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Light Weight Service Mash up Middleware with REST Style Architecture and Multi Priority DAG Workflow for IOT application

Mrs. Afrin Banu [1] , Angel.J, ME [2]
[1] Assistant Professor M.E ,[2] Student M.E
[1 2] Computer Science and Engineering, Rajas International Institute of technology for women

***Abstract:-* Internet of Things can provide new value-added service by connecting the physical devices to virtual up bringing s connection with their framework, and there is also a vast demand in ad-hoc facilities by the end users for IoT applications. By spreading mash up concept into IoT applications, we can accomplish a novel and more lightweight amenities creation approach. This paper suggests a lightweight IoT service mash up middleware grounded on REST-style architecture for IoT applications, and design an uniform sensor devices entry and dynamically protocol stack management framework, offer a dispensed publish/subscribe created messages sharing service, and conditional IoT services mash up approach, which can be unified easily to create new a malg a mated and conditional applications, and also apply the REST principles to define an extensible edge to build comprehensive and situational mash up applications. Based on proposed service mash up middleware, end user can assimilate applications and services in a more lightweight manner. We also demonstrated the states for REST ful Web service mash ups representing for coal mine safety monitoring and control automation. In the experiments, the end-user evaluation has been conducted to evaluate the middleware, and also the performance has been measured and analyzed.**

***Index Terms*—Internet of Things, Service Mash up Middleware, REST ful Style**

I. INTRODUCTION

1.1 The Internet of Things (IoT)

The Internet of Things may be a hot topic in the industry but it's not a newidea. In the early 2000's, Kevin Ashton was laying the groundwork for what would become the Internet of Things (IoT) at MIT's AutoID lab. Ashton was one of the pioneers, conceived this notion as he searched for ways that Proctor & Gamble could improve its business by linking RFID information to the Internet. The concept was simple but powerful. If all objects in daily life were equipped with identifiers and wireless connectivity, these objects could be communicating with each other and be managed by computers. In a 1999 article for the RFID Journal Ashton wrote:

"If computers that knew everything there was to know about things—using data they gathered without any help from us – It would be able to track and count everything, and greatly reduce waste, loss and cost as well as know when things needed replacing, repairing or recalling, and whether they were fresh or past their best and need to empower computers with their own means of gathering information, so that can see, hear and smell the world for themselves, in all its random glory.

RFID and sensor technology enable computers to observe, identify and understand the world—without the limitations of human-entered data." At the time, this vision required major technology improvements. After all, would connect everything on the planet. The type of wireless communications could be built into devices, and changes would need to be made to the existing Internet infrastructure to support billions of new devices communicating? What would power these devices, then must be developed to make the solutions cost effective. There were more questions than answers to the IoT concepts in 1999. Today, many of these obstacles have been solved. The size and cost of wireless radios has dropped tremendously. IPv6 allows us to assign a communications address to billions of devices. Electronics companies are building Wi-Fi and cellular wireless connectivity into a wide range of devices. ABI Research estimates over five billion wireless chips will ship in 2013.

Mobile data coverage has improved significantly with many networks offering broadband speeds. While not perfect, battery technology has improved and solar recharging has been built into numerous devices. There will be billions of objects connecting to the network with the next several years

IoT Key Features:

The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below:

AI – IoT essentially makes virtually anything “smart”, meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. Mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low, and to then place an order with your preferred grocer.

Connectivity – New enabling technologies for networking, and specifically IoT networking, Mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IoT creates these small networks between its system devices.

Sensors – IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration.

Active Engagement – Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product, or service engagement.

Small Devices – Devices, as predicted, have become smaller, cheaper, and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

IoT Advantages:

The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer:

Improved Customer Engagement – Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.

Technology Optimization – The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.

Reduced Waste – IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.

Enhanced Data Collection – Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

Internet of Things:

The Internet of Things (IoT) can create new value added service by connecting the physical devices to virtual environments in modern life, which will grow gradually through deployment of new intelligence applications combining the physical and information space. Mashup, a way to compose a new service from existing services, is expected to play an important role in these cases because people have different use cases and preferences. The mashup paradigm has been successfully applied to fast prototype valuable applications. Some works have introduced the use of “mashup” concepts, also known as user-generated comprehensive applications. However, they mainly focus on mashing up information services and do not address the requirements that come with IoT objects integration completely. As more real-life elements become connected, we envision that the IoT mashup services that are aware of their surrounding environment. Many recent researches suggest that mashup in IoT is possible with existing Web mashup technology if each thing exposes its

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functionalities as a Web service. However, mashup in IoT environment has more challenges because of large number of devices, and their heterogeneity and availability. We give the more specific challenges for IoT services mashup applications.

Devices Heterogeneity:

The nature of heterogeneity for sensors requires an abstraction from the lower device layer to a common access layer for other applications. Middleware can be used to serve as the abstraction instance as it has the capability to gather and connect the data from different sensor platforms.

Data Distribution:

With the huge amounts of data from the edge of the sensor networks or electronic devices to the applications to be available anywhere and anytime, and new type of middleware is needed in the IoT networks, it is important with advanced and intelligent event filtering capability, enabling management of frequently disconnected and heterogeneous physical sensing devices in the IoT.

Software Services:

The deployment and provision of the IoT application is expected to consider with a new range of user-centric based services. There is a huge demand in ad-hoc services by the end users, and the delivery of those IoT services will be frequently transparent and intuitive for the user.

User Interaction:

Visualization is critical for the IoT applications, which can allow the interaction of the user with the physical sensory devices environment. Hence, the traditional user-interfaces should to become multimodal and fully intuitive. It is necessary to provide a uniform and easy approach to access the physical devices for the sake of interoperability and integrating these sensor devices into the IoT applications. The IoT services mash up is a relatively new area of interest. In particular, a significant effort is needed to enable Internet-connected objects to become seamlessly integrated into services and support dynamic service composition. An ideal IoT service mashup middleware should provide abstractions at various levels such as heterogeneous environment for physical devices and software interfaces, and the software service creation process. In order to meet the above requirement, it is important to propose a middleware software platform to provide the abstraction from the physical sensory environment, and providing corresponding intelligent services. Here, proposes a lightweight service mashup middleware for IoT applications, by extending the mashup concept to IoT physical objects, which allow the physical things seamless integration into the Web, thus providing a new type of IoT applications, and make aim to IoT applications development and deployment easily, and which allow both visualization and processing of a sensory data ecosystem at different levels. Also, the middleware can provide the support to create and adapt individual information centric applications easily for end users. Specifically, the contributions of this paper can be summarized in the following.

1. Propose a uniform devices access and protocol stack management framework, which can dynamically manage the physical sensory devices and the corresponding protocols, which can be assembled the different protocol stack to parse the sensory data from the physical devices space. To improve the automation, a three-step deployment process and an automatic protocol adaptation method are presented for the management framework.
2. Design a distributed publish/subscribe(Pub/Sub)-based messages distribution service, which contains one or more distributed message brokers, which matches messages sent from sensors with subscriptions and delivers them to control visualization widgets. The broker supports service interaction actively, and can distribute data between services in real-time.
3. Design a situational IoT services mashup approach that supports the on-the-fly integration of different data services mashup level, as well as the decision-making process mashup level, which can be integrated easily to create new composite and situational applications.
4. Design a REST principles-based extensible interface to build comprehensive and situational mashup applications, which can obtain comprehensive IoT application scenarios for physical devices data streams, sends devices control commands simultaneously. Five abstract patterns of IoT functions are also defined that can be used to package the IoT resources into RESTful API.

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II SYSTEM DESIGN

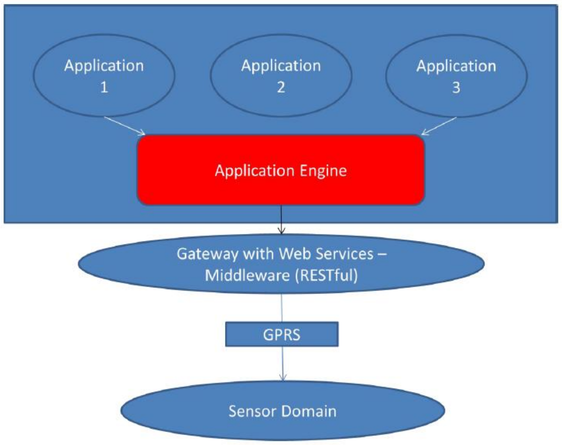


Fig 1: Data Flow Diagram

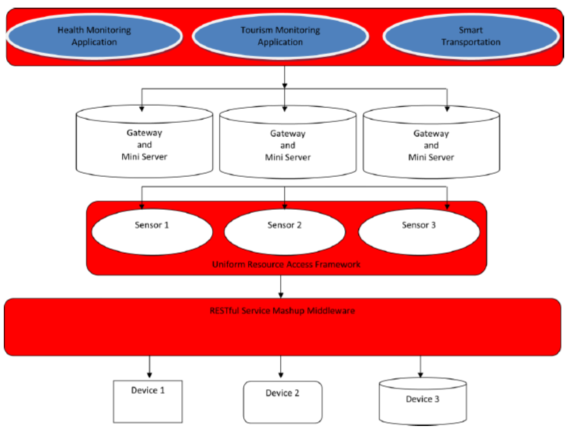


Fig 2: Architecture

The architecture of lightweight service mashup middleware with REST Style for IoT applications is depicted in Fig.2 and consists of the following components layers: Physical sensor layer, uniform resource access framework layer, uniform message space layer, service mashup layer, open service interface layer and applications layer. These six components are connected in a pipeline resulting in the provision of intelligence IoT services. The overall goal of this architecture is to accelerate the integration of sensory devices with existing services and other information resources.

Physical sensor layer, each sensory nodes and physical devices are plugged into the sensor network, and the nodes are deployed in appropriate areas to acquire the environmental data and detect possible anomalies.

Uniform resource access layer, provides a uniform framework to obtain sensory data and operate various physical devices, which adopts the OSGi technology to create a uniform protocols management framework. In the framework, a three-step deployment process is designed for the set of protocols, and an automatic adaptation method is also presented to access a proper protocol intelligently without user intervention.

Uniform message space layer, provides a publish/subscribe based messages distribution service, which contains one or more distributed message brokers, which matches messages sent from sensors with subscriptions and delivers them to control visualization parties. For the broker, a topic-based publish/subscribe mechanism and message routing mechanism are provided to support service interactions actively. Also, a topic-based data distribution communication model is presented to real-timely distribute data between services in dynamic IoT environment.

Service mashup layer, use the sensory data from underground with other resources to form a novel safety monitoring and control application. The mashup approaches can be categorized into physical data mashup, process mashup and widget mashup. For data mashup, a hybrid mashup approach is presented based on data operators and data services, which supports end-users to customize the physical data according to their requirements. For process mashup, a situational choreography approach is proposed to customize the IoT processes. For widget mashup, a WYSIWYG (what you see is what you get) mashup approach is introduced to quickly create the user interface of IoT applications.

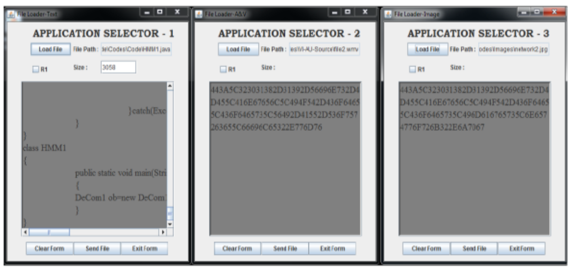
Open service interface layer, provide the REST API interface to access the mashup services, and to get the sensory data and send the control commands on the Internet. For this layer, five abstract patterns of IoT functions are defined to package the IoT resources into RESTful API.

Application layer, a JavaScript based dashboard is provided for displaying various sensor data visualizations quickly and easily, and thus achieves the control automation of underground physical devices.

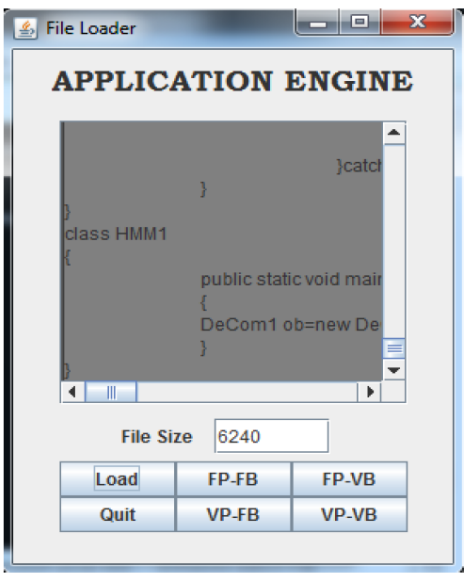
III RESULT AND SCREESHOTS

We prepared four different experiments to test the lightweight mashup middleware with actual scenarios, and each experiment reflected the performance of the whole system from a different aspect. The event driven SOA-based services coordination approach has several advantages over a framework-oriented approach at developing dynamically adapting business processes, which provides general models that need to be instantiated and customized before they are implemented. Since those models operate at a higher-level of abstraction than frameworks, they impose fewer initial constraints upon the system being developed. Therefore, event driven SOA-based services coordination approach is more suitable for IoT application scenarios that are highly delay sensitive and demand a strict real-time response.

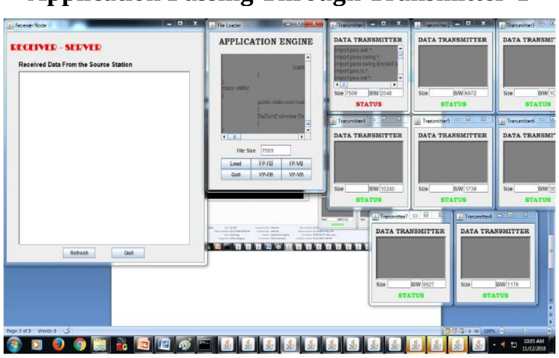
Application Selector



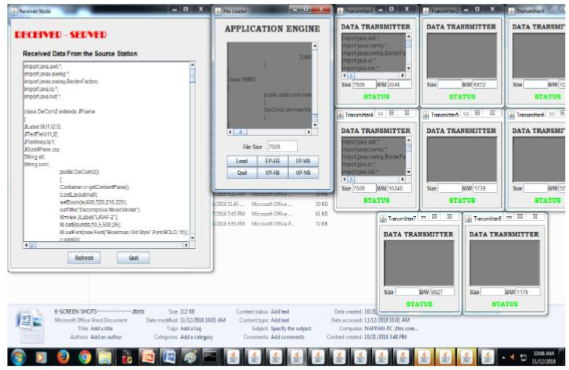
Application Engine



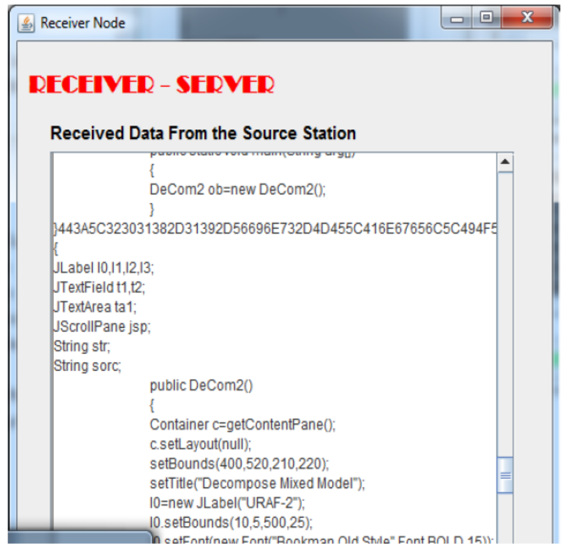
Application Passing Through Transmitter-1



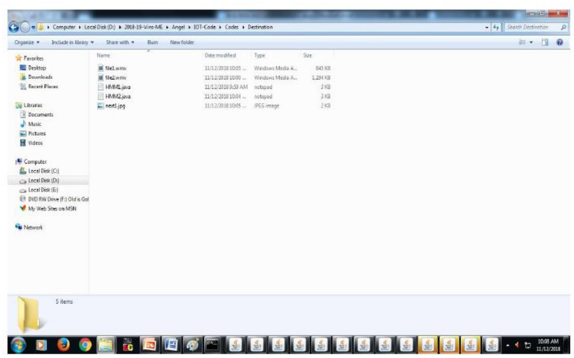
Application Passing Through Transmitter-2



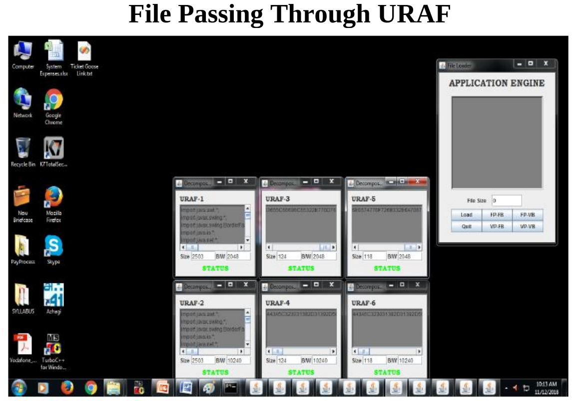
Application Received at Destination Level



File stored in Destination



File Passing Through URAF



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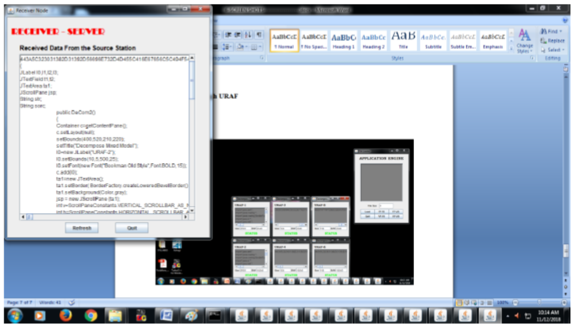
Application at the Destination



CONCLUSION

A lightweight IoT service mashup middleware based on REST-style architecture for the IoT applications. Focus on the design and implementation for an OSGi based uniform devices access and protocol stack management framework, distributed publish/subscribe based messages distribution service, and a situational IoT services mashup approach that supports the on-the-fly integration of different data services mashup level, as well as the decision-making process mashup level, which can be integrated easily to create new composite and situational applications, also apply the REST principles to define an extensible interface to build comprehensive and situational mashup applications and deployed a prototype in the coal mine to test system validity. The results showed that the lightweight mashup middleware worked well as expected.

FUTURE ENHANCEMENT

It is essential to optimize the real-time data distribution service and data congest scheduling strategy with different QoS constraints for a large IoT application deployment. Also, the energy consumption will be a challenge if some IoT services are directly deployed on the IoT devices, the optimization method of energy consumption should be introduced into such IoT scenario. Further it makes more efficient and useful approach for future.

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