Runtime Conflict detection in Smart City Services

Vallari Kulkarni[1] Shishir Kumbhar[2] Pallavi Mirje[3] Siddhi Kulkarni[4] Prof.M.A.R.Shabad[5]

[1][2][3][4][5]Dept.of Computer Engineering

Sinhgad Academy of Engineering,Kondhwa

Pune,India

***Abstract*— The populations of large cities around the world are growing rapidly. Cities are beginning to address this problem by implementing significant sensing and actuation infrastructure and building services on this infrastructure. However, as the density of sensing and actuation increases and as the complexities of services grow there is an increasing potential for conflicts across Smart City services. These conflicts can cause unsafe situations and disrupt the benefits that the services were originally intended to provide. This project monitors and evaluate the overall health of smart city transportation services using real-time data feed.**

We have prepared an architecture, which focus on health monitoring and alert that arise on Transportation services.

Keywords—Smart Cities,Conflict Detection,Data mining,cloud computing.

I. Introduction

Urbanization is not a new phenomena, but has never before proceeded so rapidly. Over the last century human migration and aspiration have concentrated to its cities[1]. The reliable availability to diversity of employment, public services, and housing is strong incentive that drives this change in human habitation. Further, cities no longer serve their population with a set of discrete services. Increasingly, public services are seamlessly intertwined and support each other, from transportation to health-care to utilities. With the arrival of technological tools such Internet of Things (IoT), Big Data, Cloud computing products , and Crowd Sourcing platforms, cities are becoming increasingly able to monitor the state of their infrastructure, services, and populace, cost effectively and at scale. With a connected populace and infrastructure, cities are also able to dynamically act on changes based on the observations it makes with increased accuracy. A city that employs such technologies to mitigate the strains of urbanization[14], to improve the quality of life for it inhabitants, and the competitiveness of its economy[8] is commonly referred to as a Smart City. There are a number of cities that are already embracing the notion of a Smart City, such as the city of Santander in Spain . One key open problem is that with many services operating simultaneously, conflicts will arise. Conflicts have both an immediate effect on human life, as well as long term secondary/tertiary effects. In the complex system-of-systems that is a Smart City, services will come into conflict when contending over the same resources, incurring opposing actions[13], and when having contradictory or conflicting objectives. These conflicts are both institutional and technical, and have to be resolved holistically. Finding and classifying conflicts are non-trivial but crucial to the operation of a Smart City due to (i) the scale of a Smart City system, (ii) the diversity in services, and (iii) the wide range of ways the services interact with the city. While some of these conflicts can be detected during the design phase of services, many conflicts can occur unpredictably at runtime, i.e., when the implementation phase is over and the services are operating simultaneously[11]. Detecting runtime conflicts is significantly more challenging than detecting design time conflicts, as runtime conflicts involve a higher degree of uncertainty. Once a runtime conflict is identified, resolving it often involves a compromise, such trade offs have both a technical and administrative component.

This paper primarily explores the nature of the runtime conflicts that arise in a Smart City and how they can be mitigated through architecture (Figure 1). The
primary contributions of this paper are as follows:

· The enumeration of Smart City services characteristics.
· The classification of conflicts.
· The design of a watchdog architecture to detect and resolve these conflicts.
· An evaluation of conflict analysis that demonstrates the high probability of conflicts using actual data from a Smart City.

-Objective

- To Evaluate the overall health of the Smart City Transportation System.
- To gather and Analyze the data use Live Data Streams.
- To Further Process the data so that effective knowledge can be gain for the Administrator.

II. Architecture

Given below is the brief architecture of proposed system. The architecture consist of three unit.

A. Remote Sensing big data acquisition unit(RSDU).
B. Data processing unit(DPU).
C. Data analysis and decision unit(DADU).
These units are explained below.

A. Remote Sensing big Data acquisition Unit(RSDU)

The bottom layer of the architecture there are various transportation systems. For ex. buses, trains, vehicles etc. These systems contain sensing units which senses the environment. Data is collected using the sensors and then this sensed data is sent to data processing unit (DPU). The sent data contains both online and offline information for processing.

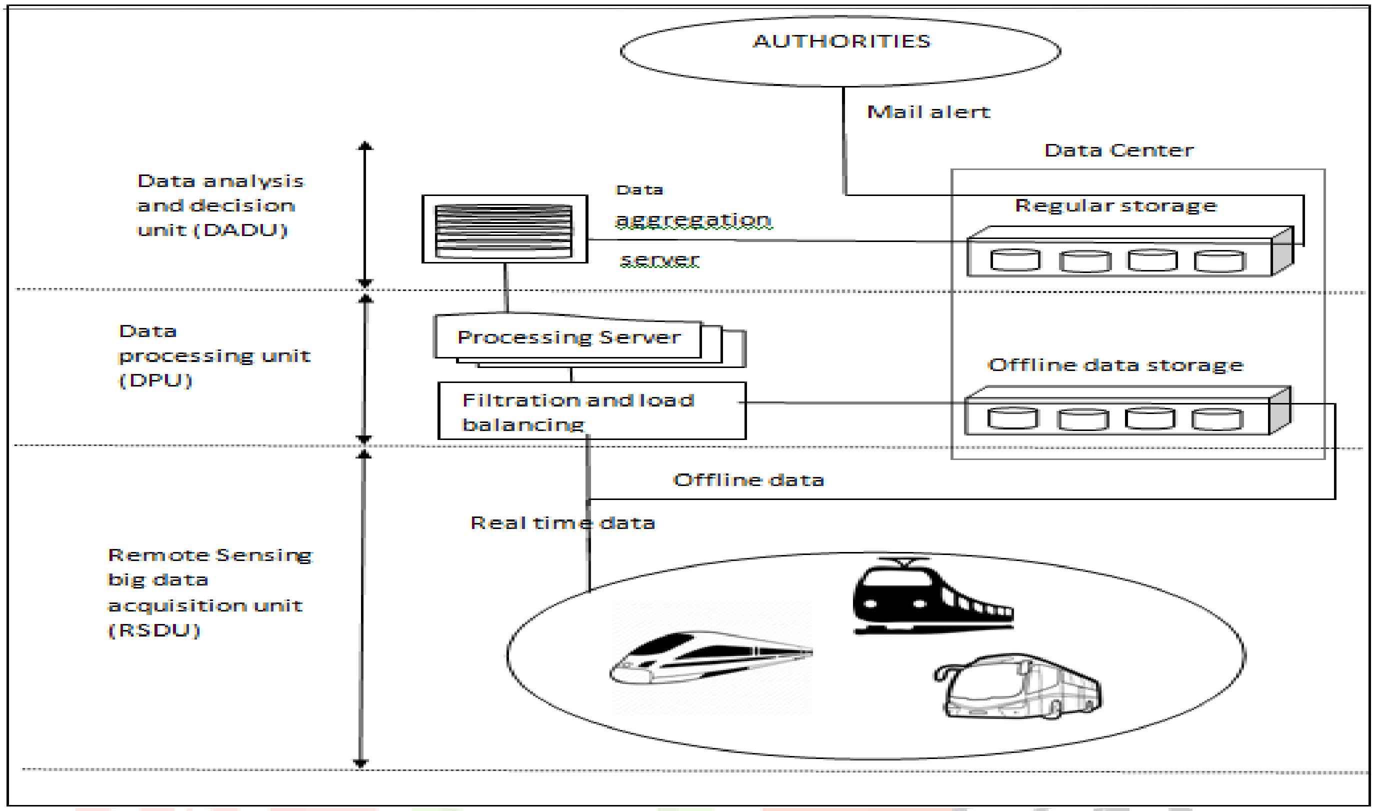

fig.1

B. Data Processing Unit(DPU)

The next layer is data processing unit. As the name suggest the data is processed in this unit. There are three steps in DPU. First step: Filtration and load balancing algorithm. Second step: Processing and calculation algorithm. Third step: Multi model summarization algorithm. The data is collected according to required attributes. These attributes define the type of data. Not all data is processed which is available on the authorized cloud.

In first step the gathered data is filtered according to filtration algorithm. Then this filtered data is balanced using load balancing algorithm.

After applying these two algorithms the next step is processing and calculations. MongoDB queries are used to handle the data and calculations. And the last step which is third step is multi model summarization.

As shown in the above figure, the real time data and offline data both are processed in the data processing data(DPU). Offline data storage is used to store the data which will be further used for taking decisions for authorities.

C. Data Analysis and Decision Unit

In this unit the processed data is analised and decision is made. The processed data is stored in the data aggregation server . The DADU also contain regular storage.The authorities will receive the alert through mails or messeges.After receiving the alerts the authorities will take an appropriate decision.

III. Data Capturing

The data capturing is an important aspect in our project, hence we have explained it in different section.

To use the API, we had register for access tokens and had send those tokens as part of our request. The default response format was JSON.

When the data emerges from the API, it is uniformly consistent in output and structure. The core benefit for this approach is that with the API acting as a facade, the logic and processes behind creating the API and merging the datasets are abstracted away from us[6].

This means that TFL has deal with all of the complexity of stitching the many formats and nuances of the many data formats and qualities from their source systems, and provide us with a unified API that is easier to use[5].

This approach also allows us to maintain a compatibility layer going forward. If the input source data systems change, the data can still be provided in the same format out of the API and allow our systems to carry on working in the future.

The data provided by the API regularly updates from the source systems to deliver the most accurate information available at the time.

The API is designed to support a model of interaction where we query the API rather than needing to load the data into your own systems [9].

IV. IMPLENTATION

The implementation involves various steps. The first step is detecting the disruptions, second step is reading data and deciding the value of status as status is the key in our data. We have chosen most frequent value of the status key to get the result. Next step is finding bus stops' name on specific road by comparison. By using these bus stop names and road ID we are creating dynamic mail body. These mails are sent to the authorized person. Mail body also contains the reason behind disruption in the service (shown in img.1). So that,the authorized person can take decisions based on situation. We are using verification email for the authorized person before sending the alert messages, emails will only be sent after person agrees to the terms and conditions (shown in img.2). This prevents the alert messages going directly to the spam folder.

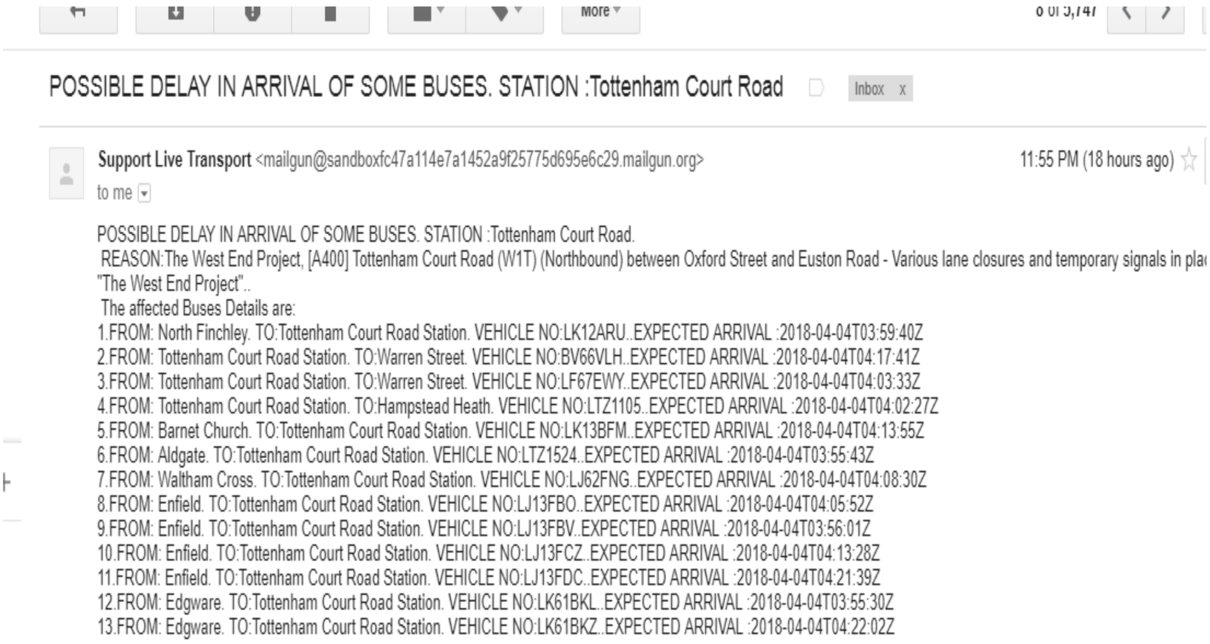

Image. 1

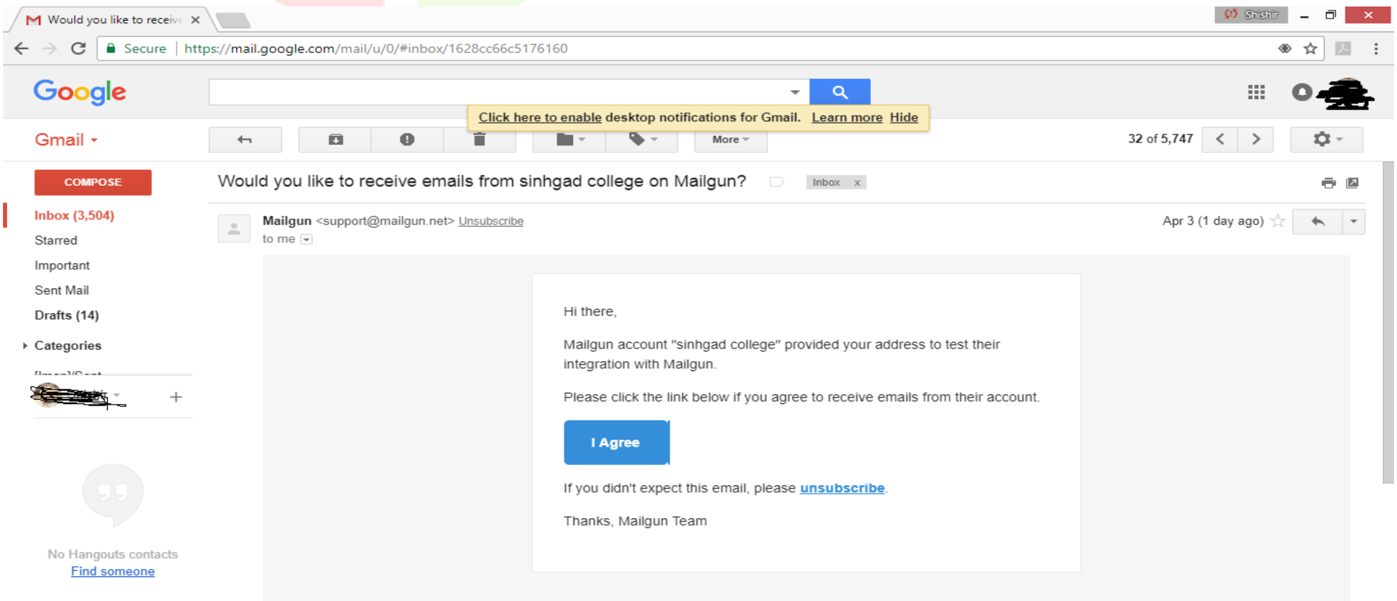

Image.2

V. Conclusion

Conflicting services create serious safety threats and operational failure in a Smart City environment. This paper focuses on formulating the problem of conflicts. Specifically, it (i) shows several characteristics of services that contribute towards conflicts, (ii) proposes a conflict taxonomy in terms of origin of conflict, and (iii) outlines issues and research challenges of detection and resolution of conflicts. In addition, a architecture is designed for intercepting actions from all services and detecting and resolving conflicts. The conflict detection module contains designated modules to detect device, environment, and human conflicts. Here we have taken two different services that is bus stops and roads as there are no common key values pairs in raw data. Thus our project gives a synchronization between various services of different domain.

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