Institute Technical Summer Project-2015

Project Abstract

Smart Traffic Signal

Team: Optimus Primates

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- **Introduction:**

Traffic jams are one of the worst nightmares that most of the Mumbaikars can have. Traffic jams today have become an issue of great concern as leads to many serious problems like air pollution which in turn causes many medical problems, excessive use of fuel and waste of precious time. The exhaust materials form automobiles include harmful gases like Nitrogen Oxides, Carbon Monoxide, Sulphur Dioxide and Suspended Particulate Matter. It has been estimated that transportation accounts for 24% of the air pollution.

Keeping these serious problems in mind, we aim to design a traffic signal controller that will automatically adjust its signal duration according to current traffic density. A different form of this project has been implemented in some countries. But we plan to design the project more in accordance with Indian scenario.

- **Concept:**

  The main aim of this project is to evaluate the number of moving and stationary vehicles and accordingly make suitable changes in the time of traffic signals.

- **Stationary Cars:**

To calculate number of vehicles at traffic signal 4 to 5 set of ultrasonic emitters and receiver would be installed on both the sides of the road maintaining some distance between each set. Many transmitters are available in the market with range of signal up to 60m. Typical emitted frequencies lie between 40-60 KHz. Through reflection distance travelled by the wave will be calculated by both set of sensors. This data will be received by some microcontroller like ardiuno or TI Launchpad MSP430.or Atmel. These microcontrollers would be coded with the help of proper softwares like ardiuno or atmel studio or TI Launchpad MSP430 respectively.

Coding will be done in such a way that it will compare the distance between distances traveled by wave with the distance of road and then evaluate how many vehicles are present. We will have average width of vehicle and width of road for comparison.

Example: Assuming average width of car to be 1.7m, width of road to be 5m, each lane will be of 2.5 m. So when distance travelled by any reflected radiation is less than 1.6m (0.8*2), definitely a car is present at the signal.

These distances would be calculated based on the time taken by sound to reach the receiver once it is emitted.

We will define three different conditions and based of
these conditions the Microcontroller will provide delay to the traffic signal.

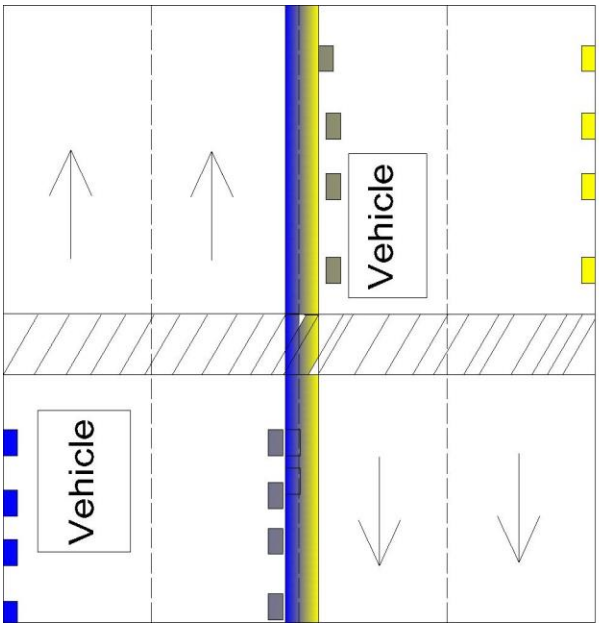
Density of vehicle	No.of vehicle*	Time interval (in Second) RED	Time interval (in Second) yellow	Time interval (in Second) Green
Low	10	30	05	30
Medium	20	20	05	40
High	30	10	05	50

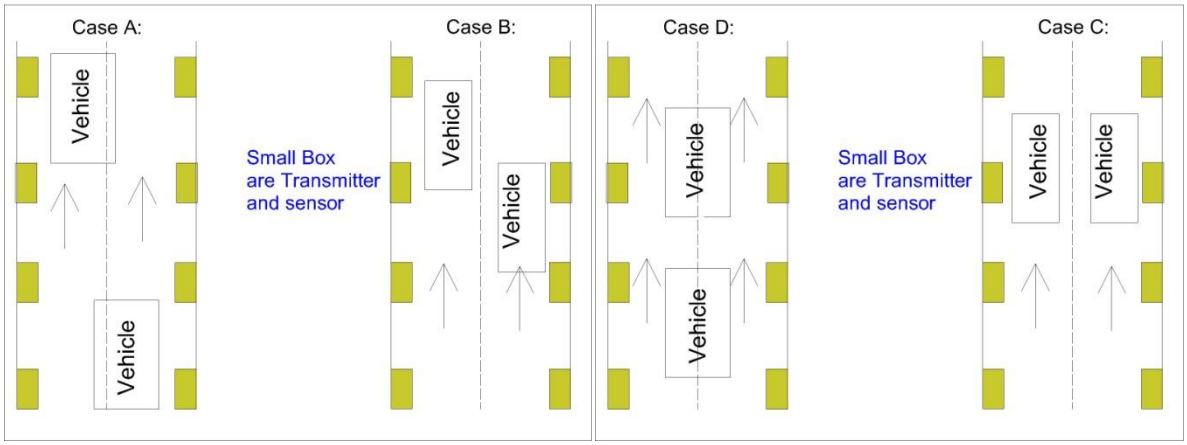
Ref:http://www.slideshare.net/MuzzamilShaikh/smart-traffic-congestion-control-system

*vehicle No in low medium high can be changed in coding depended on were we get permission for demonstration

Example: If the number of vehicles detected is 10(low density), red signal duration can be set high at around 30 Sec. At the same time if number of vehicles on other road is 20, red signal duration would be less for that road at around 20 Sec. to ease the jam.

General Case:





Moving Cars:

1) **With ultrasound:**

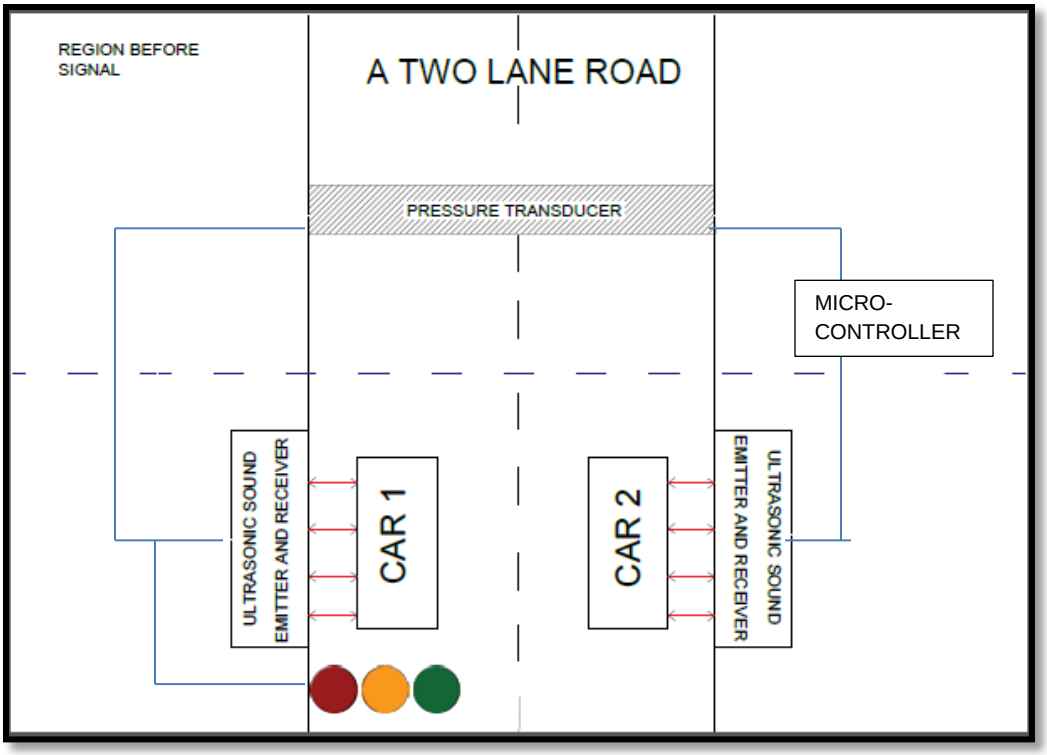
A pair of ultrasonic transmitter and receiver pair will be put up on the either sides of the road. When a car will pass in front of transmitters, distance travelled by the reflected radiation will change thus prompting the microcontroller to increase the count by one. The measurements from both set of sensors would be estimated as if

two cars are running in parallel, both the receivers would receive distance less than some preset distance as mentioned above. Now this time the microcontroller will increase its count by two.

Problem: It may happen that time taken for calculations and hence processing is more resulting in inaccuracy Very less probability so an alternative to above method id given below:

2) **With pressure transducer:**

Before a traffic signal, a strip of pressure transducer (like piezoelectric crystals) will be laid out across the road. It will be used to detect the number of vehicles passing over the road. Each time a car passes over the sensor, pressure will vary and the feedback will be given to microcontroller. After each variation, counter would increase by one. Hence total number of vehicles passing can be calculated.



- **Future Scope:**

The smart traffic signal can be used in the areas where traffic density is very high. As the signal duration will be automated, more preference would be given to the lanes with higher traffic thus avoiding the traffic jams and further problems. In future we plan to implement this project on larger scale(for 4 lanes) with proper modifications. These modifications may include installing the ultrasonic sensor at a particular height above the road or using different instruments like metal detectors, vehicle detectors or lasers along with photo diode. For multiple lanes, an array of such transmitters and receivers would have to be set above the road instead of on the sides as done in this project.

- **Final Demonstration.**

The project with proper permissions can be demonstrated on any road of our institute. If we fail to get proper permissions, the project would be demonstrated on smaller scale by creating roads on cardboards and with toy cars.

- **Timeline Of The Project:**

Week 0: Learing of use of microcontroller and software like aurdino, TI Launchpad MSP430

Week 1: Complete learning their specifications and use, Acquiring the components.

Week 2: Commencing the assembly of the project. Creating an arena, installing the ultrasound transmitters and receivers. Installing pressure transducer before the area of traffic signal. Connecting both pressure transducer(if used) and ultrasound receiver to microcontroller

Week 3: Starting with coding part. Coding the microcontroller, debugging the program.

Week 4: Final assembly of the project and commencing the final tests.

Week 5: Analyzing the test data, rectifying the problems that may arise by making necessary changes in the project.

- **Learning Outcomes Of The Project:**

At present, we only have knowledge about basic electronics like transistors, flip-flops, registers, ADC's and to some extent knowledge about microcontrollers like arduino and ATMEGA2560.
Through this project, we intend to learn about working of some other microcontrollers like Raspberry Pi and electronic gadgets like ultrasound sound transmitter, pressure transducers, different sensors, actuators,etc.

- **Estimated Cost Of The Components:**

*All cost mentioned below are quoted after checking the rates of the respective components online.

Ultrasonic transmitter and receiver (Qty approx. 8)	Rs- 800/- (each)
Arduino (Uno) or Launchpads	Rs-800-900/-
Pressure Transducer	Rs-600/-
Regular components	Rs-400-600/-
(Resistor, OP AMP, Connecting wires, LEDs)	
Material to build model Accordingly.	

Total cost= Rs-8000-9000/-(approx.)

- **References:**

1) http://www.instructables.com/id/Use-Arduino-code-on-a-TI-Launchpad-MSP430/
2) http://www.ti.com/ww/en/launchpad/launchpads-msp430.html#tabs
3) http://en.wikipedia.org/wiki/Traffic_light_control_and_coordination
4) http://www.slideshare.net/MuzzamilShaikh/smart-traffic-congestion-control-system
5) http://en.wikipedia.org/wiki/Traffic_optimization
6) http://en.wikipedia.org/wiki/Signal_timing
7) http://newsoffice.mit.edu/2015/smarter-stoplights-cut-greenhouse-gas-0331 (this is deals with tells MIT implemented with reducing energy loss Not very imp for us)