INTEGRATED DEVELOPMENT ENVIRONMENT FOR IOT-BASED SENSOR DATA PROCESSING IN SMART CITY

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Abstract--Smart city involve large number of interconnected service oriented devices. A research challenge in smart city deployment is aggregation and processing of real-time data. Whereas, the technologies had different format with respect to different sensing applications and processing of this high-level data cloud is still a research focus in smart city domain. In this paper we introduced the smart city framework for handling large-scale IoT data streams and introduced the simulation of hardware as well as software for real-time data representation. We deploy the introduced framework in Integrated Development Environment with a platform of microcontroller for real-time sensor data streaming and processing of sensors data. We also point out the challenges of smart adaptation, user centric cloud based decision support and trustworthy information processing for smart city applications.

Keywords: Internet of Things (IoT), Smart City, Data Collection, Arduino

I. INTRODUCTION

In the recent years, with the growth of computer and Information Technology the urban areas are found to be smart city with the deployment of sensing device which leads to data transfer to the IoT (Internet of Things). Smart city project has become popular as the deployment of sensing devices in urban areas is found to be easy to setup. Since these devices communicate with each other, it results in data transition to the cloud. The various communication technology will be solution for challenges explore by urban population [1].

The smart city is interconnected physical infrastructure for collective devices. The information technology converts the traditional city services to the smart city [2]. A key challenges for smart city is real-time data streaming and analysis. The huge amount of dataset by every deployed sensors in urban areas transmitted towards IoT centralized cloud. The challenge towards the smart city is online data aggregation and streaming [3]. The presented paper introduced the environment sensor to collect air data and transmitted to the cloud using the Bluetooth device. The simulation represented the future technology used for real time sensor data processing of smart city. The authors of [4] proposed the technique for energy efficient smart building.

II. MOTIVATION

Smart city developed result in utilization of Information and Communication Technology (ICT) such that the life living of people of urban areas utilized and use the limited sources (energy, spaces, medical etc.). Urban municipalities provided the smart projects to acquire the best facilities for living people by use of technology and also to monitor each environmental parameters. The base bond of these systems is: sensors, data acquisition devices, computer and server at the end to store those data. The requirement of data analyst expert needed at the server side to analyse and discover the pattern and prediction for environment elements to predict the future values of it. The deployed system must have capability of plug-and-play sensor, securely data aggregation and service quality.

A unifying information management platform delivers a capability across application domains essential to town. Whereas massive volume of information assortment and interpretation are already engaging at completely different levels at intervals city councils mistreatment manual and semi-automated strategies, mostly isolated, like any massive organization, it is inevitable that vast parts of those information stay disjoint in the time scales over that they are collected and so to the capacity for them to be integrated. Supplementary degree urban information framework has been enabled by IoT provides a solution for consolidating these tasks and sharing of information between various service suppliers within the city.

The applications among the urban atmosphere that can get pleasure from a smart town IoT capability will be sorted according to impact areas. This includes result on: citizens (health); transport (mobility, productivity, pollution); and services (critical community services). Several projects can be deployed to make smart city of urban areas that can include: public parking monitoring; microclimate monitoring; public vehicular services (auto rickshaw, public transportation). A number of specific application domains have additionally been identified that might utilize the smart city IoT infrastructure to service operations in: Health Services (noise, air and water quality level); Strategic designing (mobility); property, Business and city security and safety.

Choose microcontroller base of Arduino Uno as the platform for the system. The environmental data are generated and store using the DHT11 sensor. Processed data are transmitted towards the cloud. Finally, displaying the result on web page to users to help in decision making and forecasting. We can set the high and low limit for the values and additionally, this range values used to make alert for if the data go beyond this threshold. The analytics of data result in efficient usage of limited resources and provide alert if the usage reach at any threshold. It is the kind of environment low cost, low power monitoring program for IoT.

III. IoT INFRASTRUCTURE FOR SMART CITY

a. **IoT Framework :** Defining and deploying the architecture framework for the smart city is the difficult task, especially when the network had exceeding large number of objects and technical devices, linking layers between them and uninterrupted data flow association between them, also having high dependency and infrastructure of smart city that leads the complexity in data analysis. Still, [5] had found the main three key components of IoT framework: Network-centric, Cloud-centric and data-centric IoT. The framework can be visible in three layers. Wireless sensor network provides the collection, processing, analysis and centric data storage [6]. The data from different deployed sensors in wireless sensor network are stored at cloud. The cloud provided the services of infrastructure, software and platform. The framework and development model have been proposed by [7] to implement the IoT system for smart city development. As shown in figure 1 the data-centric model take the all responsibilities of database management. It collect, interpret and manage those data generated by end points of every location points of smart city project and stored at centric location at server for the monitoring.

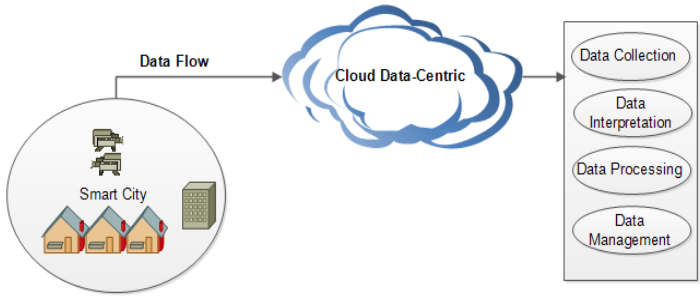

Fig. 1. The Network, Cloud and Data centric IoT Framework for smart city

b. **IoT Data Analysis:** The accumulated data transferred to our cloud by web services and store as data stream to our analytic server in respect to find the patterns and also they are stored in local host centralized database also.

IV. SETTING OF A TEST ENVIRONMENT

The setup for the test environment is the experiment with the Arduino base on voltage. The setup is the combination of Arduino UNO board, DHT11 sensor, HC (Bluetooth device) and different ohms of resistors. Ohm's law describe the directly relationship between Voltage (V), current (I) and Resistance (R) [8] of a circuit.

$$V = I \cdot R \quad (1)$$

The resistors we used are of the capacities of 4.7K Ohm, 6. 2.2K Ohm and 7.1K Ohm Resistors to charge flow of opposition. The gateway devise for the sensors data are microcontroller and breadboard circuit play role of platform provider for sensor and resistors to be placed as shown in figure 2.

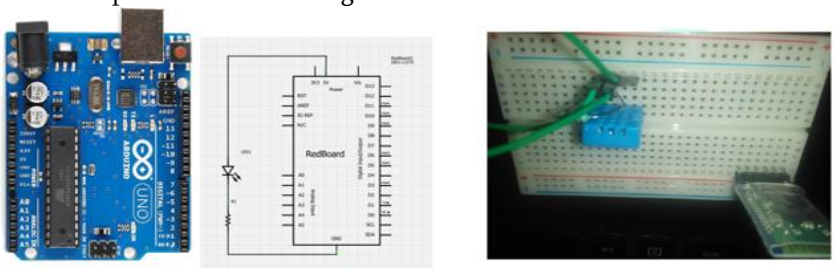

Fig. 2 (a) The microcontroller and breadboard platform **(b)** physical setup with DHT11 sensor and Bluetooth node (HC)

- **REAL-TIME SIMULATION**

In this section, it is described the simulation setup of software as well as hardware using the arduino uno microcontroller, is an interactive platform to research and can rewrite the program effectively and easily [9]. İn figure 3 we presented the proposed simulation using Ardino UNO and its applications used to simulate the sensors data at IoT. The data are captured using the network nodes. Data are collected and transmitted. Also, it is useful to store large amount of data at IoT. The Arduino (IDE) integrated development environment is an open source software.

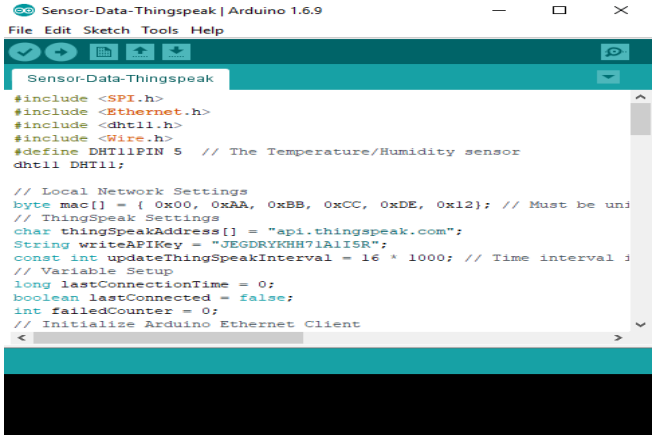

Fig. 3 Simulating with Arduino UNO

The hardware of HC-05 Bluetooth module is selected, DHT11 Temperature and Humidity sensor [10] that enables the dataset to be displayed on web for monitoring.

We also provide the alert signal if the values for the variables of smart city exceeded the safe guard value. With the use of this tool we can represent the data by placing it on the web, the cloud become the source for the data and continuous monitoring of real-data have been taken place. The Integrated development environment found to be useful for the research perspective sensors data are captured and processed by it.

V. RESULTS AND CONCLUSION

Smart data needs the monitoring and analysing continuously. We deployed new and better technique with easy deployment for data monitoring and analysis for smart city projects in this work. Also the implantation of framework with deployed nodes has environment monitoring for safer smart city deployment for easy human urban life. The work is easy in implementation with respect to cost and monitoring. Also it introduced the smart city framework with IoT uploaded data using Integrated Development Environment (IDE) for cloud based data monitoring. The web based data representation reach at the end level of users, and additional provide the alert for unhealthy environment changes.

VI. REFERENCES

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