

Crowdsourcing with Smartphones for Traffic Dissemination

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Abstract— Existing schemes are based on assumption that vehicles and roadside devices are equipped with sensing and communication capabilities [1]. To overcome this problem the idea of crowd sourcing has been evolved. Crowd sourcing with smart mobile phones enables certain ITS applications without the need of any special sensors or communication devices. Major change is to integrate human inputs, with multiple information sources, aggregate and localize according to driver's geo-location.

Keywords—ITS,CCTV

I. INTRODUCTION

The projected estimate of 8.5 million driving-related deaths by the year 2020 is one of the motivations behind numerous academic, commercial and governmental engagements in adapting technology for transportation industry. Communication and sensing technology used in the transportation industry is widely termed as Intelligent Transportation System (ITS) [2].

Data collection and dispersion are of utmost importance for the proper operation of ITS applications [3]. Numerous standards, architectures and communication protocols have been anticipated for ITS applications. However, existing schemes are based on assumption that vehicles and roadside devices are equipped with sensing and communication capabilities. One of the major gaps of these approaches is their inability to capture events that can easily be logged by drivers using their mobile phones [4].

Crowdsourcing is a distributed problem-solving and production model. In such model, initially, the problems are formulated in a format that can be understood easily by technical and non-technical people. These formulated problems are then broadcast to an unknown group of solvers, i.e., the Crowd, in the form of an open call for their solutions [5]. The Crowd, usually knitted together via web-based technology submits their solutions. The submitted solutions can also be sorted and filtered out by the Crowd itself, in search for finding the best set of solutions.

Driving in today's metropolitan cities is becoming a time consuming and a tedious process. Getting stuck in traffic due to construction or an accident ahead is a common-occurrence in today's driving experience. However, this does not have to be the case. If a driver is informed of a congested zone in a timely fashion he or she can choose to avoid such a zone. In order to let other

drivers know about such events we need a way to sense these events when they happen, process the sensed events, and then communicate them to the drivers that might be affected by such traffic events. Therefore we need a technology that can perform the following functions: sensing, information processing and communication. Today's smartphones are powerful mobile computers that can perform all of these three functions. Smartphones can sense information such as location [6], direction, and speed, process the information and communicate it via data-enabled networks. Here, a client server system that exploits the Smartphone technology to disseminate relevant traffic information to individual drivers in a timely fashion, thus providing a more efficient and pleasant driving experience.

II. SYSTEM DESIGN

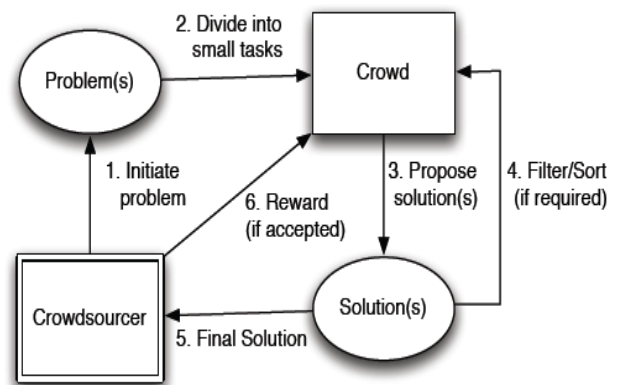


Figure.1. Crowdsourcing with smartphones: A smartphone crowd is constantly moving and sensing providing large amounts of data that enables new services and applications.

Crowdsourcing, in general terms, is the act of taking a job traditionally performed by a designated employee and outsourcing [7] it to an undefined, generally large group of people (a "Crowd") in the form of an open call.

Crowdsourcing is the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers. Often used to subdivide tedious work or to fund-

raise start-up companies and charities, this process can occur both online and offline. The general concept is to combine the efforts of crowds of volunteers or part-time workers, where each one could contribute a small portion, which adds into a relatively large or significant result. Crowdsourcing is different from an ordinary outsourcing since it is a task or problem that is outsourced to an undefined public rather than to a specific, named group.

III. EASE OF USE



Figure.2. Traffic Enforcement Cameras

In the currently applied methods of information dissemination traffic information is detected, processed and disseminated using integrated, advanced systems [8]. The detectors utilized in ITS include but are not limited to: sensors, cameras, and infrared beacons. Brief overview of some of these detectors is provided.

- **Loop Detectors:** A coil installed under the road surface that can detect vehicles passing over it. The coil generates a magnetic field, when a vehicle passes through this magnetic field the inductance of the coil changes and this change is detected [9]. Inductance is the ability of an electrical component to store energy in its magnetic field. Loop detectors are used to measure traffic flow.
- **Closed Circuit Television (CCTV) Cameras:** A collection of video cameras that send video signals to a limited set of monitors. The video images can be processed manually by humans or automatically using software. The video images are useful in measuring traffic flow, monitoring of specific intersections, license plate reading, and vehicle tracking [11].
- **Ultrasonic Detectors:** There are two types of ultrasonic detectors: continuous wave and pulse detectors. The continuous wave detector works on the principle of sending an ultrasonic sound wave towards a vehicle and measuring the frequency of the wave

that is reflected from the vehicle. The frequency of the reflected wave depends on the vehicle's speed. Similarly the pulse detector works by sending an ultrasonic pulse and measuring the time it takes for the pulse to come back. This application of ultrasonic detectors includes vehicle speed measurement, vehicle detection, and vehicle class detection.

- **Infrared Beacon:** Infrared beacons are used for short-range vehicle communication. Infrared beacons can receive and send data to specialized in-vehicle units. They can also be used for vehicle detection.

The current technologies are effective in enhancing road safety, and helping manage traffic. However, these technologies are costly and need special site deployment, they are prone to failure due to bad weather. These technologies are not accessible to all countries in the world yet.

IV. CONCLUSION AND FUTURE WORK

Intelligent Transportation Systems (ITS) is an active area of research and development in government, academic and industrial sectors. Here, advocating the use of Crowdsourcing for non-real-time ITS applications. Motivation is to enable these applications without the needs of deploying sophisticated sensors on the roads or complex communication devices within the vehicles. Describing the design of Crowdsourcing in ITS; namely, Crowd ITS, explains various architectural components and report on the application development of congestion free path re-routing, for the Android and iPhone mobile phones.

Gmaps uses Crowdsourcing to obtain traffic condition information as well as integrating traffic information obtained from other ITS sources [12]. The information dissemination in Gmaps is performed in a context-aware manner which ensures a driver does not receive information that is of no benefit. Another powerful feature of Gmaps that is generally not available in other information dissemination systems is efficient navigation service that takes into account current traffic road conditions in planning a route for a driver. Since our system depends on smartphone location detection [13], which also uses Wi-Fi and cellular towers to determine the user's location, navigation using our system is also possible in areas where a regular GPS would fail due to loss of GPS signal. These features combined make Gmaps a powerful system that represents a significant contribution to the field of traffic information dissemination [14].

Numerous technical and non-technical challenges still need to be overcome in order to adopt Crowdsourcing at a wider scale within ITS applications. Main research challenges are to device efficient data aggregation and verification algorithms, traffic prediction and efficient interface design for Crowd reporting. As future work, we plan to evaluate and report on the wide-scale deployment and performance of the CrowdITS system while developing other exciting ITS applications [15].

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