Intelligent Traffic Management and Signal control by incorporation of Traffic Density Analysis (TDA)

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Abstract—composed movement for the most part has settled needs, paths, right-of-way, and traffic control at crossing points. Association regularly creates a superior blend of movement security and proficiency. Occasions which upset the stream and may make movement worsen into a disrupted chaos incorporate street development, crashes, and trash in the roadway. The proposed framework is a movement flag controller framework that responds to the density of activity. The time required for changing signs modifies consequently relying upon the density of movement. Traffic issues contribute a noteworthy issue in numerous urban areas and furthermore expands fuel utilization and contamination. Activity signals working on settled flag timing delays don't conform to the changing movement thickness. At the point when the activity thickness builds in excess of a breaking point at one specific side, it needs a more extended green light length to ease movement flow.Our thought is to embed sensors at consistent interims in the street and screen the continuous density of movement and control the flag as indicated by the information acquired. In light of the thickness of activity, the framework changes and differs the term of the flag in every street, prompting a proficient movement administration framework.

I. INTRODUCTION

Traffic on roads consists of road users including pedestrians, ridden or herded animals, vehicles, streetcars, buses and other conveyances, either singly or together, while using the public way for purposes of travel. Traffic laws are the laws which govern traffic and regulate vehicles, while rules of the road are both the laws and the informal rules that may have developed over time to facilitate the orderly and timely flow of traffic. Traffic congestion is a condition on transport networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this result in some congestion.

As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage.Mathematically; congestion is usually looked at as the number of vehicles that pass through a point in a window of time, or a flow. Congestion flow lends itself to principles of fluid dynamics.

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available street capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. About half of U.S. traffic congestion is recurring and is attributed to sheer weight of traffic; most of the rest is attributed to traffic incidents, road work and weather events.

Traffic research still cannot fully predict under which conditions a "traffic jam" (as opposed to heavy, but smoothly flowing traffic) may suddenly occur. It has been found that individual incidents (such as accidents or even a single car braking heavily in a previously smooth flow) may cause ripple effects (a cascading failure) which then spread out and create a sustained traffic jam when, otherwise, normal flow might have continued for some time longer.

II. EXISTING TRAFFIC MANAGEMENT SYSTEM

Organized traffic generally has well-established priorities, lanes, right-of-way, and traffic control at intersections. Organization typically produces a better combination of travel safety and efficiency. Events which disrupt the flow and may cause traffic to degenerate into a disorganized mess include road construction, collisions, and debris in the roadway.

Road traffic control usually involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public.

Traffic control also includes the use of CCTV and other means of monitoring traffic by local or state roadways authorities to manage traffic flows and providing advice concerning traffic congestion. Some traffic engineers have attempted to apply the rules of fluid dynamics to traffic flow, likening it to the flow of a fluid in a pipe. Congestion simulations and real-time observations have shown that in heavy but free flowing traffic, jams can arise spontaneously, triggered by minor events ("butterfly effects"), such as an abrupt steering maneuver by a single motorist. Traffic scientists liken such a situation to the sudden freezing of supercooled fluid.

However, unlike a fluid, traffic flow is often affected by signals or other events at junctions that periodically affect the smooth flow of traffic. Alternative mathematical theories exist, such as Boris Kerner's three-phase traffic theory (see also spatiotemporal reconstruction of traffic congestion).

Because of the poor correlation of theoretical models to actual observed traffic flows, transportation planners and highway engineers attempt to forecast traffic flow using empirical models. Their working traffic models typically use a combination of macro-, micro- and mesoscopic features, and may add matrix entropy effects, by "platooning" groups of vehicles and by randomizing the flow patterns within individual segments of the network. These models are then typically calibrated by measuring actual traffic flows on the links in the network, and the baseline flows are adjusted accordingly.A team of MIT mathematicians have developed a model that describes the formation of "phantom jams," in which small disturbances (a driver hitting the brake too hard or getting too close to another car) in heavy traffic can become amplified into a full-blown, self-sustaining traffic jam. Key to the study is the realization that the mathematics of such jams, which the researchers call "jamitons," are strikingly similar to the equations that describe detonation waves produced by explosions, says Aslan Kasimov, lecturer in MIT's Department of Mathematics. That discovery enabled the team to solve traffic-jam equations that were first theorized in the 1950s.

III. Proposed System

Considering the fact that butterfly effects can cause major traffic congestion over a period, it is necessary to take into account those small congestions to avoid the big jam effects over a tenure. This project is a traffic signal controller system that reacts to the density of traffic. The time required for changing signals adjusts automatically depending on the density of traffic. Traffic problems contribute a major problem in many cities and also increases fuel consumption and pollution. Traffic signals operating on fixed signal timing delays do not adjust to the changing traffic density. When the traffic density increases more than a limit at one particular side, it needs a longer green light duration to ease traffic flow.

Our idea is to implant sensors at regular intervals in the road and monitor the real time density of traffic and control the signal according to the data obtained.Based on the density of traffic, the system adjusts and varies the duration of the signal in each road, leading to an efficient traffic management system.

A. *Algorithm:*

The job of this particular algorithm developed is explained in detail in this section. The primary responsibility of the algorithm is to decide which traffic light should be in what condition for how long. Though there are certain powerful machine learning algorithms that can help us with this problem, the basis on which the actuation signal is generated is elaborated further. To add clarity to the algorithm, a particular scenario modelled on real world constraints was chosen. Consider a four-road junction where the vehicles can go straight, right or left, i.e. in any of the three directions when it receives a green signal. Such a scenario not only demonstrates a condition where the mobility of vehicles is maximized upon receiving the signal, it also is computationally lighter on the processor. Let us call the four roads leading to the junction as say A, B, C and D. Let the road A receive the first green light.

The signal would be green for say 40 seconds before turning red again. Now, the algorithm takes the data from the sensors in the other 3 roads and processes the following. By default, the next road to receive the green light would be road B. But before giving the actuation signal to turn the lights green for road B, the algorithm compares the traffic accumulation data from roads C and D with that of B. Now, if the difference of traffic accumulation in either of the roads is greater than a preset upper threshold, then that particular road is given the green light first.

For instance, if the traffic accumulation in road C is found to be greater than that in road B, road C is given the green light before road B. This process is done again to decide which road gets the green light next. For example, continuing with our previous case, if road D is found to have a traffic accumulation greater than that of B, D is now given the green light. But, after this case even though the traffic accumulation might be greater in roads A or C, B is given the green light to complete one cycle.

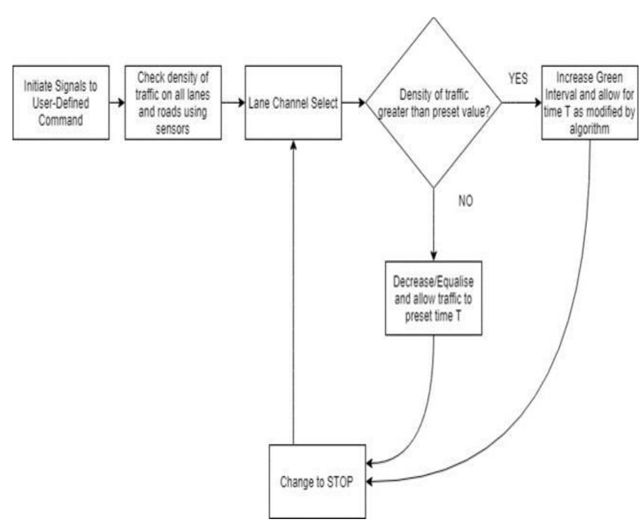

Fig1.The block diagram shown depicts the overall

process outlook of traffic management.

After this, the whole process starts again and continues in the same fashion as explained above. This ensures the optimization of the flow of traffic by making sure that the number of vehicles moving per unit time, once the green light is received, is maximized.

IV. RESULT

The proposed solution provided better and accurate results with respect to the existing solutions. Furthermore, The ease of access and higher control stability provides a better, efficient and hassle free system. This allows for free flow of traffic without the formation of butterfly effects. The eradication of this effect allows for reduced congestion of traffic and finally provides better transportation connectivity.

V. CONCLUSION

From the results and data obtained, we have analyzed to understand that the proposed system is a better option to provide better connectivity between various distinguished points, allowing ease of transfer from locations with reduced risks and better management of congestion and other cascading effects. The proposed solution is an advantageous and feasible solution when compared to the existing solution, thereby eliminating the need for manpower and reduction of costs, solely due to the intelligent sensing and automation.

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