A Smart ITS based Sensor Network for Transport System with Integration of IoT and Bigdata Approches

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Abstract - *Applying big data analytics for processing the transport data has contributed for the planning of the smarter transport network. The main Contribution of this paper is to combine both bigdata and IOT approaches to produce ITS cloud services for helping transportation planning. An intelligent transportation system (ITS) provides "the application of advanced and emerging technologies in transportation to save lives, time, money, energy and the environment" . Many of these applications are based on sensors and sensor networks. In the field of intelligent infrastructure sensors in pavements are used for road traffic monitoring systems to measure the intensity and fluidity of traffic (vehicle count sensors) and to provide information for traffic lights which are then controlled.*

***Key Words* – Traffic Sensor, IOT, Bigdata, ITS, Web service, Cloud.**

1. INTRODUCTION

An intelligent transportation system (ITS) can be defined as "the application of advanced and emerging technologies (computers, sensors, control, communications, and electronic devices) in transportation to save lives, time, money, energy and the environment".

The Internet of Things (IoT) [1][12] refers to uniquely identifiable objects (things) and their virtual representations in an Internet-like structure. Internet of Things refer to everyday objects, that are readable, recognizable, locatable, addressable, and/or controllable via the Internet using either RFID[2], wireless LAN, wide-area network, or other means.

Connecting huge numbers of sensor-equipped physical objects to the Internet generates a new big data ecosystem. The IoT-generated data possesses properties that conform to the big data paradigm, including volume in terms of generating masses of data; variety in the form of a mixture of structured and unstructured IoT data; and velocity referring to the different data generation frequencies among IoT devices, and different timeliness requirements for data delivery. However, IoT big data differs somewhat from what is generally thought of as big data because of the many different types of data collected and higher real-time requirements, in addition to their noisiness and often high sampling redundancy [6]. Moreover, IoT devices are often associated to a location context and every piece of data has a timestamp. This distinguishes typical big data from IoT big data as the latter includes spatial and temporal context in the data analytics system. In terms of data value in the acquisition and transmission, only a small portion of sensor data may be valuable.

Cloud computing [4] is a model for on-demand access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, services, and software) that can be easily provisioned as and when needed. Cloud computing provides an abstracted interface aggregates the resources to gain efficient resource utilization and allow users to scale up to solve larger science problems. It enables the system software to be configured as needed for individual application requirements. For research groups, cloud computing will provide convenient access to reliable, high performance clusters and storage, without the need to purchase and maintain sophisticated hardware.

Big Data [13][14] is defined as a collection of complex and large datasets that are difficult to process with available database tools. Big Data can originate from technologies such as sensors, cluster computing, internet and computer networks[15]. According to Gartner [34] Big Data has three dimensions- volume, variety and velocity. Volume refer to large transactions, variety refers to data types (tabular data, documents, video, images, e-mails, stock ticker data), originating from social media and mobiles, and velocity refers to structuring of data and making it available for access and delivery. The challenges associated with Big data, are to capture, search, share, visualize, store the data with the existing database technologies, and processing & analysing the data. Big Data analysis benefit the decision making capability in various domains such as science, astronomy, environment studies, commercial, economy, medical, social networking etc[15].

Organizations like Google, Microsoft, and IBM are researching for technologies and techniques to handle Big Data in reasonable time. In medical stream, MRI imaging, CT Scan and genetic analytics creates huge digital data related to patients[16], when analysed gives fundamental insight in the environmental & genetic causes of the diseases, that leads to advancement in diagnosis techniques. Mobile apps are generating huge amount of context-aware data in form of images, audio, video, text, mails etc. IOT also contributes a big portion to the Big Data. Environment sensors monitoring the content of gases present in the air, and generate data. The effective mining of the collected data helps the climate simulators to predict the effect of the gases on the atmosphere. In IoT every device will have an IP and are on IP connected network, based on dedicated hardware. Exchanging the sensor data, in such an environment results in expensive infra structure. Cloud can be a most promising & cost effective solution to connect, manage and track the IoT[3].

Cloud models suitable for IoT are[14]:

- IaaS, for sensor & actuator business models and resource access models.
- PaaS provide access to the IoT data and control services.
- SaaS, for monitoring services application domain.

2. CONCEPTUAL FRAMEWORK FOR URBAN SMART TRANSPORT BASED ON CLOUD AND IOT

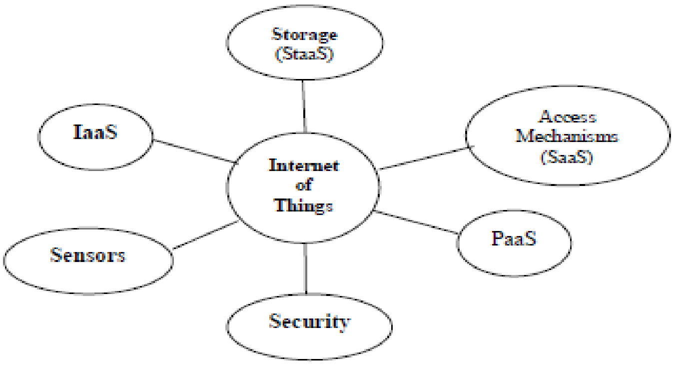

Figure 1. Internet of Things, Sensing and Cloud Computing

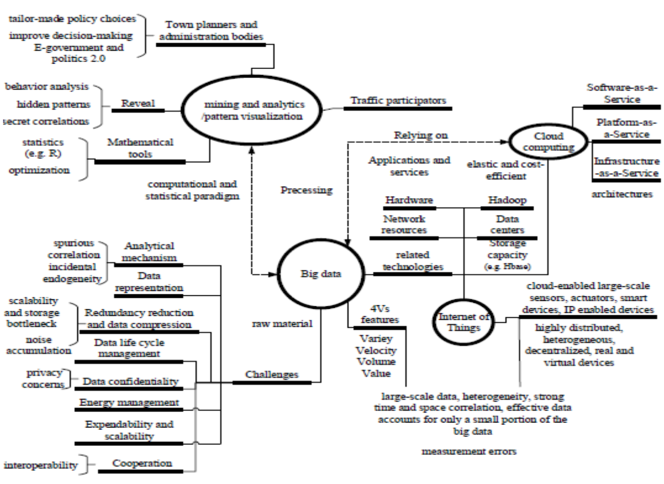

Fig. 2 Conceptual Framework for Urban Smart transport based on Cloud and IOT

Figure 2 presents the conceptual framework of urban smart transportation based on cloud and IoT. Contemporary smart urban transport systems:

(1) employ secured IoT to generate big data, which comprise billions of devices that sense, communicate, compute and potentially actuate, massive connected via GIS-T, widely available real time communication network(e.g. 4G, Wi-Fi, Bluetooth);

(2) generate big data with "4Vs" features, as raw material facing great challenges

(3) rely on resilient cloud computing to store, manage, mine and create values for insight as the solution to many of our society's traffic and transportation problems.

(4) in an era of data abundance, there is a clear need for visualization tools to provide insight into how coordinated systems should be expected to operate under different parameter settings and to document coordinated system behaviour.

Figure 1 depicts that the evolving technologies like IoT, sensor networks and cloud computing complement each other.

3. Proposed Architecture

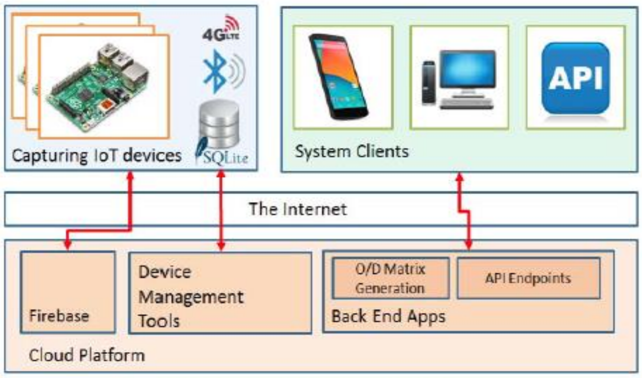

Figure 3. Proposed architecture

The architecture provides merging of capture, classification [18] and acceptance sub system into a unique sub system running over IOT enabled device even providing local storage. The platform designed is combination of two subsystems along with clients. The first one denominated as sensor subsystem responsible for capturing, analyzing, filtering and storing and recording of Bluetooth signals.

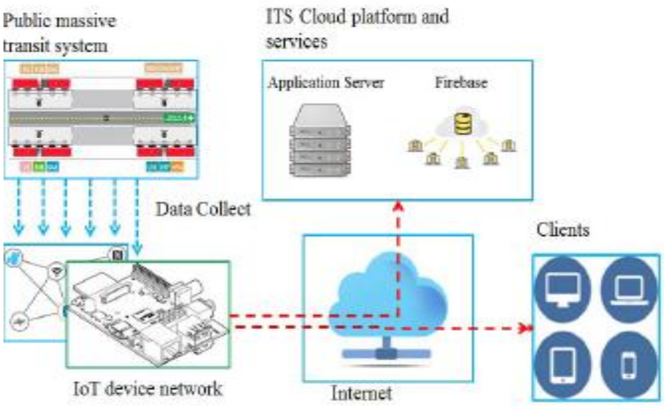

Fig 4 IOT system Integration

The first subsystem in figure4 focuses on capturing Bluetooth signals,second analyzes filter data captured and decides which one to be accepted to be processed, third eliminates duplicate records in a time range and last subsystem gives result of an O/D matrix from a specific date and time[18].

Second subsystem is composed of

1. Firebase: Collects and stores the information prevenient from the first system.

2. Backend Apps: Runs analysis and generation tasks for O/D matrix.Also provides standard application interfaces, to allow the system clients to connect and retrieve data.

3. Device Management tools: Set of tools used to admin and monitoring deployed devices.

3.1 Capture Device Architecture

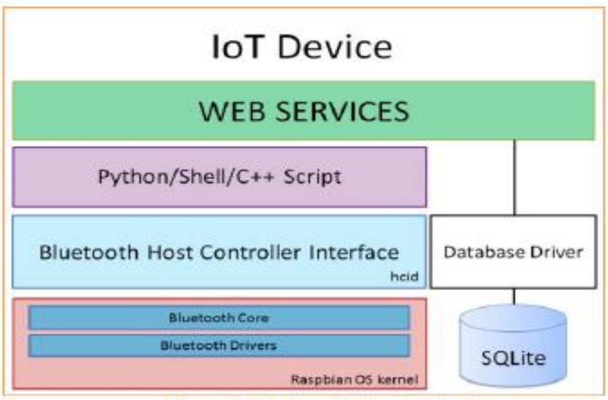

Figure 5. Capture device architecture

IoT capture device is is composed of several technologic bricks which supports the functionalities of sensor subsystem[18].This device integrates an embedded web server,database and Bluetooth signal sniffer.

4. CONCLUSIONS

The main Contribution of this paper is to combine both big data and IOT approaches to produce ITS cloud services for helping transportation planning. A new implementation of Internet of Things for capturing data for an ITS solution is been proposed. The designed system helps to capture vast amount of data required by transport system. It provides fast deployment of ITS solution reduce cost, provides reliability, flexibility and easy access of Iot approach.

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