Internet of Things for Environmental Monitoring

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ABSTRACT- Increasing population in cities demands satisfactory provision of services and infrastructure for the city‘s residents and visitors. The deployment of information and communication technologies to accomplish this objective presents an opportunity for the progress of cities, where management of city and citizens are given access to real-time information about the environment. This paper presents the structure for environmental monitoring using the Internet of Things (IoT). The structure comprises the complete information system from the sensor level to data management and cloud-based information about the environment. This Iot vision is applied to temperate, waste management and vehicle parking to demonstrate a method for existing systems that can be adopted for the enhancement and delivery of services.

Keywords—Internet of Things (IoT), Temperature, waste management, vehicle parking, MQTT.

I. INTRODUCTION

The Internet of things (IoT) is network of objects, in which the objects of everyday life are embedded with microcontroller, sensors and software that enables these objects to collect and communicate data with one another and the users, becoming the essential part of the internet. The IoT model, aims at making the Internet even more persistent. Furthermore, by enabling easy access and communication with a wide range of devices such as, for example, home appliances, surveillance cameras, monitoring sensors and so on, the IoT is implemented for the development of applications that makes use of the enormous amount and the data generated by such objects provide services. This method finds application in many different areas, such as home automate, mobile healthcare, traffic management and many others [1].

In this scenario, the application of the IoT paradigm to a city environment is of particular interest, as it responds to the governments to adopt information and communications technologies (ICT) solutions in the management of public affairs, thus it is called Smart City concept [2]. Though there is no yet formal and widely accepted definition of ―Smart City‖,the aim is to make a better use of the municipal resources, increasing the quality of the services presented to the residents, while decreasing the operational costs of the municipal administrations. This objective can be tailed by the deployment of an IoT, i.e., a communication infrastructure that provides cohesive, simple, and inexpensive access to a overabundance of public services, thus unleashing potential interactions and increasing clearness to the citizens. An IoT has numerous benefits in managing and optimizing traditional services, such as transport and parking, lighting, observation and maintenance of public areas, protection of cultural heritage, garbage collection, hospitals, and school. Furthermore, the accessibility of different types of data, which is collected by a persistent IoT, may also be used to take advantage to increase the clearness and promote the actions of the local government toward the residents, improve the awareness of people about the status of their town, stimulate the active participation of the residents in the management of public administration, and also stimulate the building of new services provided by the IoT [3]. Therefore, the presentation of the IoT standard to the City is particularly to regional and regional administrations that may become the early implementation of such technologies, thus acting as catalyzes for the implementation of the IoT paradigm on a wider scale.

The paper is organized as follows: Proposed system, especially from the perspective of environment is first given in Section II. We then present the details of the IoT implementation for environmental monitoring in Section III, the results for the proposed system in Section IV. We also present the summary and future thoughts in section V and section VI respectively.

II. PROPOSED SYSTEM

IoT has various of application in this paper we are discussing about the temperature, vehicle parking and waste management. These are the few issues which we are facing regularly in our day today life with the use of IoT we can provide solutions to these problems.

A. Temperature

The IoT plays a great role in the development of future smart cities. For instance, Air Quality Eggs can be found across America, Western Europe and East Asia, and may finally play a role in developing countries with the most rapid urban population growth and peak rates of pollution. This is a community-led air quality sensing network that allows anyone to collect very high contents of Nitrogen-di-oxide (NO2) and Carbon monoxide (CO) concentrations of their surroundings. These two gases are the most suggestive elements related to urban air pollution that are sense-able by reasonably priced, DIY sensors. The temperature plays a very crucial role. The temperature varies from time to time. The temperature in the day times is completely different in the night. In paper gives an idea of how a temperature can be identified for the city using IoT concept.

B. Waste Management

Waste management is a main issue in many growing cities, due to both the cost of the service and the problem of the storage of garbage accumulation. A deeper penetration of information and communications technologies solutions in this field may result in the savings and inexpensive and environmental advantages. For instance, the use of intelligent waste containers, which identify the level of load and allow for an optimization of the collector trucks route, can reduce the cost of waste collection and improve the quality of recycling [4]. To realize such a smart waste management service, the IoT will connect the devices, i.e., intelligent waste containers, to a control centre where optimization software process the data and determines the optimal management of the collector truck.

C. Vehicle Tracking

The vehicle tracking facility is based on road sensors and intelligent displays that direct drivers along the ZANELLA et al.: INTERNET OF THINGS FOR SMART CITIES 25 best path for parking in the city [5]. The benefits deriving from this service are various: faster time to locate a parking slot means fewer CO emission from the car, lesser traffic congestion, and happier citizens. The vehicle parking facility can be directly integrated in the IoT infrastructure. Furthermore, by using communication technologies, such as Radio Frequency Identifiers (RFID) or Near Field Communication (NFC), it is possible to understand an electronic confirmation system of parking permits in slots reserved for residents or disabled, thus offering a better service to residents that can legitimately use those slots and an efficient tool to quickly spot violations.

III. IMPLEMENTATION

IoT service provides a simple but powerful capability to interconnect different kinds of devices and applications all over the world. IoT service acts as MQTT broker and is thus responsible for distributing message to connected clients. Devices and applications communicate with MQTT broker using MQTT protocol.

A.Temperature Architecture

This paper discuss about the temperature variations in and around the place using the data received from the satellite.
There are three entities defined in our system that is cloud devices and app as shown in the Fig.1.

Cloud: Cloud becomes prevalent, an increasing amount of data is been stored in the cloud and shared by the devices with specific privileges, which defines the access rites of the stored data. The user gets an API Key, the password and the device purpose for which it is registered. Once he is registered to the cloud. Using these API Key and the password he could access the data received from the devices.

Devices: Devices can act as sensors for the purpose of receiving or to transmit the data to the cloud. The devices can be anything which can sense the data.

Apps: Applications are programs that consume the information received from those devices.
MQTT: Message Queue Telemetry Transport/Things transport. In IoT things are nothing but the devices like Buildings, systems etc. Telemetry is an automatic device which is used to measure and transmit the data. It can be considered as the secrete behind the IoT service. MQTT is a simple lightweight, publish/subscriber messaging protocol on top of TCP/IP protocol

JSON: JavaScript Object Notation. It acts as a bridge between the physical objects and the web sensors.

B.Waste management and Vehicle Tracking

This paper also discuss about the waste management and vehicle tracking using the data received from the satellite. There are three entities defined in our system that is cloud devices and app as shown in the Fig.2.

Cloud: Amount of data is been stored in the cloud and shared by the devices with specific privileges, which defines the access rites of the stored data. The user gets an API Key, the password and the device purpose for which it is registered.

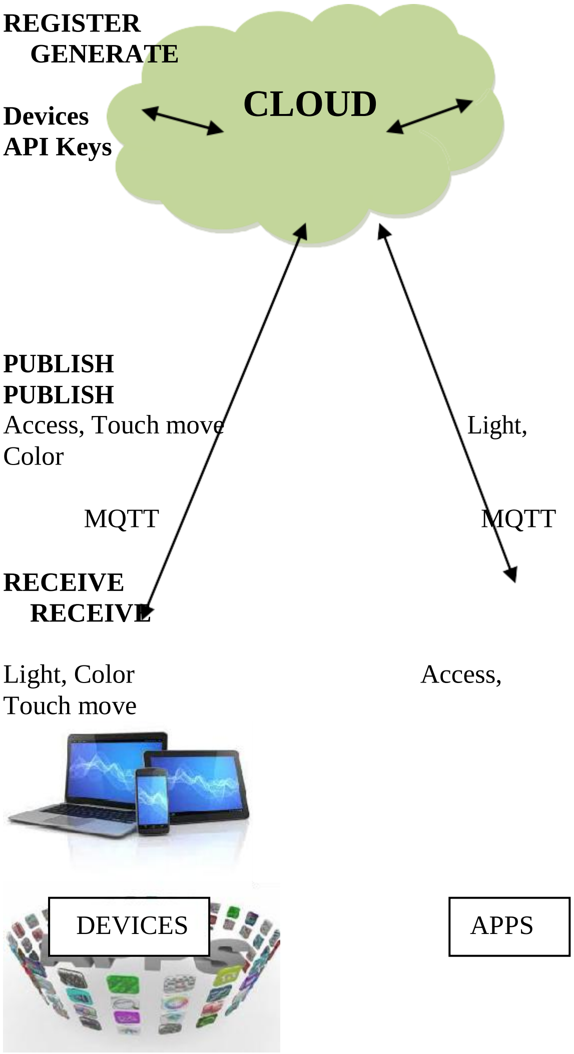

Fig. 1 Architecture for Temperature IoT

Once he is registered to the cloud. Using these API Key and the password he could access the data received from the devices.

Devices: Since now a day most of the devices are GPS enabled, it is very easy to track the exact locations of the vehicles. Since in our day to day life, we do not know the exact time when the waste truck arrive to collect the garbage from every particular area. The details of the waste truck and the vehicle to be tracked are based on the latitude and longitude of the particular region.

Apps: Programs that receives data from the devices.

As in the below description the app is used to access the data from the cloud.

Node red is a simple open source visualization tool that connects devices for the IoT. Node red has been developed in node.js, a server JavaScript widely used in IoT pits and can be run in cloud.

Notice that the data collected from these devices are accessed by the satellite which in turn sense these accessed data to the base station. The data sent to the base station is sent in the form of raw data. The cloud filters the raw data and the filtered data can be accessed by the app. Both apps and devices place a very important role in publishing the collected data and to receive the data.

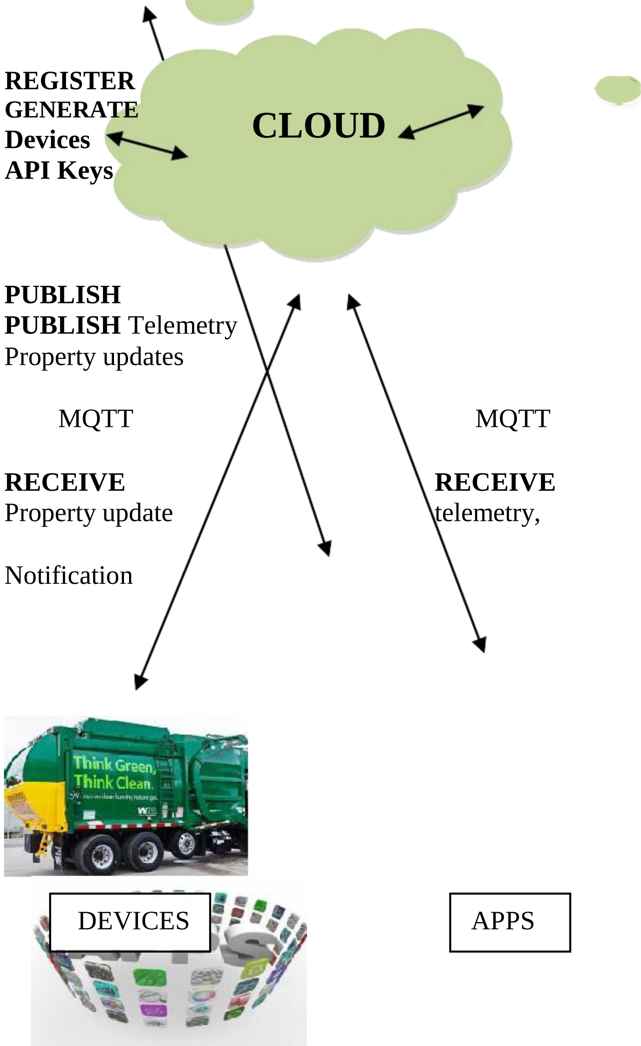

Fig. 2 Architecture for Waste management and vehicle Tracking IoT

IV. RESULT

Basically we have to get connected with the cloud to retrieve the data from the cloud. We can see the login page in Fig. 3, where the user has to login with the particular API Key and the token which is given by the cloud so that privacy is maintained to access the server.

In Fig. 4 we can see the temperature variation. We‘ll be getting the second to second update of the temperature. And through the graphs and meter we can get to know the variation in temperature. If the temperature is less than 30, the indication will be in green color. If the temperature lies between 31 and 75, we can see that the color changes to yellow and if the temperature is above 75 then the color changes to red.

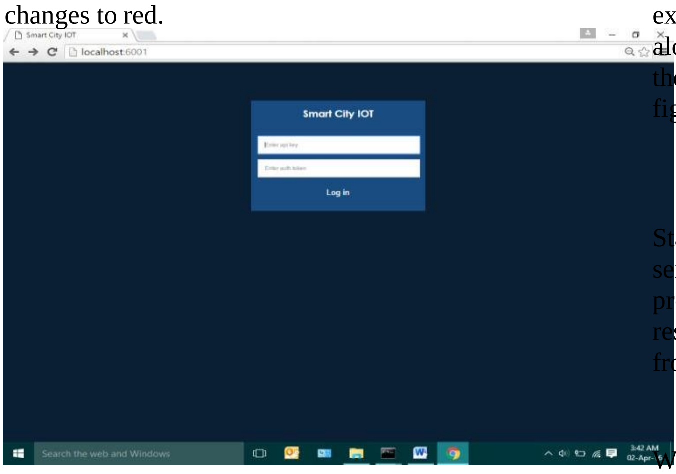

Fig. 3 Login Page

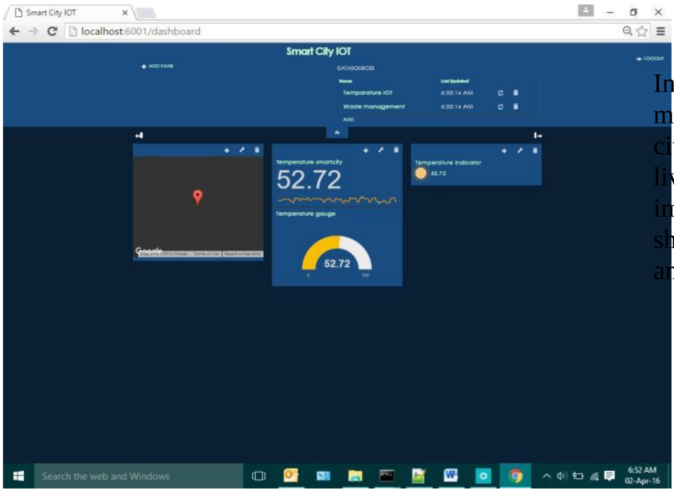

Fig. 4Result of Temperature.

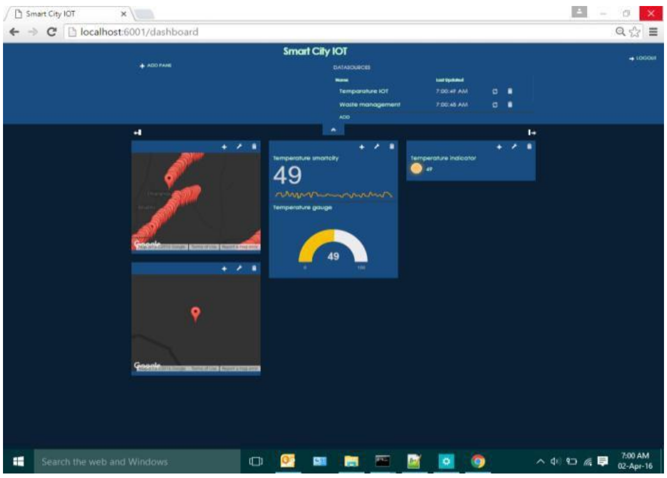

Fig. 5 Overall result of the project

In fig. 5 we can see that we are linking to Google map for tracking the cab of the waste collector. And we can also see that the garbage collector truck has been tracked so that the user will get to know the exact location of the garbage collector truck. Also along with the garbage collector truck we can see the temperature as well as vehicle tracking in this figure.

V. SUMMARY

Start the IoT starter app in device, it starts to collect sensor data. From the device it goes over MQTT protocol to IoT cloud and there you can access via rest API. The data collected are accelerometer data from device.

VI. FUTURE WORKS

We can also implement this in android watches, attached to other IoT concepts like home security, structural health, city energy consumption, smart lighting and so on.

VII. CONCLUSION

In this paper, the notation of environmental monitoring using IoT was proposed to monitor the city from the damages cost which may affect the living of the citizens. As a proof of concept we implemented a IoT of a proposed system. We showed that our system can access the data without any embedded system.

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