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Design of Gateway for Integration of Wireless Sensor Network to Internet

Jaywant Kamble, Prof. Mahesh Navale

PG Student [VLSI], Dept. of E&TC, SKNCOE, Pune, Maharashtra, India

Assistant Professor, Dept. of E&TC, SKNCOE, Pune, Maharashtra, India

ABSTRACT:According to analyst and media, in 2008, the number of connected devices surpassed connected people and it has been estimated that by 2020 there will be 50 billion connected devices which is seven times the world population. In fact, one of the most important elements in the IoT paradigm is wireless sensor network (WSN). WSN behave as a digital skin, providing a virtual layer where the information about the physical world can be accessed by any computational system. In the Internet of Things (IoT), the everyday objects that surround us will become proactive actors of the Internet, generating and consuming information. By embedding computational capabilities in all kinds of objects and living beings, it will be possible to provide a qualitative and quantitative leap in several sectors: healthcare, logistics, domestics, entertainment and so on. There are so many approaches for putting sensor data to Internet, in this project the Gateway approach is used. Gateway will act as a translator between WSN network and the Internet network. Gateway will capture or accept sensor data and with by doing necessary operations on the data will put that data on the Internet. With Gateway approach, the load on the sensor node is reduced significantly and hence the cost and battery power to establish the sensor network and to get sensor data and make it available on the Internet for further use in web application.

KEYWORDS:WSN, Internet of Things, Gateway, Zigbee.

I.INTRODUCTION

In the upcoming Internet of Things (IoT), the everyday objects that surround us will become proactive actors of the Internet, generating and consuming information. The elements of the IoT comprise not only those devices that are already deeply rooted in the technological world (such as cars or fridges), but also objects foreign to this environment (garments or perishable food), or even living beings (plantations, woods or livestock). By embedding computational capabilities in all kinds of objects and living beings, it will be possible to provide a qualitative and quantitative leap in several sectors: healthcare, logistics, domestics, entertainment, and so on[1].

At larger level if we look towards it, it's basically three layer architecture Context aware layer, Network layer and application layer that make the IoT architecture [2]. This paper is implementation paper and the paper is arranged as, Section II gives the brief about the technologies used to implement the IoT, Section III gives the details about the proposed methodology for the project, Section IV gives the results of implementation and Section V concludes the paper and gives the guideline regarding the future work that can be done in this project.

II.LITERATURE SURVEY

IoT is a hot topic in which many important players in connectivity predict a large growth within the next ten years. But till date there no any promising standard protocols and architecture is designed for IoT, that's why key players who are already towards implementation taking the suitable protocols and started the implementation of the IoT system for particular interest application.

As given in [2], the generalised architecture consists of three layer architecture which contains: Context aware layer, Network Layer, Application Layer.

There are many different wireless technologies in the IoT atmosphere [3] as follows:

1. Zigbee
2. Bluetooth
3. WiFi, etc.

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This three are mostly used and from the comparison given in Table 1, we can observe that application is the key point for the selection of the protocol.

Parameter	Zigbee	Bluetooth low Energy	WLAN
Cost	Low	Low	High
Security	Moderate	Moderate	High
Power Consumption	Very Low	Moderate	High
Range	Less than 100m	Less than 100m	More than 100m
Nodes	1024 to 65532	7 or more	Depends on router
Data Rate	Low	Moderate	High

Table 1: Comparison of Wireless Protocols

Protocols Available to be used in IoT Architecture are as given below:

1. Web Technologies: CoAP(Constrained Application Protocol),DTLS (Datagram Transport Layer), DDS (Data-Distribution Service for Real-Time Systems), DPWS(Device profile based Web Services): WS-Discovery, SOAP, WS Addressing, WDSL, and XML Schema, HTTP/REST, MQTT(Message Queuing Telemetry Transport), UPnP, XMPP(Extensible Messaging and Presence Protocol), AMQP (Advanced Message Queuing Protocol), etc.
2. MAC/PHY Technologies: Zigbee, WiFi, WiMAX, Bluetooth, Digi Mesh,NFC.

Organizations in IoT are as belows:

1. ETSI (European Telecommunications Standards Institute)
2. IETF (Internet Engineering Task Force)
3. IEEE (Institute of Electrical and Electronics Engineers)
4. OMG (Object Management Group)
5. OASIS (Organization for the Advancement of Structured Information Standards)
6. OGC (Open Geospatial Consortium)

III.PROPOSED METHODOLOGY

As given till now the IoT is the very large paradigm, consisting of every technology till now evolved. It has so many different standards used for real time deployment which makes it difficult to be established as explained in literature survey section.

In this project we will use the gateway approach because of so many advantages of using it as listed below:

i. Reduced work load on the nodes in the IoT.
ii. Reduced power consumption of nodes which makes them stay on the field for more time.
iii. Reduced maintenance cost due to increased life time of network.
iv. Strong functionalities can be provided to the network as the gateway is more intelligent and resides at the field area.

An architecture with a gateway that serves as an interface between the wide-area network (Internet) and the short-range network is required as shown in Fig. 1.

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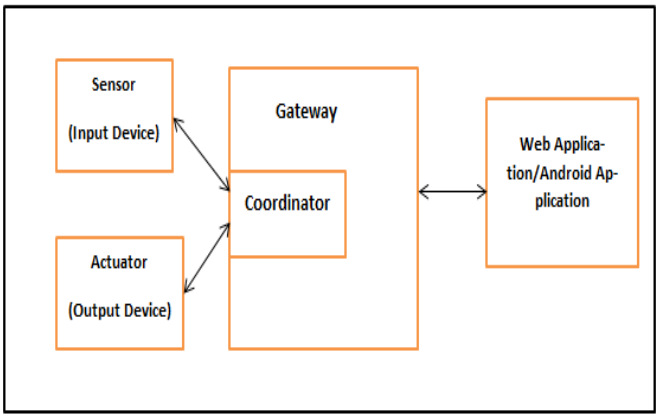

Fig.1: Proposed Methodology

The actual implementation of the proposed methodology can be given as Fig. 2., In this raspberry pi is used as a Gateway and Xbee is used to establish the WSN network and Web Application forms the user Interface.

Fig. 2 : Implementation of the proposed Methodology

IV. RESULTS AND DISCUSSION

The results of the projects can be divided into two parts

1. Database logged data
2. Web Application for User Interaction with the system

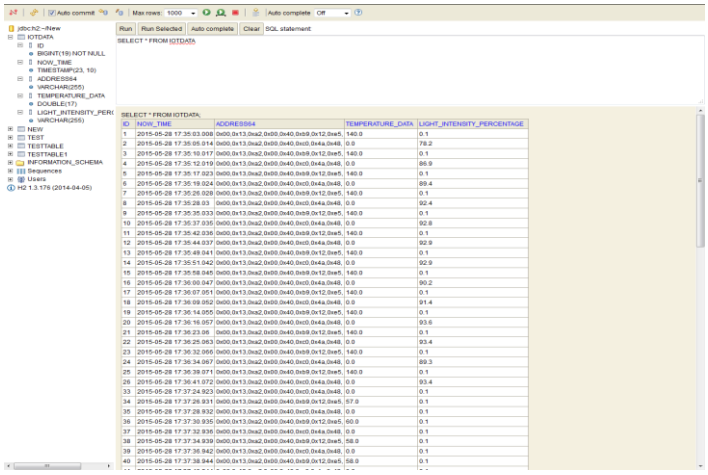

Fig. 3: Screenshot of the H2 database console showing the data logged from the WSN network

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Fig. 3 shows that the data gets successfully logged into the database and can then be used for applications which will use this data and perform the functions of interest.
H2 database is the very light weight and used in many applications where the database data storing and getting requires a lot of speed or more specifically we can say that the Real Time applications uses H2 database.

Fig. 4: User Log In Page of Web Application

"Login Page" of the Web Application performs the functions of the User validation and verification and then depending on the user type displays User Page or Admin Page.
In this project two types of the users are considered

1. General Users/ General Public
2. Administrative access user

As per the user the controls or functions given are different as shown in Fig. 5 and Fig. 6.

Fig. 5: User Page of Web Application

User Page of Web application has provided the functionality to the user to see the result of the data from the WSN network and depending on the drop down menu selection the Report of the Data is generated and displayed in the form of table as Fig. 5.

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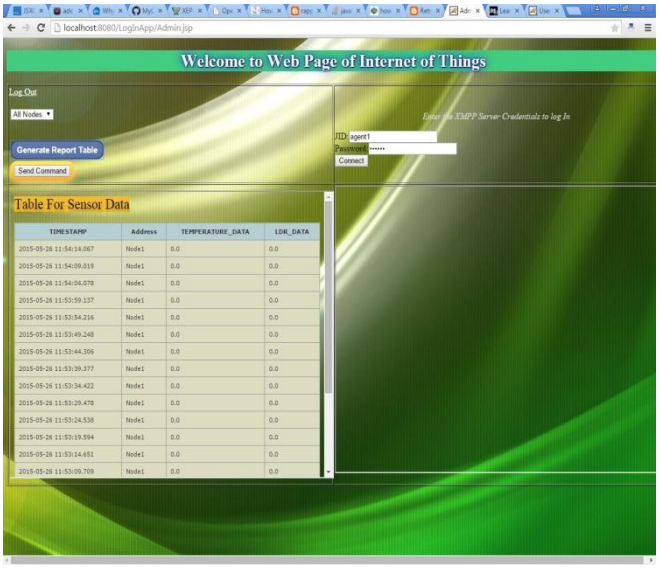

Fig. 6: Admin Page of Web Application with more functions

Admin Page is for the Administrative user and hence the more functionality are given such as command button which is used to send the command to the WSN network output device, for prototyping it the LED is used which gets ON for 3 seconds and then gets OFF. This command button functionality is to show the ability to control the WSN node output from the Web Application.

V. CONCLUSION

In this project, literature survey about the different IoT system components is carried out. From this the most suitable Zigbee protocol is selected and implemented successfully for the WSN network and Raspberry Pi is used as the hardware for the Gateway as per its more promising feature as per IoT is considered and JAVA is used to develop the application which will run on the Raspberry Pi and make it function as a Gateway. Web Application makes the user interface more attractive. As it is the first step towards the learning and implementing the recent and hot technology or more specific paradigm called as Internet of Things (IoT) there are so many work can be done in it such as protocol standardisation for IoT and implementing more functionalities so that it can cover broader applications.

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