Smart Traffic Control System

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Abstract : The traffic congestion problem can be considered as a major problem in development of a city.Technology based solutions provided till date, were not totally optimal to handle this issue.
Work done till now have used techniques like Ultrasonic sensor,Infrared sensor,Graph theory,Image processing,Air quality based detection etc.Every used technology used so far had its own benefits and issues.Ultrasonic-sensor model had limitations like use of too many sensors to get exact idea of traffic.Ultrasonic-sensor model also formed a bulky architecture.Infrared-sensor model has issues like short range and interference with sunlight.Graph Theory based model is poorly applicable for large scale data.Image processing model was unable to detect exact number of vehicles.Air quality based model only considers pollution as a scale to measure pollution which is unable to give exact picture of pollution.In proposed system we are using the combination of image processing and ultrasonic sensor along with pollution detection sensors to get the values of parameters like number of vehicles,pollution levels and density of traffic.Servo motor provides wide coverage of area,due to which the number of ultrasonic sensors required are reduced.Proposed system will come handy in the scenario where traffic density is varying and air pollution levels are considerably high.

Keywords **- image processing, air quality sensor, noise sensor, servo motor, dynamic traffic timer.**

I. INTRODUCTION

Traffic congestion is a severe problem in many modern cities around the world.Traffic congestion has been causing many critical problems and challenges in the major and most populated cities. To travel to different places within the city is becoming more difficult for the travelers in traffic. Due to these congestion problems, people lose time, miss opportunities, and get frustrated. Traffic congestion directly impacts the companies. Due to traffic congestion there is a loss in productivity from workers, trade opportunities are lost, delivery gets delayed, and thereby the costs goes on increasing.

To solve these congestion problems, we have to build new facilities and infrastructure but at the same time make it smart. The only disadvantage of making new roads on facilities is that it makes the surroundings more congested. So for that reason we need to change the system rather than making new infrastructure twice. Therefore many countries are working to manage their existing transportation systems to improve mobility, safety and traffic flows in order to reduce the demand of vehicle use.

This project uses simple electronic components such as cameras, sensors and a Microprocessor for auto change of signal according to traffic density.

Microprocessor is the brain of the project which initiates the traffic signal at a junction. The LED's are automatically on and off by making the corresponding port pin of the micro controller high. At a particular instant only one green light holds and other lights hold at red. During transition from green to red, the present group yellow led and succeeding group yellow led glows and then succeeding group led changes to green. This process continues as a cycle.

The current scenario of traffic system is based on hard coded waiting time at traffic signals. Due to this system, commuters face ample amount of time loss at traffic signals. Proposed system which uses image processing, ultrasonic sensor works on determining the number of vehicles. Identification of number of vehicles leads to applying algorithm which schedules the waiting time at traffic signal depending on number of vehicles and density of traffic. As well as air quality detection sensors provide the data about the pollution for monitoring.

II. MOTIVATION

In a smart-city program of government of India, ease of transportation is also a parameter according to the committee led by government officials, have led down some parameters according to which "smart cities need smart transport services". Proper movement of people, goods and services accelerate the growth and development of a region. A well planned and efficiently managed transport network is a must for any society. Taking motivation from this government initiative in proposed system we have demonstrated how the dynamic traffic control system will lead us to saving the substantial amount of time of commuters in general.

III. LITERATURE SURVEY

Various quality improving tech are used to improve the overall result of the smart traffic control system. Ultrasonic sensor gives the density of overall traffic, living and non- living on the road at that time instance [1].Till date, the hard coded transportation system was in use which made travelers s to wait for more time than usual. The dynamic manipulation of vehicles gave us insight in how we can schedule the system optimally [2].

Using the Graph theory technique, we have proposed how traveller will manage to travel in minimum time [3]. The comparison of empty road and current scenario of road is compared. This comparison provides us with the number of vehicles present on the road at current time instance using Image Processing [4].

Air quality monitor focuses mainly on Ozone, Particulate Matter (PM2.5), Carbon Monoxide, Sulphur Dioxide, and Nitrous Oxide. Mostly air quality monitor uses this principle. The device sucks the air from the surrounding and let pass it through Sensors and then sensors check the air quality and also PM2.5 levels in your air through laser beam and give you the result on display [5].

IV. IMPLEMENTED SYSTEM

In the Fig 1., ultrasonic sensors are mounted on servo motors on every left hand side of the lanes such that, maximum area is covered across all four lanes. Similarly the air quality sensor are mounted on servo motors opposite to ultrasonic sensors on the dividers of the lanes. The traffic signal lights are interconnected via ad-hoc network and will communicate according to the traffic density. The cameras will capture real time images and will confirm the vehicle presence and their count.

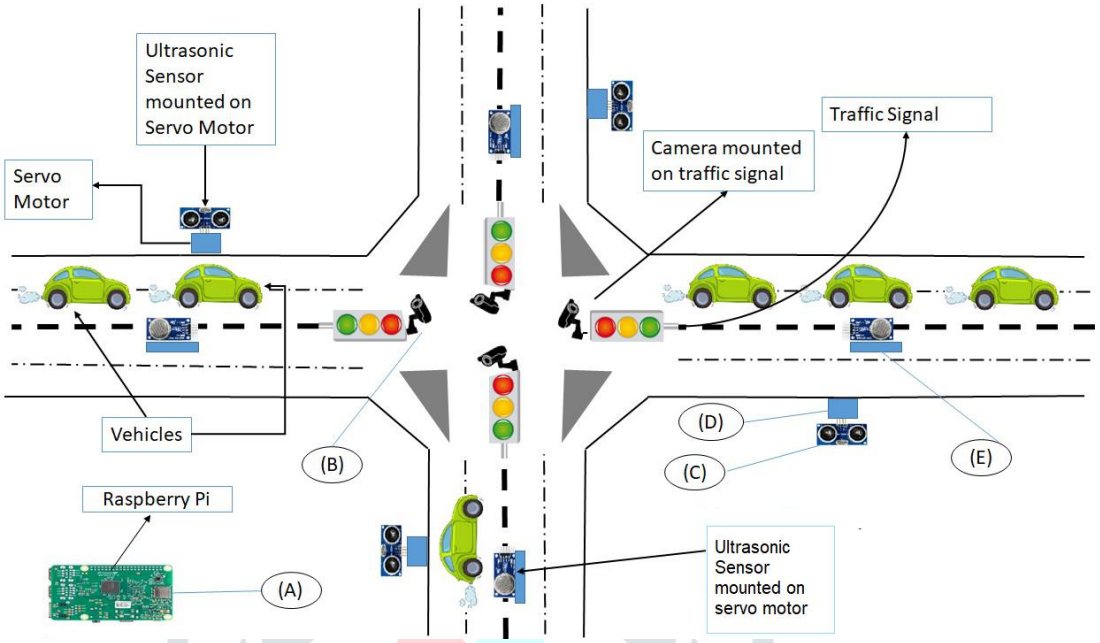

Fig 1. System Model

COMPONENTS

(A) Micro Controller–Raspberry pi 3:

1.The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

(B) CCTV Camera

Closed-circuit television, also known as video surveillance, is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors.It will give us the count of the vehicles present on the lanes.

(C) Ultrasonic Sensor

Ultrasonic transducers or ultrasonic sensors are a type of acoustic sensor divided into three broad categories: transmitters, receivers and transceivers.

(D) Servo Motor

Servos use feedback to determine the position of the shaft; you can control that position very precisely. As a result, servo motors use used to control the position of objects, rotate objects, move legs, arms or hands of robots, move sensors etc. with high precision.

(E) Air Quality Sensor

Air pollution sensors are devices that detect and monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments.

V TEST CASES

7.2 Test cases and Test Result

figure 3.7 System Implementation Plan

Test case Id	Test case	Test case Description	Expected Result	Actual Result	Status
TC 01	D1>D2	Density of vehicles at road1 is greater than road2	Green signal timer get increased for road R1	Green signal timer get increased for road R1	pass
TC 02	D1<D2	Density of vehicles at road1 is less than road2	Green signal timer get increased for road R2	Green signal timer get increased for road R2	pass
TC 03	D1=D2	Density of vehicles at road1 is equal to road2	Green signal timer will be equal for both roads	Green signal timer will be equal for both roads	pass

VI.Implementation Screenshots

Fig 2:Image Processing Module

Fig 3:Air Quality Module

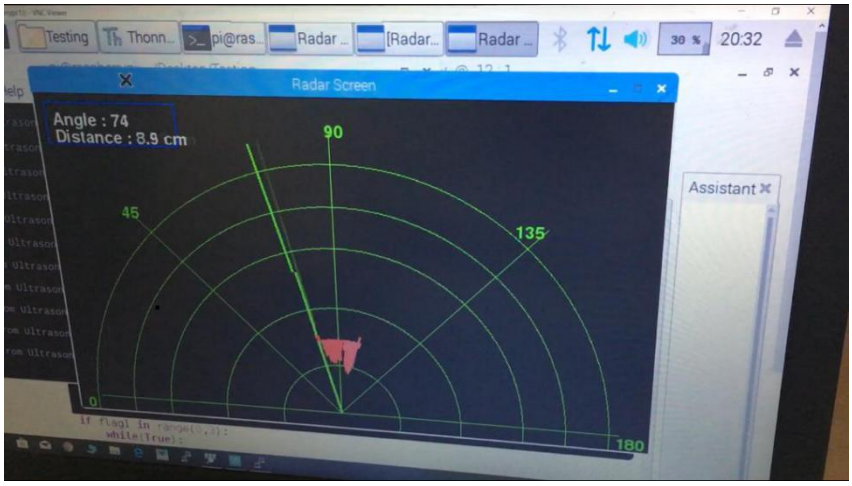

Fig 4:Ultrasonic Module

VII.MATHEMATICAL MODEL

Let S be the System
where,
S = I, O, F, f, s, DD, NDD

where,
I is set of Inputs I.e. Parameters (image feed, sensor data)
O is set of Output I.e. Dynamic Signal Timer Generation
F is set of Functions I.e. F1, F2, F3

where,
F1 is function for Input Processing
F2 is function for Density Calculation
F3 is function for Dynamic Signal Timer Generation
f is condition for failure I.e. physical damage to the hardware.
s is state of success I.e. System is fully functional and generates accurate results.

(Deterministic Data): -

1. Input parameters: sensor data, camera feed etc.
2. Output of mathematical formulas.

NDD (Non - Deterministic Data): - Output of combination of different parameters and different scenarios.

1. input: density count from local pedestrians, external feed to air and noise sensors.
2. output: calculations of the situation report generated based on the situation.

VIII.CONCLUSION AND FUTURE WORK

Moderate range camera gives the input to raspberry-pi.Processing the data from camera gives us the number of vehicles. On processing the number of vehicles present on each lane at crossroad,it decides which road should be given priority to have a green light.Count of the vehicles also provide the idea of time for which a signal should be red.Pollution detecting sensors provide a data about which road should be chosen.Also this data of sensors also provides a input for weather analytic project.

Future work should be more focused on compulsion of following the rules.Assumption in this project is that nobody is cutting the lane and everyone is following the rules.Future work also might involve the separate way for emergency vehicles like ambulance,as death toll in accidents in India is unimaginable.

IX. ACKNOWLEDGMENT

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