Auto Traffic Control in Metro Cities using Cloud Computing

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Abstract - The normal function of traffic lights requires sophisticated control & coordination to ensure that traffic moves as smoothly & safely as possible and that the pedestrians are protected when they cross the roads. In traffic control, simple & old forms of signal controllers known as electro-mechanical signal controllers are still used. Unlike computerized signal controllers, electro-mechanical signal controllers are mainly composed of movable parts that control signals that are wired to them correctly. Aside from movable parts, electrical relays are also used. In general, electro-mechanical signal controllers use dial timers that have fixed, signalized intersection time plans. Cycle lengths of signalized intersections are determined by small gears that are located within dial timers. Cycle gears, as they are commonly known, range from 35 seconds to 120 seconds. If a cycle gear in a dial timer results in a failure, it can be replaced with another cycle gear that would be appropriate to use. Since a dial timer has only one signalized intersection time plan, it can control phases at a signalized intersection in only one way. Many old signalized intersections still use electro-mechanical signal controllers, and signals that are controlled by them are effective in one way grids where it is often possible to coordinate the signals to the posted speed limit. They are however disadvantageous when the signal timing of an intersection would benefit from being adapted to the dominant flows changing over the time of the day. Today traffic jam in many cities is major problem. Using cloud computing we can reduce this problem. The Computerized Traffic Signal System employs a "distributed" system design, by implementing intelligent units at all on-street locations and an Advanced Traffic Management System (ATMS) at the Traffic Operations Centre. This design provides a means of auto timer change in any of traffic signal point as and when camera detects the traffic jam position. It will be decided by computer system when to cross the limit of vehicles in same direction. Advanced system will send the instruction to all related traffic point for increase or decrease time of green/red signals to control the traffic jam.

Key Words - New-technology, Cloud-Computing, Sharing-Resources, Auto-detect, Traffic clear.

I. INTRODUCTION

Traffic jam position occurs when a volume of traffic generates demand for space greater than the available road 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 metro 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 which then spread out and create a sustained traffic jam when, otherwise, normal flow might have continued for some time longer. Using cloud computing features we may minimize traffic jam position in cities.

II. MATHEMATICAL THEORIES

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 manoeuvre by a single motorist. Traffic scientists liken such a situation to the sudden freezing of super cooled 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 randomising 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 has 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.

Traffic jam has a number of negative effects:

- Wasting time of motorists and passengers ("opportunity cost"). As a non-productive activity for most people, congestion reduces regional economic health.
- Delays, which may result in late arrival for employment, meetings, and education, resulting in lost business, disciplinary action or other personal losses.
- Inability to forecast travel time accurately, leading to drivers allocating more time to travel "just in case", and less time on productive activities.
- Wasted fuel increasing air pollution and carbon dioxide emissions owing to increased idling, acceleration and braking.
- Wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements.
- Stressed and frustrated motorists, encouraging road rage and reduced health of motorists
- Emergencies: blocked traffic may interfere with the passage of emergency vehicles travelling to their destinations where they are urgently needed.
- Spillover effect from congested main arteries to secondary roads and side streets as alternative routes are attempted ('rat running'), which may affect neighbourhood amenity and real estate prices.
- Higher chance of collisions due to tight spacing and constant stopping-and-going.

III. OBJECTIVE

To workout a solution for heavy traffic congestion in metro cities.

IV. LITERATURE REVIEW

This section offers a short introduction to what cloud computing is, and how it can be distinguished from related concepts such as grid computing. Cloud computing has been cited as 'the fifth utility' (along with water, electricity, gas, and telephone) whereby computing services are readily available on demand, like other utility services available in today's society [Buyya, Yeo, Venugopal, Broberg, and Brandic, 2009]. This vision is not essentially new. Dating back to 1961, John McCarthy, retired Stanford professor and Turing Award winner, in his speech at MIT's Centennial, predicted that in the future computing would become a 'public utility' [Wheeler and Waggener, 2009]. In 1969, Leonard Kleinrock, one of the chief scientists of the original Advanced Research Projects Agency Network (ARPANET) project which seeded the Internet, said: 'As of now, computer networks are still in their infancy, but as they grow up and become sophisticated, we will probably see the spread of "computer utilities" which, like present electric and telephone utilities, will serve individual homes and offices across the country' [Kleinrock, 2005, p. 4]. It could be argued that cloud computing has begun to fulfil this vision of computing on demand. The first step of studying research into cloud computing is to clarify the concept. Attempts to define cloud computing have come from different perspectives within practice and academia. Among the various definitions, the one by the NIST (National Institute of Standards and Technology) has gained recent recognition and popularity. For the purpose of this study, the NIST definition of cloud computing is adopted to facilitate the following discussions:

Security: Cloud security has been a common concern for the public [Bellovin, 2011]. Some articles in this subcategory look at general security mechanisms such as restrictions and audits [Spring, 2011a; Wang, Wang, Ren, Lou, and Li, 2011], multi-tenancy authorisation [Calero, Edwards, Kirschnick, Wilcock, and Wray, 2010],

third-party assurance [Zissis and Lekkas, 2010], and cloud-based security services [Li, Li, Wo, Hu, Huai, Liu, et al., 2011]. Other articles addressing specific cloud related security issues fall into two categories: data security and network security. The data security category includes papers looking at data encryption [Anthes, 2010], data colouring, and software watermarking for multi-way authentications [Hwang and Li, 2010], and a data-partitioning scheme for implicit security [Parakh and Kak, 2009]. The network security category includes papers discussing intrusion detection in the cloud [Vieira, Schulter, and Westphall, 2010], and cloud-level defence against HTTP-DoS and XML-Dos attacks [Chonka, Xiang, Zhou, and Bonti, 2011].

Business Issues: This category concerns the business implications of cloud computing. Articles in this category treat cloud computing as a black-box technology which can generate business value to both providers and users. Seven sub-categories have emerged in this category.

1. Cost: This subcategory examines the economic benefit from a cloud-user perspective. Topics in this category include a comparison between the cost of leasing cloud services and that of purchasing and using a local server cluster [Walker, 2009], techniques to estimate and monitor costs for cloud services [Truong and Dustdar, 2010], algorithms for finding minimum cost storage strategy [Yuan, Yang, Liu, and Chen, 2011], and more specific ones such as analysing operational costs for hosting online games in the cloud [Losup, Nae and Prodan, 2010].

2. Pricing: Articles in this subcategory mainly focus on the pricing strategies of cloud providers. A common approach for studying this topic is to compare different pricing strategies and analyse the pros and cons in terms of acceptance of customers. Comparisons can be made between fixed prices and variable prices [Yeo, Venugopal, Chu, and Buyya, 2009], or between piece-rate pricing and flat-rate pricing [Li, 2011].

3. Legal Issues: This subcategory examines legal issues associated with cloud computing. With rapid advancement in technology, regulators are often in a 'catch-up' mode with regard to policy, governance, and law [Kaufman, 2009]. Articles in this category introduce general legal risks of adopting cloud computing [Joint, Baker, and Eccles, 2009], as well as addressing specific topics such as digital forensic investigation in cloud computing systems [Taylor, Haggerty, Gresty, and Hegarty, 2010] and uncertain jurisdiction for Internet activities in geographically distributed cloud data centres [Ward and Sipior, 2010].

4. Ethical Issues: This subcategory analyses the cloud computing phenomenon from an ethical standpoint. It contains articles which propose that IT professionals, when making decisions about cloud computing deployment, should consider applied ethics methods such as Utilitarian, Deontologist, and Rawlsian [Miller, 2010].

5. Trust: This subcategory examines approaches for cloud providers to gain trust from prospective users. Articles in this category identified two factors affecting trust in the cloud—transparency [Bret, 2009] and public audit ability [Wang, Ren, Lou, and Li, 2010]. In addition, an instrument for evaluating the transparency of a cloud provider is proposed [Pauley, 2010].

6. Privacy: This subcategory specifically addresses privacy issues from either an ethical or legal point of view. With cloud computing, privacy is an inevitable concern, as the cloud users have to upload and store (in some cases sensitive) business and personal information into remote data centres managed by external parties [Katzan, 2010c]. Articles in this subcategory propose a method for analysing privacy in cloud computing in the workplace [Barnhill, 2010] and argue that cloud providers need to display clear policies about how user data is used [Ryan, 2011].

7. Adoption: This subcategory explores topics related to cloud-computing adoption in businesses. Some articles in this category target general businesses by providing ROI (Return on Investment) models for firms to decide on the suitability of adopting cloud computing [Misra and Mondal, 2011]

V. PROPOSED MODEL

In this cloud-computing based model, t1 to the traffic signals point. When excess number of vehicles cross any traffic point (this will recorded by web camera and a report will be sent to the cloud based control point application server), then application server immediately increase the timer of the present red signal position such as by one minute or more depending on the traffic. This act can control traffic jam position in next point of traffic signal. Cloud based Database server collects the total movement of traffic. This will help planning of traffic control in particular area of city.

Logic of traffic auto control:

If vehicle> 100 in t1

Then application server increases 1 minute for the red position in t1

If vehicle>150 in t1

Then application server increases 2 minutes for the red position in t1

(this logic may apply for all traffic point)



VI. CONCLUSION

In metro cities, one or two particular areas may become overcrowded due to some special event or function such as a political event or a market fair etc. making the traffic control in that particular area a big problem. Using proposed cloud based web control model of traffic control we may minimize this problem.

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