



INTERNET OF THINGS: A SURVEY ON WEB BASED IOT APPLICATION

MONIKA B. KHAKHARIYA¹

MECE- Atmiya Institute of Technology and Science (AITS), Rajkot, Gujarat, India

monika7.397@gmail.com¹

Abstract -The term IoT-Internet of Things can be defined as A system of inter related computing devices, mechanical and digital machines, objects, animals or people which provides unique identifiers and capability to transfer data over the network in the absence of human- to- human or human- to-computer interaction. The Web technologies such as HTTP that provides uni-directional communication mechanism and Web socket that provides bi-directional communication mechanism. This study implements the web based IoT application for the home automation and the social sensing.

KEYWORDS -IoT, Internet of Things, Web Socket, HTML5, JavaScript, WoT, Web of Things.

I. INTRODUCTION

Internet is getting evolved continuously from the last many decades. Previously Internet was mainly the World Wide Web (a network of linked HTML), which was slowly enhanced to Web 2.0. Due to this now social networking, blogging and online enterprise applications (consumer to business and business to business) are enabled. And it is constantly getting dominated by new web architectures like Web 3.0 (as the Semantic Web). On another side- Sensor networks, RFID's Near Field Communication is also getting evolved. Combination of both technologies (Internet and Sensing Devices) enables new opportunities of machine-to-machine communication over the internet, which is known as the Internet of Things (IoT). [6]

The Web of Things (WoT) is a term used to describe approaches, software architectural styles and programming patterns that allow real-world objects to be part of the World Wide Web. Similarly to what the Web (Application Layer) is to the Internet (Network Layer), the Web of Things provides an Application Layer that simplifies the creation of Internet of Things applications. [2]

Rather than re-inventing completely new standards, the Web of Things reuses existing and well-known Web standards used in the programmable Web (e.g., REST, HTTP, JSON), semantic Web (e.g., JSON-LD, Microdata, etc.), the real-time Web (e.g., Web sockets) and the social Web (e.g., OAuth or social networks). [2]

To achieve IoT we need a universal protocol to combine several heterogeneous devices. This protocol should be: simple, lightweight, loosely-coupled, scalable, flexible and standard. And this is where the HTML5 and Web socket comes into the picture. [4]

HTML5 plays a key role in implementing IoT. HTML5 will act as a bridge to link IoT and Web Socket. IoT based application needs not just broadcast, but also bidirectional communication that is Web Socket which provides the perfect environment. A very important tool for real-time communication across the internet is the web socket. [4]

II. Internet of Things

IoT is a collection of technologies and notations that enables developers to connect objects with online services. These would include the following:

- Embedded systems and especially Microcontrollers (MCUs), System-on-Chip devices (SoCs) and the networking modules. [5]
- Wireless communication networks such as WiFi, Bluetooth, ZigBee, ZWave, RF, etc and protocols such as MQTT, CoAP, Web socket, etc. [5]

Includes the notations as follows:

- Sensing the user context, transmitting that information and processing it.
- Acting remotely on devices. [5]
- Adding sensing and acting capabilities to legacy devices. [5]
- Processing the device data, making smart decisions on behalf of the user and/or alerting them based on specific conditions. [5]

Connection devices with online services make sense for:

- Adding intelligence to dumb services. [5]
- Combining device information with information from online services such as social networks, weather channels, user profiles, etc. [5]

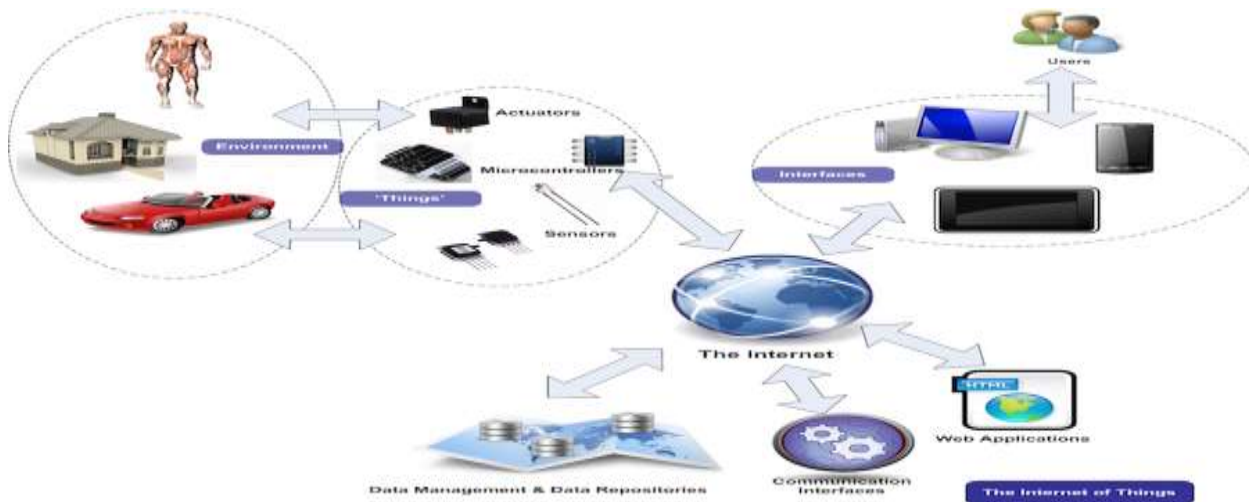


Figure 1- Internet of Things [5]

III. Basic components of IoT

To build the Internet of Things there is need of some basic elements of IoT application are as follows:

- Physical devices that has some sensing or actuating capabilities. This means that the device features a microcontroller and sensors and/or actuators. [5]
- One communication module for that device that allows it to interact with other devices or online services. [5]
- A gateway, there is no ubiquitous Internet in the air; the mobile phone connects to a gateway (base station) for voice or data connection over 3G/4G or a WiFi access point. In the same way an IoT device needs a gateway to connect to the Internet. No matter what the communication technology is. Wired (Ethernet, NX, etc.) or Wireless (WiFi, ZigBee, Bluetooth), there is always a device part of a larger IP network that enables communication with the Internet. [5]
- One online application that interacts with that physical device. We may call it online service, cloud-based application, server application, back-end service, etc. this will be software that runs on a centralized (or not) infrastructure and interacts with connected device by collecting data, processing it and interfacing with the user. [5]
- Users: there is no point in building an IoT project if there is no one to use it. [5]

IV. Design and Implementation of Web-based IoT Applications

Smart Lighting and Control Application

A. Component

Built an HTML5 based application to demonstrate a smart lighting and controlling IoT service. The concept of the sample service consists the following elements: a light, a switch, a sensor and the sun. The light is a component that visualises the light status. The switch is a component that represents an actuator that can control the light. The sensor is a component that senses the environment brightness. The sun represents the environment. [1]

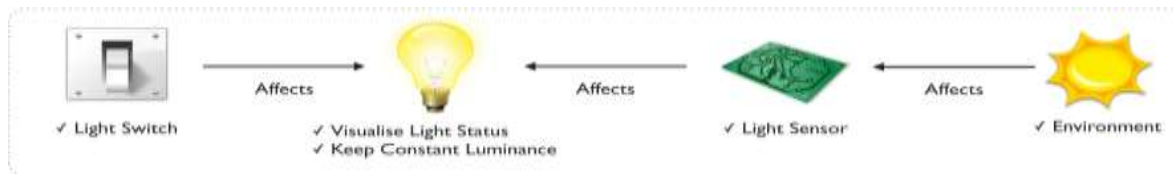


Figure 2 - Components of The Smart Lighting and Control Application and Their Relationship [1]

B. Implementation of The Backend

to implemented an embedded we attached a WebSocket server to the NodeJS, and a WAMP server on top of the WebSocket server. Abstract layer that describes information and generic configuration of a device, e.g., component type (temperature sensor, humidity sensor or light actuator etc), device ID, returnable, timeout, data sent rate and some other hardware parameters. The generic component also implements a function that control the component events. In the survey, the generic component covers sensor and actuator. Thus, we added another component layer onto the generic component. All the layers interconnected will, subsequently, play the role of sensor or actuator. [1]

Light sensor are Get current sensor data, Configuration and Reset. [1]

As for actuator, Switch on, Switch off, Switch a light, Adjust luminance, Configuration and Reset. [1]

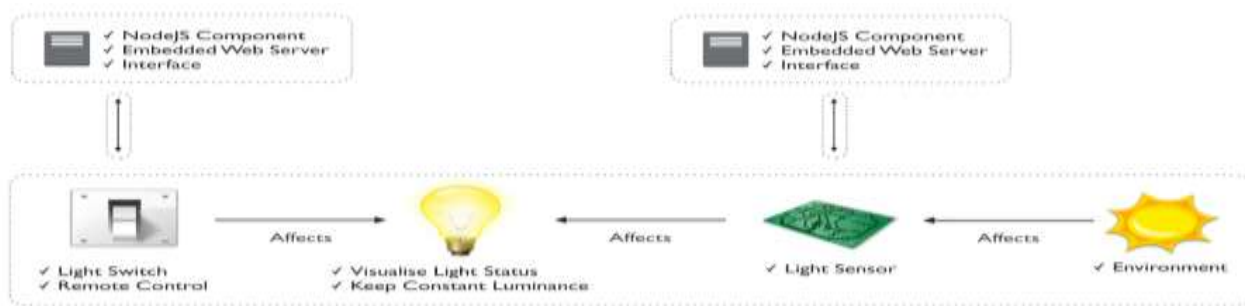


Figure 3 - Components Connected to the Embedded Web Server [1]

C. Implementation of The Front-end

Web-Sockets, a Web Socket layer has arranged at the bottom. The Web Socket layer handles the connection with the embedded web server. The communication coming from the embedded web server is however, using WAMP protocol. Thus, added another layer, WAMP layer, on top of the Web Socket layer. With these two layers, the front-end and the backend can now communicate. [1]

We also would like to control the backend, and thus we added another layer, APIs layer, on top of the WAMP layer. The APIs layer contains light sensor APIs and light switch APIs. [1]

D. Overall Structure

The APIs layer connects users and the interface provided by the backend. WAMP Client talks with WAMP server through Web Socket Client which talks with Web Socket Server. [1]

The Role of Messaging Patterns

Publish/Subscribe (Pub/Sub) is one of the message exchange patterns. Messages are exchanged based on publishing and subscribing. A sender of a message is called a publisher. Usually, each message contains a topic. A receiver filters and receives a message by the message topic. The receiver who subscribes topics is called a subscriber. [1]

Remote Procedure Call (RPC) is one of the Inter-Process Communication methods for data exchange among threads or processes on different hosts. [1]

These two patterns, handled by WAMP layer, cover the two most important interactions in **Internet of Things**: notification and command. [1]

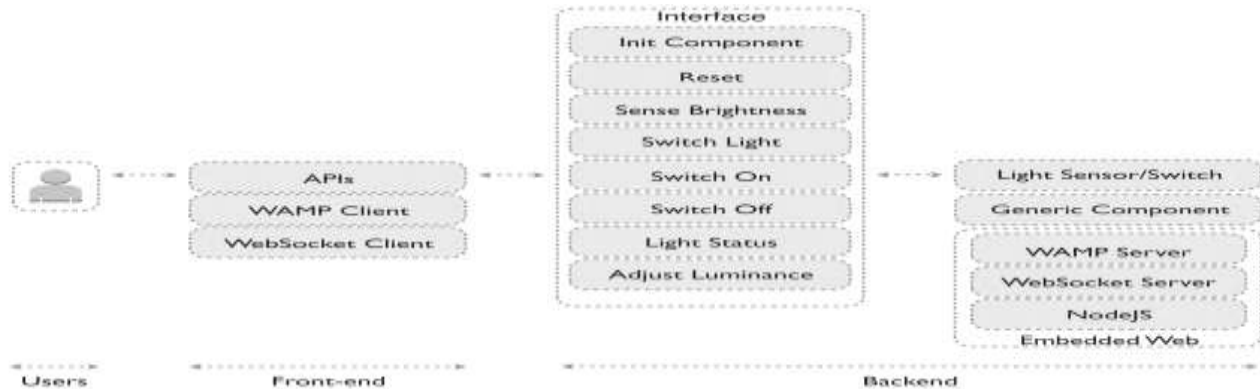


Figure 4 - Overall structure [1]

As the front-end is built with HTML5 technology, the sample is capable with any browser that supports HTML 5 feature (WebSocket). Thus, the architecture is designed in a way that end users can control the light switch and view the light status via a browser. When end user control the light switch, such as turning on the light; turning off the light; or adjusting the luminance of the light, it sends the command using RPC patterns. RPC pattern is also applied in component initialization and reset. When the user view the visualization of the light status, it communicates with the components via Pub/Sub patterns. The interaction between the light switch and the light is using Pub/Sub pattern. [1]

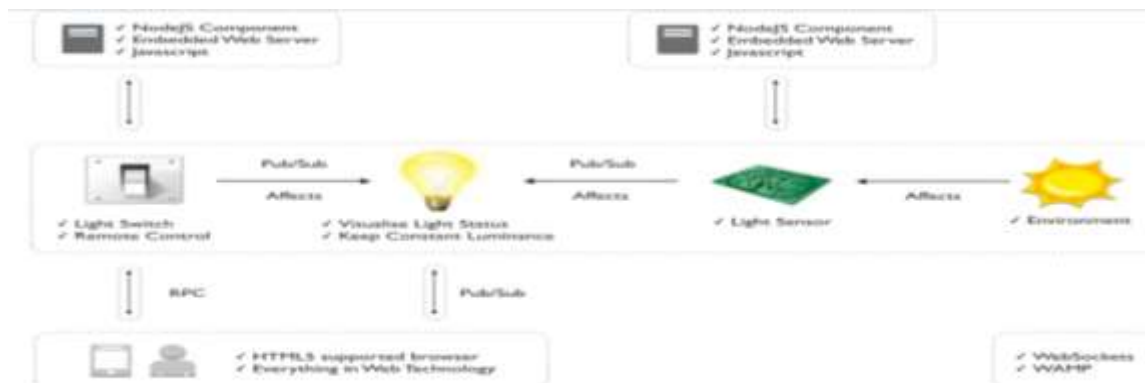


Figure 5- Overall structure with Message Pattern [1]

V. Conclusion

The Internet of Things is the Future of Internet. Every Device i.e. Electronics, Mobile or any other device will be connected through Internet of Things. Mobile device will communicate with each other to provide service. Numerous Libraries and languages are there for communication. Within next 5 years, entire communication will be based on IoT. In this survey paper we focused on the web technology by using the Web socket as a key role. We integrate a sensor and actuator in to a web application that is the Internet of Things.

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