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PRIVACY-PRESERVING TRANSPORTATION TRAFFIC MANAGEMENT IN ROADWAYS SYSTEMS USING CPRS

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Abstract— Traffic measurement is a critical function in transportation engineering. We consider privacy-preserving point-to-point traffic measurement in this project. We measure the number of vehicles traveling from one geographical location to another by taking advantage of capabilities provided by the intelligent cyber-physical road systems that enable automatic collection of traffic data. The challenge is to allow the collection of aggregate point-to-point data while preserving the privacy of individual vehicles. We propose a novel measurement scheme which utilizes bit arrays to collect "masked" data and adopts maximum likelihood estimation (MLE) to obtain the measurement result. Both mathematical proof and simulation demonstrate the practicality and scalability of our scheme.

I. INTRODUCTION

An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular function. Industrial machines, automobiles, medical equipment, cameras, household appliances, airplanes, vending machines and toys are among the myriad possible hosts of an embedded system. Embedded systems that are programmable are provided with programming interfaces, and embedded systems programming is a specialized occupation.

Modern embedded systems are often based on microcontrollers but ordinary microprocessors are also still common, especially in more complex systems. In either case, the processor used may be types ranging from rather general purpose to very specialized in certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP)

The key characteristic, however, is being dedicated to handle a particular task. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. Some microcontrollers may use four-bit words and operate at clock rate frequencies as low as 4 kHz, for low power consumption. They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping may be just nano watts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

To protect the privacy of a file transferred to a storage device, Yang, Wu and Chiu proposed the first secure control protocol using the Schnorr signature scheme. To solve those problems. proposed a three-factor authentication protocol based on Elliptic Curve Cryptosystem (ECC) that requires the password, smart card, and biometric characteristic for authentication.

2. LITERATURE REVIEW

2.1 Effective Urban Traffic Monitoring By Vehicular Sensor Networks By: R. Du, C. Chen, B. Yang, N. Lu, X. Guan, and X. Shen

Traffic monitoring in urban transportation systems can be carried out based on vehicular sensor networks (VSNs). Probe Vehicles (PVs), such as taxis and buses, and Floating Cars (FCs), such as patrol cars for surveillance, can act as mobile sensors for sensing the urban traffic and send the reports to traffic monitoring center (TMC) for traffic estimation. In TMC, sensing reports are aggregated to form traffic matrix, which is used to extract traffic information. Since the sensing vehicles cannot cover all the roads for all the time, TMC needs to estimate the un-sampled data in traffic matrix.

As this matrix can be approximated to be of low-rank, Matrix Completion (MC) is an effective method to estimate the un-sampled data. However, our previous analysis on the real traces of taxis in Shanghai reveals that MC methods do not work well due to the uneven samples of PVs, which is common in urban traffic. To exploit the intrinsic relationship between unevenness of samples and traffic estimation error, we study the temporal and spatial entropies of samples and successfully define the important criterion, i.e. average entropy of the sampling process.

A new sampling rule based on this relationship is proposed to improve the performance of estimation and monitoring. With the sampling rule, two new patrol algorithms are introduced to plan the paths of controllable FCs to proactively participate in traffic monitoring. By utilizing the patrol algorithms for real dataset analysis, the estimation error reduces from 35% to about 10%, compared with random patrol or interpolation method in traffic estimation. Both the validity of the exploited relationship and the effectiveness of the proposed patrol control algorithms are demonstrated.MC methods do not work well due to the uneven samples of PVs, which is common in urban traffic.

2.2 An Information Theoretic Approach To Traffic Matrix Estimation By: Yin Zhang, Matthew Roughan, Carsten Lund and David Donoho.

Traffic matrices are required inputs for many IP network management tasks: for instance, capacity planning, traffic engineering and network reliability analysis. However, it is difficult to measure these matrices directly, and so there has been recent interest in inferring traffic matrices from link measurements and other more easily measured data. Typically, this inference problem is ill-posed, as it involves significantly more unknowns than data. Experience in many scientific and engineering fields has shown that it is essential to approach such ill-posed problems via “regularization”.

A new approach to traffic matrix estimation using a regularization based on “entropy penalization”. Our solution chooses the traffic matrix consistent with the measured data that is information theoretically closest to a model in which source/destination pairs are stochastically independent. We use fast algorithms based on modern convex optimization theory to solve for our traffic matrices. We evaluate the algorithm with real backbone traffic and routing data, and demonstrate that it is fast, accurate, robust, and flexible.A point-to-point traffic matrix gives the volume of traffic between origin/destination pairs in some network. Traffic matrices are required inputs for many IP network management tasks: for instance, capacity planning, traffic engineering and network reliability analysis. However, it is difficult to measure these matrices directly, and so there is interest in inferring traffic matrices from link load statistics and other more easily measured data The variability in terms of boarding per day and new stops frequented with the days of travel on the transit network is examined. In the variability of travel behaviours of transitusers performed with smart card data collected over a ten months period.

Data mining techniques are then used to classify days of travel according to the similarity of the boarding time periods. In this view, the use of two specific smart cards is examined in more details. These experiments first show that the behaviours of regular transit users evolve with time both frequency boardin, variability of behaviours also changes for various user types.

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2.4 Cooperative Communication Aware Link SchedulingFor Cognitive Vehicular Networks By: Miao Pan, Pan Li,and Yuguang Fang

Throughput maximization is a key challenge for wireless applications in cognitive Vehicular Ad-hoc Networks (CVANETs). As a potential solution, cooperative communications, which may increase link capacity by exploiting spatial diversity, has attracted a lot of attention in recent years. However, if link scheduling is considered, this transmission mode may perform worse than direct transmission in terms of end-to-end throughput.

A cooperative communication aware link scheduling scheme and investigate the throughput maximization problem in C-VANETs. Regarding the features of cooperative communications and the availability of licensed spectrum, we extend the links into cooperative links/general links, define extended link-band pairs, and form a 3-dimensional (3-D) cooperative conflict graph to characterize the conflict relationship among those pairs. Given all cooperative independent sets in this graph, we mathematically formulate an end-to-end throughput maximization problem and near-optimally solve it by linear programming. Due to the NP-completeness of finding all independent sets, we also develop a heuristic pruning algorithm for cooperative communication aware link scheduling. Our simulation results show that the proposed scheme is effective in increasing end-to-end throughput for the session in C-VANETs.Various broadband vehicular communication applications in Vehicular Ad-hoc Networks (VANETs), which can entertain passengers and make long journeys enjoyable, are envisioned to be prevalent in the near future. However, proliferation of vehicular applications beyond safety requires additional radio resources to support, which makes the already crowed licensed spectrum even worse. Meanwhile, for all these passenger oriented applications, no matter vehicle-to-vehicle (V2V) communication based applications network gaming among passengers in different cars, file transfers, virtual meetings among coworkers, vehicle-to-roadside (V2R) communication based ones web browsing, cooperative downloading, online video, etc. the most critical and essential requirement is the data transmission with high end-to-end throughput, which is also a challenging task in VANETs.

On the other hand, by employing multiple antennas, e.g., multiple-input and multiple-output (MIMO), spatial diversity has been shown to be effective in lowering bit error rate, enhancing power efficiency and improving throughput in VANETs. However, equipping a wireless node with multiple antennas may not always be practical.

2.5 5 An Identity-Based Security System For User Privacy In Vehicular Ad Hoc Networks By: Jinyuan Sun, Chi Zhang, Yanchao Zhang, and Yuguang Fang

Vehicular ad hoc network (VANET) can offer various services and benefits to users and thus deserves deployment effort. Attacking and misusing such network could cause destructive consequences. It is therefore necessary to integrate security requirements into the design of VANETs and defend VANET systems against misbehavior, in order to ensure correct and smooth operations of the network. A security system for VANETs to achieve privacy desired by vehicles and traceability required by law enforcement authorities, in addition to satisfying fundamental security requirements including authentication, non repudiation, message integrity, and confidentiality. Moreover, we propose a privacy-preserving defense technique for network authorities to handle misbehavior in VANET access, considering the challenge that privacy provides avenue for misbehavior. The proposed system employs an identity-based cryptosystem where certificates are not needed for authentication. We show the fulfillment and feasibility of our system with respect to the security goals and efficiency.Fundamentally, VANET security design should guarantee authentication, non repudiation, integrity, and in some specific application scenarios, confidentiality, to protect the network against attackers. Besides the fundamental security requirements, sensitive information such as identity and location privacy should be preserved

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from the vehicle owner's perspective, against unlawful tracing and user profiling, since otherwise it is difficult to attract vehicles to join the network.

On the contrary, traceability is required where the identity information need be revealed by law enforcement authorities for liability issues, once accidents or crimes occur. In addition, privilege revocation is required by network authority's network administrator once misbehavior is detected during network access. It is less difficult to prevent misbehavior of unauthorized users since legitimate users and roadside units (RSUs) can simply disregard communication requests from outsiders by means of authentication.

2.6 Fast Accurate Computation Of Large-Scale IP Traffic Matrices From Link Loads By: Yin Zhang, Matthew Roughan, Nick Duffield and Albert Greenberg

A matrix giving the traffic volumes between origin and destination in a network has tremendously potential utility for network capacity planning and management. Unfortunately, traffic matrices are generally unavailable in large operational IP networks. On the other hand, link load measurements are readily available in IP networks.

A new method for practical and rapid inference of traffic matrices in IP networks from link load measurements, augmented by readily available network and routing configuration information. We apply and validate the method by computing backbone router to backbone-router traffic matrices on a large operational tier-1 IP network a problem an order of magnitude larger than any other comparable method has tackled. The results show that the method is remarkably fast and accurate, delivering the traffic matrix in five seconds. Crowdedness spot is a crowded area with an abnormal number of objects. Detecting the crowdedness pots of moving vehicles in an urban area is essential to many applications. An intuitive method is to cluster the objects in areas to get the density information. Unfortunately, the data capturing vehicle mobility possesses some new features, such as highly mobile environments, supremely limited size of sample objects, and no uniform biased samples, and all these features have raised new challenges that make traditional density-based clustering algorithms fail to retrieve the real clustering property of objects, making the results less meaningful. A novel no density-based approach called mobility-based clustering.

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2.7Fleanet: A Virtual Market Place On Vehicular Networks By: Uichin Lee, Joon-Sang Park, Eyal Amir and Mario Gerla

Over recent years, mobile Internet devices such as laptops, PDAs, smart phones etc, have become extremely popular and widespread. Once on board of a vehicle, these devices can automatically connect to the vehicle processor and thus greatly amplify the communications and processing capabilities available to the owner in a "pedestrian mode." We envision that this "amplification" opportunity will be one of the drivers of car to car and car to curb communications.In fact, the car communications system will not be used exclusively for mobile Internet access, but also as a distributed platform for the "opportunistic" cooperation among people with shared interests/goals. Exchanging safety messages among vehicles is a compelling example. Stretching opportunistic cooperation well beyond safety messages, The concept of virtual "flea market" over VANET called Flea Net. In Flea Net, customers, either mobile or stationary pedestrians, roadside shop owner, express their demands/offers, .t to buy or sell an item, via radio queries. These queries are opportunistically disseminated exploiting in part the mobility of other customers in order to find the customer/vendor with matching needs/resources. We identify the key performance metrics, namely query resolution latency, scalability, and mobility. Based on the metrics, using models and simulation, we show that Flea Net can efficiently support a market place over vehicular networks.

Flea Net to provide a "virtual flea market" service running in urban vehicular networks. Flea Net operates on the vehicular "ad hoc grid" without any infrastructure support. We will show that Flea Net provides an excellent method for people to communicate with each other as buyers and sellers of goods or information and to efficiently find matches of interest, potentially leading to transactions. Urban vehicular networks formed by vehicles on the road and roadside stations in metropolitan areas can be characterized as large scale the whole metropolitan area, dense up to hundreds of thousands of nodes in a 100 square mile area, and highly mobile up to 60 mph. These characteristics pose a formidable challenge to Flea Net. Epidemic query dissemination such as used in People Net becomes less efficient because large amount

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of information might be flooded into the entire network due to very frequent car encounters in a large-scale vehicular network. In addition, while epidemically spreading, a given query could find the same matched query more than once, thus leading to potentially many redundant matches.

2.8 Privacy-Preserving Point-To-Point Transportation Traffic Measurement through Bit Array Masking In Intelligent Cyber-Physical Road Systems

By: Yian Zhou, Qingjun Xiao, Zhen Mo, Shigang Chenand Yafeng Yin

Traffic measurement is a critical function in transportation engineering. We consider privacy-preserving point-to-point traffic measurement in this paper. We measure the number of vehicles traveling from one geographical location to another by taking advantage of capabilities provided by the intelligent cyber-physical road systems that enable automatic collection of traffic data. The challenge is to allow the collection of aggregate point-to-point data while preserving the privacy of individual vehicles. A novel measurement scheme which utilizes bit arrays to collect "masked" data and adopts maximum likelihood estimation (MLE) to obtain the measurement result. Both mathematical proof and simulation demonstrate the practicality and scalability of our scheme.The mobility of the network nodes has been leveraged to improve the coverage and connectivity of the networks. Liu et al. used mobile sensor nodes to cover a region for intrusion detection, so that the coverage of the network depends on not only the initial network configuration but also the sensors' mobility. proposed that mobile node should move using the knowledge of intruder to further improve the coverage of mobile sensor.

III. PROPOSED SYSTEM

The input message from tags is read by an RFID reader Each vehicle are provided with a vehicle ID. RFID are connected to the central server system through microcontroller .They collect information from the vehicle through RFID and transfer it to the central server system. Privacy preserving point to point traffic preserves the privacy of individual vehicles as well as the geographical location details. It keeps the privacy of individual vehicles. Geographical features are provided. It has a fixed identifier for each vehicle

This investigation aims to chart the challenges to take advantage of the dynamic varying context information, and provide solutions to customize the computing service to the contextual situations. The input given is different sensors and Radio Frequency Identity card. In our system,we propose a new technique where we could have the entire control of all the appliances using WiFi technology and sensor nodes.Different sensors such as temperature,gas,lights,PIR are placed in different spots.

3.1 BLOCK DIAGRAM

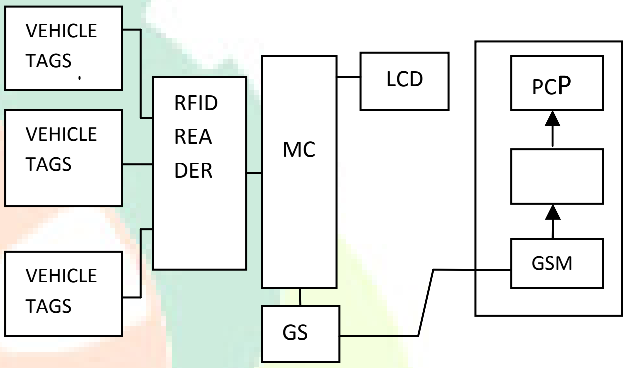

Figure 1 Block Diagram of The Design

3.1.1 AVR MICROCONTROLLER

The AVR is a modified Harvard architecture machine, where program and data are stored in separate physical memory systems that appear in different address spaces, but having the ability to read data items from program memory using special instructions.The easiest way of thinking about it is to compare a microcontroller with your PC, which has a motherboard in it. On that motherboard is a microprocessor AMD chips that provides the intelligence, RAM and EEPROM memories and interfaces to rest of system, like serial ports mostly USB ports now, disk drives and display interfaces. A microcontroller has all or most of these features built-in to a single chip, so it doesn't need a motherboard and many components, LEDs for example, can be connected directly to the AVR. If you tried this with a microprocessor, bang..

3.1.2 RFID

RFID stands for Radio-Frequency Identification. The acronym refers to small electronic devices that consist of a small chip and an antenna. The chip typicallyis capable of carrying 2,000 bytes of data or less.The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information

3.1.3 RFID READER

Radio-frequency identification is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader. Unlike a barcode, the tag does not necessarily need to be within line of sight of the reader and may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

Figure 2 RFID Implemented PCB Board

3.1.4 LCD

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly.LCDs are available to display arbitrary images as in a general-purpose computer display or fixed images with low information content which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators suffer.

3.1.5 RFID CARD

RFID tags are used in many industries. For example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line; RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips in livestock and pets allows positive identification of animals authenticity.

Figure 3.RFID Card

A significant advantage of RFID devices over the others mentioned above is that the RFID device does not need to be positioned precisely relative to the scanner. We're all familiar with the difficulty that store checkout clerks sometimes have in making sure that a barcode can be read. And obviously, credit cards and ATM cards must be swiped through a special reader.In contrast, RFID

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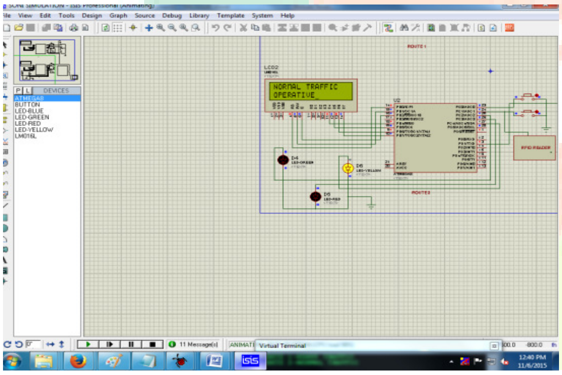
devices will work within a few feet up to 20 feet for high-



frequency devices of the scanner. For example, you could just put all of your groceries or purchases in a bag, and set the bag on the scanner. It would be able to query all of the RFID devices and total your purchase immediately. Read a more detailed article on RFID compared to barcodes.

3.1.5 GSM

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. Global System for Mobile Communications(GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones appendices

IV. RESULT AND DISCUSSION

Fig4. Heavy Traffic Indication

The above figure shows the heavy traffic in route 1 indicated by LCD screen and also by Red LED.

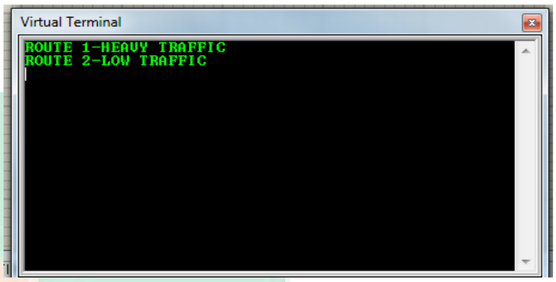


Figure 5. Server Display

The figure is the acknowledgement to the server in which the traffic is indicated in the terminal.

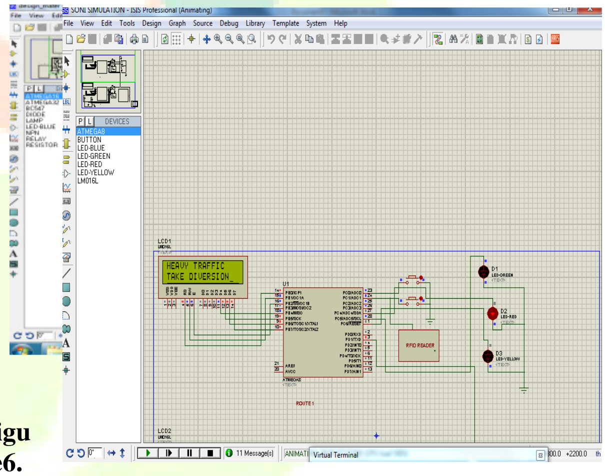


Figure6. Overall Traffic

The figure shows the overall design of the system. It includes two routes in which the traffic is continuously noticed avoiding the GPS signals and the whole process.

Figure 7.Normal Traffic Indication

The above figure shows the acknowledgement of normal traffic shown in the LCD and is indicated by LED light.

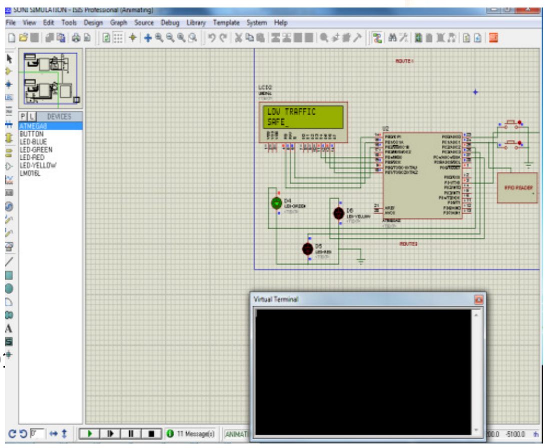


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Figure 8.Low Traffic Indication

The above figure shows the low traffic that is shown in the LCD as well as indicated by green light.

V. CONCLUSION

A few adjustments were made in the decades that followed, such as pedestrian-walk sensors, but the basic concept remained the same: Signals were for safety's sake. But today's traffic engineers are starting to give the humble signal new responsibilities programming them to not only react to the flow of traffic, but also to predict driver behaviour. The signals of the not-so-distant future may help cities cut congestion without adding lanes or building new roads. the traffic is controlled automatically with these records and the sensors such as pedestrian crossing, School, college alerts are included.

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