

A Survey on Automation System by Enabling Wireless Devices and Sensors

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Abstract- Modern technologies for building and home automation require an explicit interaction with the end user and allow a static set of working scenarios defined during system implementation. Novel home and building automation solutions should enable so-called *ambient intelligence*, deriving automatic control of appliances and subsystems dipped into an environment. The conventional SOA based automation system combines web services and automation system together, but it has some issues related to concurrent multiple request to the device when connected in complex networks. So to overcome this vulnerability, ZigBee can be used. ZigBee is compatible to control the home appliances (e.g. Turning on or off lights, sliding the window curtain, switching off smart phones when entering into a specific field, etc.) and for implementing this technique an interface is required. Therefore, android can be used to provide an interface for the end user. Android is an open source technology, which has an expressive GUI and also supports multimedia. ZigBee is cheap, scalable and the indoor range of ZigBee is up to 30 m and outdoor range is up to 100 m, can be extended by connecting it in a mesh network. In this paper, we are going to survey the connection of ZigBee with Android smart phones.

Keywords–Wireless sensor networks, ZigBee, Home Automation, SOA, Android, DPWSim, Internet of Things.

I. INTRODUCTION

Upcoming technologies and portable devices have made humanitarian work smartly. An automation system consisting of a connection between hardware and software has freed the individuals from their day to day chores. Automation is concerned with communication and controlling the networks in smart houses and building. The system consists of actuators, processing units, sensors & communication between them. Automation examples include turning on or off the lights, security surveillance and many more. The so-called ambient intelligence aims at a research where people are surrounded by intelligent devices dipped in an environment, capable of being responsive and sensitive and self-adapting behavior. Devices should interact and communicate autonomously, without the need for direct user involvement, also making decisions based on multiple factors, including user preferences and presence. They should be coordinated with intelligent systems acting as administrators. Existing systems and standard technologies developed for Home and Building Automation are far from that vision, being unsuitable for granting such an automaticity and flexibility. Automation still require explicit interaction with the user and are tied to static operational scenarios set during operation. In order to support novel and intelligent home and building infrastructures, able to adapt and autonomously control building and home appliances, smart

environments have to be considered according to the results coming from pervasive and mobile computing, agent-based software design and artificial intelligence theory. Wireless sensor network technology has been most promising technology in the field of home automation. There are many applications related in power and energy management, security, health monitoring, entertainment, etc. Building Automation refers to the communication networks in the building, this system consist of sensors, processors, actuators. Smart home combines the components of building automation with other communication system. The smart home environment is surrounded by heterogeneous subsystems that adjust its function according to the information gained from computational system. In the field of home automation interoperability is an important factor. Interoperability is able to share information with the other entities and make use of information exchanged. All this technique leads us to only one direction that is “Internet of Things”. Internet of Things is a network of objects embedded with sensors, software and connectivity to enable objects to collect data and exchange. IOT allows the object to be monitored remotely. The term “Internet of Things” was derived by British entrepreneur Kevin Ashton in the year 1999. The best example of Internet of Things is smart home energy management system using ZigBee and Power Line Communication. In this technique energy of the entire home appliance is collected and it is stored in the database. Several applications of IOT include: I) Environmental monitoring: IOT utilize the sensors to help in environmental protection by monitoring air or water quality, atmospheric condition II) Infrastructure management: IOT can be used to monitor infrastructures such as bridges, railway tracks. III) Manufacturing: The use of IOT in Manufacturing can be Management of Manufacturing equipment or manufacturing process control IV) Energy Management: Internet of things assist to manage the energy and power consumption of all the devices such as switches, televisions, power outlets, bulbs, V) Medical and Health Care System: IOT is used in the field of medical and health care system to enable health monitoring and emergency notification system. VI) Building and home automation: To control home appliances such as lighting, ventilation, air conditioning IOT is used. VII) Transportation: Traffic control, smart parking, electronic tool connection system. This paper surveys the common home automation appliances through automated reasoning techniques. This paper is organised as follows: Section II discusses the related work done in the field of home and building automation. Section III provides acknowledgement. Section IV provides a conclusion.

II. RELATED WORK

A. Existing Home Automation Technologies

There has been a significant research into the field of home and building automation. Lately, research into the field of home and building automation has continued to receive much attention in academic world. [1] developed a Java based home automation system. All the home automation devices were physically connected to an embedded board and, through integration with a personal computer based web server, provided remote access to the system. [2] Developed Bluetooth based home automation system consisting of a prime controller and a number of Bluetooth sub-controllers. Each device is physically connected to a local Bluetooth sub-controller. Moreover, the existing research has focused on the establishment of remote connectivity and has largely ignored investigating the integration of existing local networks.

B. Analysis of Existing Systems

The implementation of home automation technology by consumers has been limited. We propose that, from the home and building automation domain analysis, the problems limiting widespread consumer adoption are as follows:

I. Lack of network interoperability: Both home and building networks and the home and building automation systems which utilize them have been developed and adopted in an unintentional and ad-hoc manner. *II. Interface inflexibility:*

The existing systems offer varying methods for users to monitor and control the connected devices. However, this is normally limited to a single method of control, which offers users limited flexibility.

C. WSDL

WSDL is a web service description language which is used to provide a communication with the web service. Semantic description language expresses the language rules of the service interface element. In this approach the software agent is implemented as a web service that composes with semantic web service to fulfill the targets [3]. Service monitor maintains a database of web services which is for service composition and finally executes process recommendation to achieve goals. Service monitor depends upon the ontology service for describing the current world state. This technique allows achievement of complex goals while maintaining an accurate domain model [3]. WSDL is categorized into 3 parts I) Definition II) Operation III) Service Binding *Definition:* Definition includes both data type and message definition. They are generally expressed in XML. *Operation:* Operation, describes what action should be performed by the web service for the messages. *Service Binding:* Service binding is used for connecting types of port to the port and to achieve this binding SOAP is used.

D. DPWS

DPWS (Device Profile Web Service) enables secure web service messaging, description on resource inhibited devices. DPWS was initially published in May 2004 and submitted to OASIS for standardization in July

2008. DPWS is an architecture in which devices run on two types of services I) Hosting service II) Hosted service. Hosting Service plays an important role in discovering of the device, whereas hosted device depends on hosting device for discovery. DPWS can be also be used as an application layer protocol in WSN [4]. This is achieved by implementing W3C SOAP web service in the context of WSN. The technique of IP for the WSN it is possible to create a common class for the devices. The significant advantage of this technique is DPWS can also be used for Wireless Sensor Network [4]. The drawback of this technique is that the DPWS is restricted to the embedded devices. Indifference to embedded devices, though, WSN platforms are much more resource constrained.

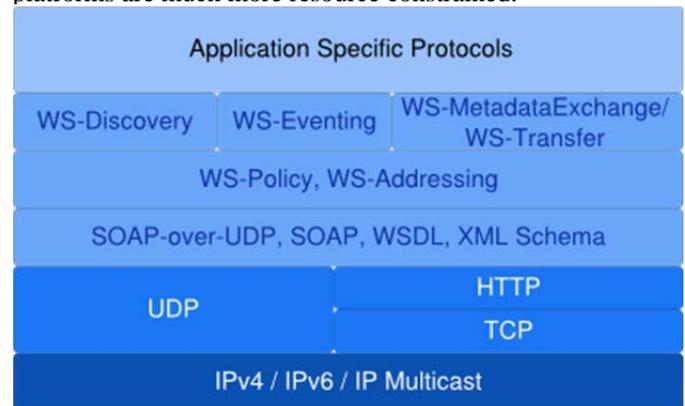


Fig: 1 DPWS Protocol Stack

E. SOA

Sensor network has become an important part in our day-to-day life, especially for health monitoring, energy management and for home automation. SOA architecture is an architecture in which it manages the devices in the home network over internet. Several researches were implemented over Service Oriented Architecture which includes IP networking without using any SOA models [5]. Other solutions include directly accessing to the sensor using an HTTP server with or without using the gateway. Distributed Operating System based on Service Oriented Architecture that manages the data by using SOA-message based on XML or JSON. This architecture included 4 layered I) Hardware layer II) OS layer III) Bridging layer IV) Application Layer. The advantage of this technology was that it reduced the power consumption minimized the issues of multi-access security, authorization.

I) SOA based DOS:

Distributed Operating System is built with the help of Service Oriented Architecture that manages the data by using SOA-message based on XML or JSON exchanged between devices in the network. This architecture is 4 layered I) hardware layer II) Bridging layer III) OS layer IV) Application Layer This technique uses queue for service multiple user requests and with the help of DNS (Domain Name System), rather it is also possible to route the client's request to the required destination. The database maintains records of all the devices in the home network. Further the Distributed Operating System manages the relation between senders and receivers. In case of the device is in switched off state, this service will

answer the client's request about when the device will be available again. The above system results in that use of JSON provide efficient results.

F. SOAP protocol

The SOAP is an acronym for Simple Object Access Protocol. This protocol is used to exchange structured information in the implementations of web services over the network. The SOAP was designed by Bob Atkinson, Dave Winer, Don Box for Microsoft in 1998. It basically relies on the protocols of the application layer such as Hyper Text Transfer Protocol (HTTP) or Simple Mail Transfer Protocol (SMTP) for its working. A SOAP message is a normally an XML document file consists of following sections: I. An envelope that recognizes the XML document file is a SOAP message. II. A header element containing the header information. III. A body element consisting of Call and Response Information of the document. IV. A fault element comprising of the errors and faults being detected. SOAP has its own processing model describing a distributed processing model containing a sender, a receiver, a message path, an originator, an intermediary.

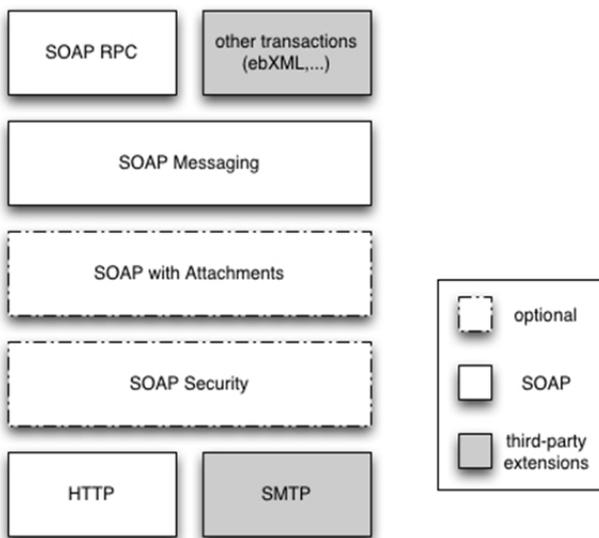


Fig: SOAP Protocol Stack

SOAP uses both application layer protocols, i.e., HTTP and SMTP as its transportation mode. HTTP is the most widely used protocols because of its performance in today's network infrastructure, especially in case of network firewalls. The considerable limitation of SOAP is serializing the XML info set as XML. It is also slower than the middleware technologies used, i.e., CORBA or ICE.

G. Ambient Intelligence

Ambient Intelligence (AmI) refers to sensitive electronic environments which are responsive to the presence of people, personalized to their requirements and anticipatory of their behavior. It is considered to be the future of consumer electronics, telecommunications and computing which was developed in late 90's and revised in the time

frame of 2001-2010. In these systems, devices are so connected to the network that the people can carry out their day-to-day activities with much ease and natural way using information and intelligence which is hidden in the network connecting these devices. This intelligence is achieved using paradigm build upon pervasive computing, ubiquitous computing, context-awareness and human-centric computer technologies that are Zelkha & Epstein, Harwig & Schuurmans in 1998 and 2001 respectively. Applications: I. Embedded Systems which include multiple network devices integrated into the environment. II. Context-aware devices that recognize situational context. III. Personalized Systems that help tailor your needs. IV. Adaptive Systems which can change according to the response of people present in the environment. V. Anticipatory Systems who can anticipate people's desires without conscious meditation.

G. SOA based BAS

Building Automation System (BAS) enables the devices in the network to interact with each other. In the recent years a new type of technology called Service Oriented Architecture has been developed that enables to share data among multiple applications. Numerous technologies have been developed to support this trend. These trends focus on how to deal with heterogeneity, scalability of the devices. To overcome this limitation a full scale SOA based BAS with the assist of web technology and DPWS has been developed. DPWS is used because it covers a large range of tools from resource constrained sensors to the new technology of android. Building ontology consist explanation of concepts that is used as a position schema for storing graph in the database. Context information is processed and passed to the service composition engine which coordinates with appropriate devices based on pre-defined policy rules. Limitations include multiple requests to the device, whereas resource constrained device cannot deal with simultaneous multiple request.

III. CONCLUSION

Service Oriented Architecture (SOA) is used for exchanging data between the devices. Current automation systems are smart enough to work within any complex environment. The rise of new techniques for SOA has led the researchers to expand their ideas to the next levels. The new techniques include IP networking without using any SOA module. Distributed operating system based on SOA, and the role of ZigBee as a communication model between devices. The above mentioned techniques have certain limitations, hence SOA based home automations consider all the factors such as power consumption, cost, security and so on. This paper surveys some of the new techniques for Service Oriented Architecture.

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