LOT – SMART INDIA

Abhishek Shahasane[#1], Dhairya Shah[*2], Sagar Palao[#3], Siddesh Dighe[#4]

[#]Third Year, Computer Engineering, Vivekanand Education Society Institute of Technology

[1]abhishek.shasane@ves.ac.in

[3]sagar.j.palo@gmail.com

[4]siddhesh.dighe@ves.ac.in

[*]Third Year, Information Technology, K.J Somaiya Institute of Engineering & Information Technology

[2]dhairyashah.dhs@gmail.com

Abstract— The concept of Smart India is surging, the more appropriate way to make it smarter is rushing it in the veins of the Engineers of India. We propose a solution which can act as the driving force for making the rate at which smart homes, smart cities, smart villages are being build grow exponentially. LoT is a research project at Microsoft which is currently deployed at the home level but it is highly scalable to be extended to the entire city, entire India and even the globe. LoT is a platform for deploying and maintaining IoT devices on a click. It offers the entire infrastructure so that the complete focus is on app development without having pre-requisite (know-how) of technology stack. Using LoT, we offer solutions to basic problems in home, cities and villages of India and show how this solutions can be deployed and maintained using LoT.

Keywords— **Smart India, LoT, HomeOS, Smart City, Smart Home, Smart Villages**

I. INTRODUCTION

'Smart India', the term is now on hype, as it is an essential step to achieve the bigger goals set by "Digital India". Definitely work is going on in this direction with some great minds working on it. But problems arises regarding the rate of development and maintenance for the same. We bring in a solution which can act as the heart of Smart India and its infrastructure – LoT. LoT is a simple, flexible and scalable platform to build, deploy and maintain IoT on the go. It can scale from home to villages to cities and that's the aim of this paper. We offer some solutions to the basic problems faced in homes, cities and villages and solve it using LoT. LoT is chosen as a solution as it is easier, cheaper and efficient to deploy and maintain an entire city from a simple home hub (server) as Microsoft calls it.

II. LoT- LAB OF THINGS

Inspired by the availability of inexpensive connected devices— such as lights, water sensors, security cameras, power meters, and thermostats— Microsoft built the Lab of Things (LoT) platform to enable easy interaction with devices for a range of applications, including automation, security, energy management, and elder care. Microsoft's goal is to substantially lower the barrier for researchers and students to develop and experiment with new technologies for the home environment. LoT provides a common framework to write applications that use connected devices and includes a set of cloud services that enable remote command/control of devices, monitoring of system health, and data collection. They released the LoT SDK in July 2013 for non-commercial use. Microsoft holds a long term vision to embed this in the concept of building smart cities.

A. LoT in current Tech Stack

The features which define the existence of LoT are:

- LoT brings down the barriers of deploying, managing, updating and collecting data from sensors in a click.
- It enables experimenting with devices in a click.
- Its cost efficient.
- It's a time saver for building an integration with the device, cloud and application on the go.
- It enables support with the Microsoft gadget gear which enables one to create own devices.
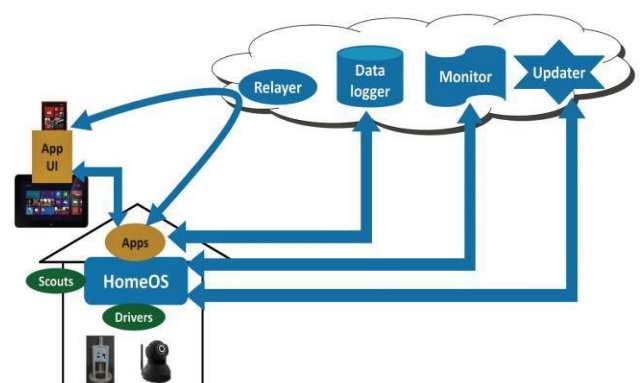- Focus on your application and leave the rest on LoT.

B. LoT Architecture

Fig. 1 LoT Architecture

The design of the LoT infrastructure can be broken down into a client-side platform deployed in each location where sensors and devices are deployed; and a set of cloud services that enable Lab of Things to scale, share data and manage deployments. Figure 1 shows the overall architecture of the

Lab of Things. HomeOS forms the core of the client side component, which is deployed on a Windows 8.x machine, called the HomeHub. An outline of the three functions of HomeHub are as follows:

1) *Protocol Abstraction:* that allows devices communicating over multiple protocols to be addressed and used transparently.

2) *Experiment Execution:* that allows logic of the experiment (also called an app) to be executed on each HomeHub.

3) *Data Aggregation:* that allows data collected as part of experiments to be aggregated and stored locally and in cloud systems of choice such as Windows Azure. The user interface of each app is implemented using HTML5.

The Lab of Things cloud-side infrastructure provides the following services:

1) *A Management Portal:* aggregates deployment-wide data from all deployed HomeHubs and presents it in the form of a webpage. Vital details for each HomeHub, such as memory and CPU usage, are also available.

2) *An Update Service*: allows software update of all client side components across all deployed HomeHubs. It can also be used to update configuration and drivers, allowing researchers to move from one experiment to the next without the need to physically retrieve, re-install and re-deploy HomeHubs. The Update service is controlled using a client-side interface, which makes scaling Lab of Things easy by reducing the effort required for software updates.

3) *An Alert Service*: allows definition of email alerts to report disruptive events such as the HomeHub going offline.

4) *A Data Collection Service*: allows each HomeHub to store data in major cloud storage systems such as Microsoft Azure and Amazon S3. It also allows storage of experimental data on the HomeHub or on any networked server. Data stored in the cloud storage system of choice can then be analyzed using standard tools.

III. SMART HOMES

Smart Home is a subset of the vision 'Smart India'. This is how we go with it:

A. Profile Mapping

LoT maintains a profile for you in your home and every member in your home. It may be as simple as a daily routine to start on and off the geyser or may be as complex as preparing coffee for you, switching off lights when you are on work, maintaining your AC based on your profile comfort. This profile are highly customizable means you are not being controlled by any device to work as per the device but you are the controller of the device. The profiles can be set as a sequence of activity which you perform and customize it on need by a simple application control.

B. Self-Learning

LoT can be implemented to be self-learning software. Self-learning is an ability of LoT to smartly learn your daily activity. Base on your daily activity tracking it learns itself and manages itself to provide you with your necessity without even setting a demand for the same. For instance, if you daily go to office at 9:00 and switches off your fans and lights, automatically after 9:00 it will sense your presence and if you are not present it will switch off the lights and fans. This learning activity goes gradually and build on a concept called 'Machine Brains'.

IV. SMART CITY

Development of Smart Cities need comprehensive development in following domains:

1. Human Resource Management
2. Land Management
3. Resource Management
4. Energy Management & Pollution Control
5. Transport Management
6. Smart Solutions for Better Infrastructure Development
7. Risk Mitigation & Disaster Management
8. Health Care

Problems faced for transforming cities into smart cities involve appropriate timeline for development & cost-efficiency for scaling up solutions. Cities can get transformed into smart cities but it may take a huge leap on the timeline suggested & may be economically untenable!

Using LoT, we can fasten the pace of development as well as have economically feasible solutions.

A. Resource Management

Resouce Management using LoT focuses on :
• Energy Management
• Waste Management

1) *Energy Management:* Energy management involves the use of unused energy for better utilization at the needed energy - intensive projects. It involves integration techniques applied for tracking pollution

caused & gaining stats on the energy left unused & where it can be put to use.

2) Waste Management: Waste Management involves using smart-tech driven implementations to segregate waste & manage it in an efficient way. Smart Dustbins can be connected with a webcam that helps in the segregation of waste as well as notifies the respective authorities when the waste can no longer be accumulated in the bin. The entire segregation & notification/alert system can be connected to LoT & deployed on cloud for better data sharing

B. Transport Management

Transport Management with LoT integrated into it, can help Traffic Control for Road Networks, wherein the entire Traffic Control Signals can be interconnected via LoT for device communication & data sharing, in a way such that the signals attached with webcams can sensor about the amount of traffic occurring at a particular place & forward the data to other signals connected to it. The other traffic control signals would work in synchronization with the data gathered & shared across them. Another example would be Piezoelectricity management using LoT, wherein the electricity generated from the shockers & dampers of railways can be used to light up the compartments, thus saving 75% of the total electricity & cost consumption implied on lighting up of compartments. Also the kinetic & potential energies of passengers can be used to light up the railway platforms.

C. Health Care

HealthCare when deployed using LoT involves data sharing of patients, facilities, medicines etc., between hospitals to manage the needs of patients & doctors as well as timely treatment for patients leading into saving more lives. Epidemic prediction can also be controlled using this, wherein the data patterns of patients among the hospitals would be used to determine the possibility of an epidemic spread & precautionary measures & controls to be taken, also it would help in arranging the medicinal & accumulation facilities for the same.

V. SMART VILLAGE

We cannot forget where our roots comes from, villages. The most driving force towards Smart India is the concept of Smart Villages.

A. Making Agriculture smart

Agriculture is the heart of India. A large population of our country is surviving on it. The current state of this is disastrous as the farmers now go with and suffers this problems. We come up with two solutions using LoT which can cover a mass range of problems in agriculture.

1) Smart crops planning and cultivation: We can build a sensors using gear offered by Microsoft to sense the quality of the soil. It maintains metrics as: current water content in soil, current nutrients available in the soil, this information can be send to the LoT cloud to identify the solutions as the fertilizers needed for it, the water needed based on the crop to be cultivated and this can be used to increase the cultivation on a whole in comparison to just the estimation of the farmers.

2) Smart Irrigation: There exists an irrigation network in India, but it is not well maintained. The primary problem being no proper and dynamic tracking of the need of different agricultural fields. We can use the sensors to identify the need for water in the fields and use the irrigation plants controlled by a single LoT network to provide water on demand to the fields.

B. Solving energy problem in villages

Energy deficiency in villages is a still faced problems in villages. The key reason behind this is most of the energy is sent to cities but however the energy is not fully utilized in the cities. We can maintain an energy meter in cities, specifically plants which consume large energy. This is because most of the energy produced by this plants are not fully utilized. LoT enables us to know about this energy which is wasted and we can use the same to power our villages.

VI. CONCLUSIONS

The primary problem which was faced in development of Smart India, specifically smart city, smart village and smart house is that an architecture was needed to be grounded so that the base goes stronger. LoT is a perfect base for starting with smart infrastructures which will increase the rate of building 'Smart India' exponentially. In addition the things where India mostly fails maintenance problems can be automated and made easier. We targeted on some basic problems and their solutions using LoT.

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