car dashboard RF receiver has been installed. Now depending on the traffic congestion RF transmitter sends the information to the vehicle having RF receiver. The signal decoder decodes the received signal and stores it in the buffer unit. This traffic congestion information is then displayed on the car dashboard LCD that is run by a microcontroller.

Prototype

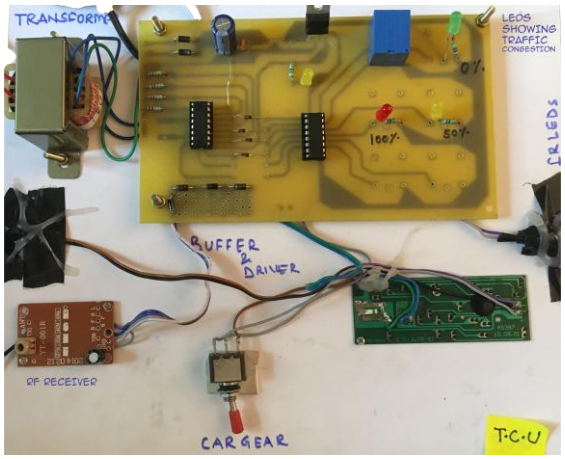

Fig 7: System on the car to indicate traffic congestion

In the car the RF receiver receives the RF signal. The RF receiver gets power for its operation from Power source regulator. Depending on the frequency of RF signal received the level of traffic congestion is estimated and required LED glows.

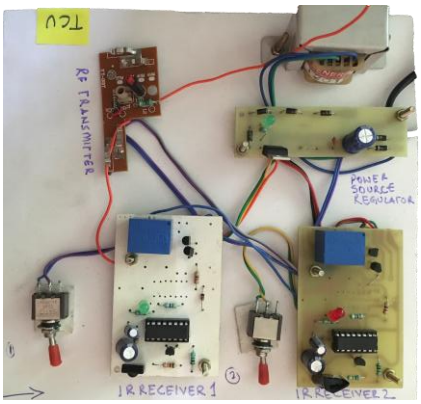

Fig 8: System on the Roadside

On the road side the IR transmitter is installed along with IR Receiver. As soon as the connection gets blocked in any of the IR transceivers, the IR receiver triggers the RF transmitter to transmit a particular RF frequency depending on the traffic congestion. The power source for the IR receiver, IR transmitter, RF transmitter, in the prototype, comes from the power source regulator.

IV. WIRELESS POWER TRANSFER

The concept of electrical cars is picking up the pace in the modern market. The reason that acts as a catalyst for this gradual transformation from automobiles, running on petrol or diesel (crude oil) to the alternative fuel (electricity), are the degradation in the availability of crude oil and the pollution caused by their usage. The various automobile manufacturing companies in this arena have showed a lot of interest. But, the main limitation that poses towards the complete implementation of this idea to take over the streets is the mileage or distance that can be covered by these vehicles in a single charge. Unlike petrol bunkers, there are no such charging stations where these vehicles can be charged on the go. So, in this paper, we have designed a prototype, which can be used to charge such vehicles in order to provide compensation for this problem.

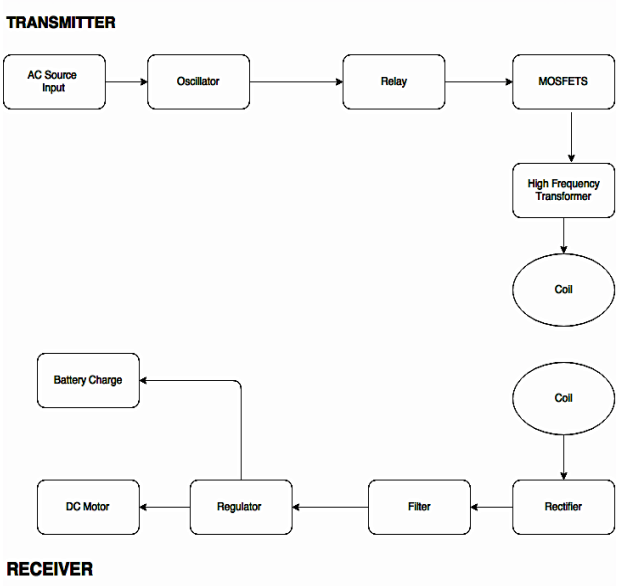

Fig 9: Wireless Power Transfer Block Diagram

Working: The basic principle, which is applied in the prototype, is mutual induction. The prototype consists of two segments. One segment is installed in the vehicle while the other segment is installed under a platform at the charging station. The segment at the charging station consists of a step up transformer, high voltage fast switching NPN power transistor, diodes, resistors and multi-layer ceramic capacitors. The primary and secondary circuits of a transformer are electrically isolated from each other. The transfer of energy takes place by electromagnetic coupling through mutual induction. The transformer used in the prototype step ups the voltage and frequency provided to it. The NPN transistors further enhances this voltage. The output of this circuit is

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connected to windings of copper coil. One more set of the similar copper coil is also placed in the segment installed in the vehicular unit. Hence, the power is transferred wirelessly between the two segments via mutual induction.

Prototype

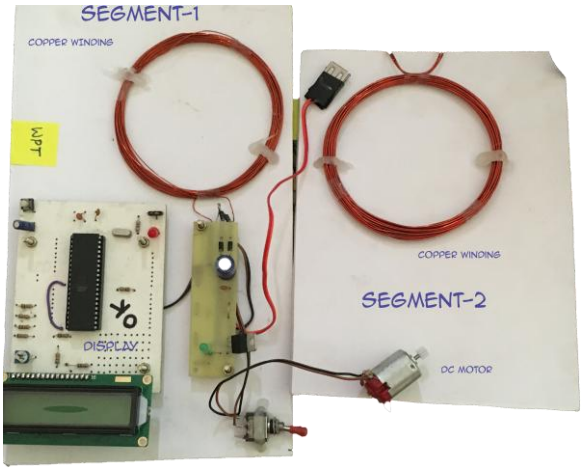

Fig 10: Wireless Power Transfer

The above prototype can charge a small phone and also can be used in running a small dc motor. So with further advancement, it is possible to charge even larger batteries such as of vehicles. Such charging stations can be installed at various public places like parking lots of offices, shopping malls etc. where people can charge their vehicles while they carry out their errands. If this idea gets a full-fledged implementation, then this will bring a revolution with a set of next-gen vehicles combating with the problems posed by their earlier counterparts.

V. CONCLUSION

Intelligent transportation system (ITS) is needed in today's vehicular environment, as the road safety and emergency are the main concern in transportation. The means of communication between moving vehicles are VANET.. In this paper, protocols discussed can be used for implementation of VANET.

Traffic management is the most critical issue in big cities. Traffic control unit discussed in this paper can help in addressing the traffic issues to large extent. Certain benefits are

- Systematic traffic management in the city
- User will be updated about the traffic condition, emergencies, roadside required facilities as he proceeds on the road towards his destination.
- As user is more informed he will be alert about the traffic conditions and he can take decisions accordingly.

Noise pollution is one of the most common problems in our environment. Using horn control unit one can at least minimise noise pollution to some extent.

This paper also gives us a review of wireless charging of electric vehicles (EV). It is clear that vehicle electrification is unavoidable because of environment and energy related issues. Wireless charging is more beneficial when compared to wired charging. In particular, when the roads are electrified with wireless charging capability, it will provide the foundation for mass-market penetration for EV regardless of battery technology. With technology development, wireless charging of EV can be brought to fruition.

Finally some of the challenges that still need some attention in VANETS are security, reliability, enhancement in routing strategies and other services like Internet and environment.

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