SMART TRAFFIC SIGNAL IMPOSING SYSTEM

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ABSTRACT: *The name of our project is* **SMART TRAFFIC SIGNAL IMPOSING SYSTEM** *The name itself gives idea about safety on roads. In India, most of the accidents happen due to signal jumping and not following the traffic rules[9]. So, we create this project, the basic concept used in this project is that when the signal light turns red or green, the modular Arduino nano with NRF24L01 transceiver gets the information from the signal light. Which is placed in front of the signal light and in this Arduino nano with NRF24L01 transceiver there is an in built RF support system to communicate with the other Arduino nano with NRF24L01 transceiver which is placed inside the vehicle. We insert the programme for the red and green light in Arduino nano with NRF24L01 transceiver which is placed inside the signal. The other Arduino nano with NRF24L01 transceiver which is in the vehicle is connected with the relay. The relay is used to connect and disconnect the supply of the current to the spark plug. When there is red light the signal light gives instructions to Arduino nano with NRF24L01 transceiver and Arduino nano with NRF24L01 transceiver transmits the signal to the other Arduino nano with NRF24L01 transceiver inside the vehicle and that Arduino nano with NRF24L01 transceiver receives the signal and command the relay to disconnect the supply of the current to the spark plug. Thus, the vehicles get stopped automatically. Same process is works in green light.*

KEY WORDS: Accident Prevention, Automatic switching off engine, Traffic signal Control, Emergency vehicle, Intersection, Red light runners, Red light, Signal system, Traffic control, Wireless sensor.

1. INTRODUCTION:

The main reason to bring this concept into consideration is a very common phenomenon of road accidents. Just to give you a heads up on the stats in 2018 alone, our country reported nearly 151 thousand fatalities due to road accidents. Among which 70% of the accidents involved young Indians[9].

The accident on road is the most unwanted thing to happen to a road user, though they happen quite often. The most unfortunate thing is that we don't learn from our mistakes on the road.

- Main cause of accidents and crashes is due to human errors. Some of the common errors of people which result in an accident are:

1) Over speeding
2) Drunken driving
3) Distractions to driver
4) Red light jumping

Out of these red-light jumpers have contributed majorly. According to the global statistics of 2015, approximately 6 lakh accidents were reported globally for red light jumping of which 41000 cases were registered in India only [10].

- The number of road accidents and fatalities in the country is very high.
- India alone accounts for more than 10% of global road accidents[9].
- Road transportation is the backbone of our nation and transport services are considered as the growth engine of the economy. It is also called more the length of roads more than the prosperity of the country.

So we are planning to reduce the death rate of our country mainly caused due to signal jumping.

It is a usual sight at road intersections that vehicles cross without caring for the light. The major motive behind Red Light jumping is saving time. The common conception is that stopping at a red signal is wastage of time and fuel.

Studies have shown that traffic signals if followed properly, saves time and commuters reach their destination safely and timely. A red light jumper not only risks his life but also the safety of other road users. This act causes chaos at crossings and intersections and thus causes traffic jams.

This is how everybody gets late to their destinations. It has also been seen that the red light jumper crosses the intersection with greater speed to avoid challan but with such speed, it hampers the ability to judge the on-going traffic and quite often crashes and there adds another accident. On account of all this, to reduce the number of accidental death in our country to some extent and to save people's lives, we have planned the design of our project: SMART TRAFFIC SIGNAL IMPOSING SYSTEM.

In this concept, the vehicle will automatically stop as soon as the red light on the traffic signal is turned on. And thus the vehicle cannot be started. Only after the green light of

the traffic signal has appeared, the vehicle can be then started again by the driver.

The whole point of the project is to bring a fall on the graph of the death rate due to road accident

> **Right Angle Crashes**

If a vehicle driver is trying to jump the signal red signal, the vehicle approaching from the perpendicular lane will crash with it. If we consider only one vehicle the fuel due to idling is very less but when we consider it globally it will have a great effect on global warming and as well as fuel will be saved. Also, the drivers won't be able to disobey the red signal. It has been a great deal for the older people and children to crossroads due to the havoc of the signal jumpers thus, that too won't be a problem.

2. METHODOLOGY:

We implement this system on the road traffic signal we made one system. We divide the system into two parts. The first part of the system is placed on the traffic signal and the second part of the system is placed inside the vehicle between the battery and spark plug or fuel pump.

Let see the first part of the system. The signal light is connected with the Arduino nano with NRF24L01 transceiver module when the red light on the signal light turns on it gives information to the Arduino nano with NRF24L01 transceiver and the same for the green light signal. Arduino nano with NRF24L01 transceiver take the information of light in the form of the frequency of the color we insert two code one for the red and another for the green in embedded c language. This part of the system takes the power supply from the solar we implement the solar panels on the traffic signal lights.
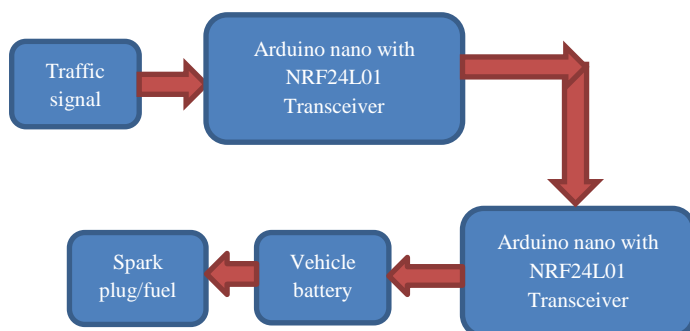

Fig. No.1

In Fig. No.1 we show the flow of project. The second part of the system is placed inside the vehicle Arduino nano with NRF24L01 transceiver with relay module when the vehicle reached the traffic signal then the Arduino nano with NRF24L01 transceiver which is placed on the signal gives information to the vehicle Arduino nano with NRF24L01 transceiver with the help of RF system and vehicle Arduino nano with NRF24L01 transceiver connect

and disconnect the power supply of the engine with the help of relay module. This part of the system takes a supply of current from the vehicle battery and your vehicle get a stop on red signal and stat on green signal if in case your system gets damaged and not working properly then we provide the button on the vehicle dashboard to rest the module after that you can easily start your vehicle without any problem[11].

3. EXPERIMENT AND ANALYSIS:

We have analyzed about the components which we are using in our project:

Arduino nano: Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board. It comes with exactly the same functionality as in Arduino UNO but quite in small size. It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V. Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins[14]. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage. It is a complete ready to use device that requires no prior technical skills to get a hands-on experience with it. You can power it by using DC power jack, battery or simply plug it to the computer using a USB cable to get started[14]. Arduino Nano is a very useful device that comes with a wide range of applications and covers less space as compared to other Arduino board.(Fig. No. 2)

Fig. No. 2

Relay Module: A relay is an electrically operated switch that can be turned on or off and the current go through or not, and can be controlled with low voltages, like the 5V provided by the arduino pins [11]. The relay module is a separate hardware device used for remote device switching [15]. With it you can remotely control devices over a network or the Internet. (Fig. No. 3)

Fig. No. 3

NRF24L01 Transceiver: NRF24L01 is a single chip radio transceiver for the world wide 2.4 - 2.5 GHz ISM band. This transceiver module consists of a frequency generator, shock burst mode controller, power amplifier, crystal

oscillator modulator, and demodulator. Output power, frequency channels, and protocol setup are easily programmable through a SPI interface. SPI is an abbreviation of Serial Peripheral Interface[16]. This module can be easily programmed and can connect with a microcontroller. It works with the help of SPI communications hence the microcontroller should have SPI port. This module is designed to operate at 3.3 volts. It is a wireless transceiver module, meaning each module can both send as well as receive data. The modules when operated efficiently can cover a distance of 100 meters (200 feet) which makes it a great choice for all wireless remote controlled projects. The module operates at 3.3V hence can be easily used with 3.2V systems or 5V systems. Each module has an address range of 125 and each module can communicate with 6 other modules hence it is possible to have multiple wireless units communicating with each other in a particular area. This module is designed for long distance and fast transmission of data. Air data transmission rate is around 2 Mbps. Its high air data rate combined with power saving mode makes it very favorable for ultra-low power applications[17]. (Fig. No. 4)
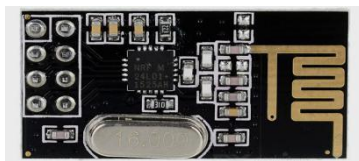

Fig. No. 4

4. RESULT:

Red-light jumping is a dangerous and costly problem. Deaths caused by red-light running are increasing at more than three times the rate of increase for all other fatal crashes. Lots of people are injured in crashes involving red-light running than in any other crash type. Reduction in red-light running will promote and protect the public health, safety and welfare of citizens.

Expected results if our concept is implemented are:

1. **Reduction in graph of accidental death rate:** Red light jumpers have contributed majorly out of all the other causes of road accidents. So after implementing the concept, there will be a major fall in the graph of accidental death rate.

2. **Severe T-bone crashes will become next to zero:** A T-bone accident is one where the front of one car or truck crashes into the side of another vehicle. Broadside accidents most often occur at intersections or where traffic overlaps when one of the drivers fails to stop at a stop sign or traffic light, or otherwise fails to yield the right-of-way to the other driver. They're usually caused by drivers running red lights or not looking before making a turn. Most of these accidents are caused by driver negligence. Due to our concept drivers will have to stop the vehicle strictly at a red light and there will be no consequences related to T-bone crashes.

3. **Reduces Fuel consumption due to idling**: The vehicles while waiting at signalized intersections are generally found to be in idling condition, i.e., not switching off their vehicles during red times. Because of idling of vehicles during red times at signalized intersections may lead to huge economic loss as lot of fuel is consumed by vehicles when they are in idling condition [19]. The situation may even be worse in countries like India as different vehicle types consume varying amount of fuel [20]. Only limited studies have been reported on estimation of fuel loss due to idling of vehicles in India [21]. So our project focuses to save the fuel wasted at signalized intersections in major cities of India by switching off the engines of vehicles.

4. **Drivers can't disobey the red signal:** Our project makes it compulsory to stop at red lights willingly or unwillingly. So if a person tries to run over a red light he can't start the vehicle.

5. **Easy cross-way for pedestrians:** Due to the increase of fast moving vehicles on the road, pedestrian has to suffer more to cross the road, which may lead to accidents. Accidents also occur due to lack of facilities, geometric features and guidelines. The random behaviour of traffic and not following signals at intersections also contributes to the suffering of pedestrians (mainly children and old aged people). Due to compulsory stop of vehicles at red signals these behaviour will controlled at a major level.

5. CONCLUSIONS:

As we all are now aware about the arising problem of signal jumping, the number of vehicles on road intersections has greatly increased over the years and so it has somewhat become mandatory for everyone to jump signals fully unaware of the consequences like fatal accidents people in large number just do it. It is believed that doing so will make them reach their destination sooner but it results in an increase of the rate of loss of lives.

Our project being the very best concept to counter this major problem will help reduce the accidental death rate and thus help in increasing our country's GDP by 3% every year [10]. It will majorly add to the development of our country as this concept is very much new. Just a small change in our traffic system and boom! It will create a drastic difference in the growth of our country.

People won't be able to break red signals from now onwards. And thus, all the accidents caused due to the same will hence be stopped colossally.

Any vehicle moving on the road, reaching the road intersections will then be automatically stopped as soon as

the red light on the traffic signal turns on. The engine will be cut off and thus allowing the vehicles on the opposite road to peacefully pass by. The pedestrians will not have any problem crossing the road whatsoever.

The cost of our project is very low as it is mainly mechatronics based project and thus it is very economical to implement practically. It surely does not have complex design or construction in any kind. It mainly consists of 3 basic electronic components viz. The microcontroller (Arduino nano), Radio Frequency Transceiver (NRF24L01) and finally the Relay Module.

When the traffic signal turns red it give proper information to the microcontroller. This info will be given to the relay. The relay will help in switching off the engine by cutting off the power supply. Similarly, for the green light, the relay will receive info to switch the engine on again. And so the driver will be able to start the vehicle again.

Because of this concept, the rate of accidents will be reduced by 70-80% every year [9]. Another major profit from our project is that it will help us save fuel. The fuel consumed due to idling during the red light won't be the case anymore. As the engine will be completely off during red signal.

6. ACKNOWLEDGMENT:

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