Development of Tracking and Sensing IoT Platform

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Abstract— Internet of Things can be defined as any "thing" can be connected to each other using any medium either wired or wireless and can share the information on internet. Here the "thing" means devices/sensors.

IoT can be generated using Vertical or Horizontal approach. Vertical approach is used in a application specific system. So, if an IoT system is built using this approach, then it is difficult to move it from one application to other since all applications may not have the same protocols and environment. This generates the need for a very generic approach which could be used for multi-domain applications. A generic IoT platform will be developed and it would be implemented for Logistics industry to track and monitor the group of vehicles, their contents

Index Terms—IoT, Horizontal Platform.

I. INTRODUCTION

Internet of things is the next new "Big Thing" in the industrial world. With more and more devices coming into picture, there is a need to connect these devices.

When internet first came into picture a revolution took place which connected people from all over the world. The next internet revolution has already began, this revolution would connect different devices to each other through internet. It is also predicted by analysts that by 2020 almost 50 billion objects would be connected over internet and would communicate smartly over it.

Internet of things could be defined as a smart network of electronic devices/sensors. It encompasses many aspects of life. Public safety, smart industries and environmental protection all now are possible by using IoT.

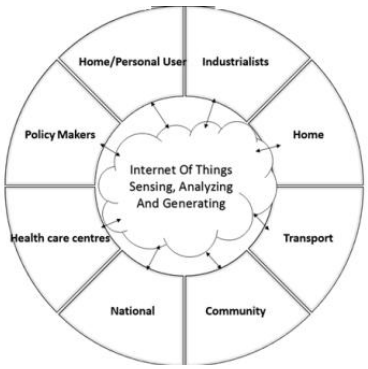

Fig. 1: Application areas of IoT

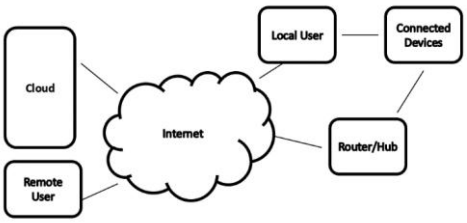

Fig. 2 Basic building blocks of IoT system

Thus it is very important that we understand this new emerging technology, the way it works, its applications and also contribute into its building process.

One of the areas where IoT system can work efficiently is in the Logistics Industry. Logistics industry faces many challenges because of the ever increasing demands of their customers. Customers now-a-days expect the transparency in their orders and inventory in order to keep a check on their perishable and non-perishable materials. Customers also expect a tight security for containers with their materials. For this purpose the logistics companies have to keep a track record of when the containers were locked and when and where they were unlocked. On-time delivery is also an important challenge faced by these industries. That means, data containing full insight of each order and its associated item level details in real time are required by these industries. These challenges could be easily overcome by using an IoTsystem. IoT system can be used to monitor different assets in logistics with different technologies and medium. It can also easily handle large amount of data that is generated and can create various reports based on the data received. Thus an IoT system can be used to acquire data, to analyze it and to alert the logistics operators the whereabouts of their shipments. The use of IoT system in logistics tackles the old difficult problems in new and exciting ways.

II. BASIC BLOCKS OF IOT SYSTEM

The basic building blocks of an IoT system consists of connected devices, local users, router, a remote user, a cloud solution and internet connectivity.

As shown in the fig.2 the connected devices are the sensors and other devices which are connected to each other either through wired connection or wireless connection. These are the devices that are to be controlled and managed using IoT system. The local

user is the one who wants to interact directly with the device to either control it or to receive information regarding its operation. The router acts as a gateway that connects this network to the outside network i.e. Internet. The connection can be via ADSL, cable, cellular, etc. A cloud solution can be simple storage of data, flowing from connected devices, or can include complex analytic functions that are to be performed on received data. Remote user is the user who is not in the proximity of the device, but wants to control or receive information.

III. LITERATURE SURVEY

As IoT is still a new technology there is no standard way to build an IoT system. The most common way to design an IoT system is by using Vertical approach. These systems which are built using vertical approach are application specific. Thus for every new application development, an engineer has to start building the system from a scratch. To avoid this a horizontal approach has to be used. This is explained in detail in [1]. A survey about how the wireless protocols could be a key enabler for broadening the idea of IoT from Vertical domain to Horizontal domain is done in [1]. The method proposed has some limitations and the most vulnerable were security and privacy challenges. The other important problems with the vertical approach are the interoperability and scalability. The system which is built using vertical approach cannot be used for any other system as this system approach is very application specific. These problem are listed out in [2] and the authors also described the need of horizontal platforms over vertical platforms. One of the way to achieve this horizontal approach suggested by [3] include a common service layer for the system.

The horizontal platform standardization is must for a boost in vertical industry applications as well as it is also useful for reducing the cost and time for development. We can come to a conclusion that the service layer compatibility is must for giving common service which is the main idea behind the horizontal approach.

IV. PROPOSED METHOD

The basic block diagram of an IoT system is shown in Fig.3. The nodes can be any sensing devices or systems which may or may not be remote in nature. These nodes form a network by using different protocols for wired and wireless connections. Microcontroller circuits along with some software framework can together be used as gateways. The interconnection between the nodes and microcontroller is done using binary protocols.

The rules engine evaluates inbound messages published into IoT platform, transforms and delivers them to another thing or cloud, based on pre-defined rules. The rules engine can also route messages to cloud endpoints such as database, asynchronous events, etc. The decision making takes place in Rule engine. The Rules engine cannot continuously monitor the data of the remote sensor. Inorder to do so, a virtual component is created which works similarly like the remote

sensor. The Rules engine continuously monitors this virtual sensor and further evaluates the messages that are to be published. IoT platform includes the Registry and Device Shadows, so we can register anything we wish to represent in the cloud with a name, some attributes, and a persistent virtual 'shadow'. Here device shadow means a virtual device is created.

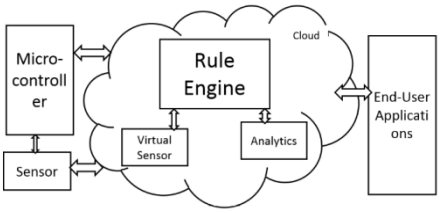

Fig.3 Basic Block diagram of IoT Platform

The Fig.4 shows the architecture of the Generic IoT platform. The architecture can be divided into two main parts depending on the protocols: 1. Sensor Network, 2. Internet

The physical layer in the architecture consists of a wide variety of protocols. The physical layers include wired and wireless protocols. These protocols are used to connect the devices and sensors to each other. The network layer may consists of IPV4 and IPV6 protocol. Every device on internet must be assigned an IP address in order to communicate with each other. Even though IPV6 has more advantages than

IPV4 we have selected IPV4 as it is an older version and would be available at all locations. The transport layer protocols add security and reliability to the data packets during its transit. Modbus and MQTT protocols are used in Application layer. MQTT is a protocol that is specifically designed for IoT and is suitable for constrained networks.

V. IMPLEMENTATION

The generic solution for IoT platform is mainly concerned with the service layer capability to serve the cloud as well as the devices according to their requirements. We are trying to build a generic solution such that the dependency of each layer in the architecture is minimum or negligible. This platform would also tackle some of the IoT challenges like Complexity and Security.

The main component of the proposed architecture is the gateway which connects the things to internet or server. The flow starts with the initialization of the gateway as shown in the Fig.5. After the gateway is successfully configured, it is connected to the server. Then it checks if any device is connected to it or not. If it senses a device it requests for the device registration

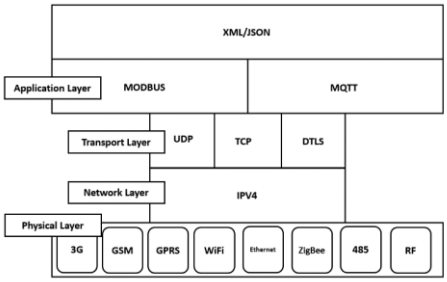

Fig.4 Architecture of Generic IoT platform

The generic IoT platform would be implemented for an application in logistics. For this purpose we would use AWS, Device Hive framework amongst the others. The analytics part include different graphs related to the data sensed. It may also include the geo-tracked path on the maps.

The end user application could be a webpage on which the user could send the request for acquiring the data or it could be an android app developed for this purpose.

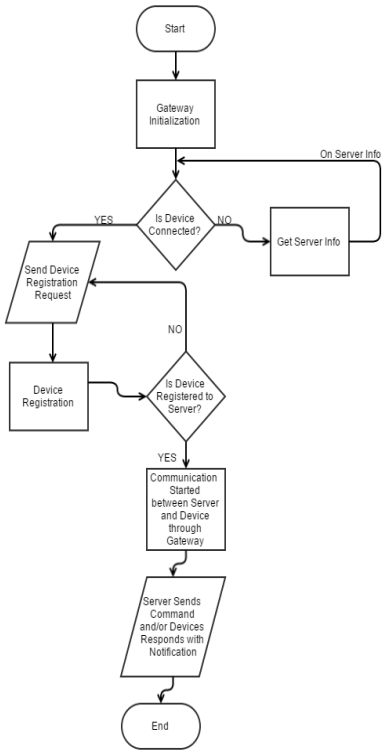

Fig.5 Flowchart for device connection

VI. CONCLUSION

There are many challenges faced while designing an IoT system. Some of these challenges are Security, Power Management, Connectivity, Complexity etc. Security being one of the measure challenge as most of our private data is sent over internet. It also has security issues such as different access and authentication control, network configuration issues, information management etc. Another challenge is the Power management. As most of the devices in IoT are battery powered we as designers need to design them with minimum power consumption. Reducing complexity is yet another challenge in an IoT system. Manufacturers want an easy connectivity for their devices. These all challenges are taken into consideration in our platform and we are trying to get the best and optimum solution.

We can conclude that the Generic IoT platform is must for the standardization of different IoT applications in various industries. This platform would reduce the time consumed for developing an IoT application.

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