

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

Implementing Internet of Things by Front End Solution and MQTT

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ABSTRACT: Industrial wireless sensor network (WSN) when assimilated with IoT requires a sensor interface device. The sensors are incorporated to measure the input, output and other event driven mechanisms. The internet and other open standards aroused due to the drawbacks of assorted communication techniques like serial lines which are dedicated. In applications like industrial automation, regulating water flow, reservoir levels, estimating the pipe pressure, observing the current flow and line voltage, monitoring function of circuit breakers, ascertaining the electricity, controlling the rail road and monitoring the process and quality control demands the integration of WSN and IoT. IoT can be enforced by various protocols in application layer. In this work, HTTP and MQTT protocols are implemented with applications demanding for both the protocols. IoT is integrated with WSN and the workstations are being monitored with the help of motes which helps in sensing, processing and communication. The database values are visualized through internet with a web page using front end solution (http) which will interpret the device in a better manner. When IoT is implemented with http it has its own drawbacks of point to point communication, in addition to its complexity for simple data transfer in turn demands the requirement of a simple lightweight protocol called Message Queuing Telemetry Transport (MQTT) with its QoS values.

KEYWORDS: IoT, WSN, IRIS motes, web page and MQTT.

I. INTRODUCTION

WSN traditionally consists of few or very thousands of sensor nodes communicating to the base station which acts as a gateway to the nodes and end user. The availability of small, smarter sensors measuring a wide range of surrounding parameter has put forth continuous time monitoring of the environment with its real time applications. A multi hop routing protocol is essential in increasing the network life time and range of network. Each of the sensor nodes consists of a sensor unit, microcontroller, power unit, transceiver unit and a memory unit. Self-configuration of nodes with multi hop capability and dynamic routing allows the nodes for automated monitoring and controlling functions. Among the various integration techniques, front end solution helps in estimating the device functionality completely.

IoT is exploited as a keyword in addressing the assorted aspects associating the internet with the physical object by means of widespread deployment of diverse embedded devices with identification (RFID or IP address), sensing and storing competences (cloud or database), wherein it provides a virtual layer for encapsulating data about the physical world that can be retrieved by any computational scheme [1]. To be brief, IoT can be stated as the process of sensing, assimilating, analyzing, predicting and serving the user. It envisions a future in which the digital and physical data are interrelated enabling device to device communication [2]. Recognizing a device, cooperating it with

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other devices, collaboration of various heterogeneous devices with security are the major investigation issues in IoT. WSN when integrated with IoT allows the remote monitoring of network, thereby overcoming the hazardous, dangerous and unmanned areas. The applications of WSN are numerous starting from precision agriculture, traffic monitoring, object tracking, condition based maintenance, fire detection, nuclear reactor control till the water/wastewater management. MQTT on the other hand is a light weight and bandwidth efficient protocol, which holds the TCP as its main transport protocol. It is a publish/subscribe method wherein it publishes its data to a broker, then transmits the value to all the subscribers. The subscriber can either be durable or non-durable. The values can be topic based, type based or content based. Node red of IBM can be used to implement MQTT.

II. MOTE PLATFORM

The IRIS mote is having the capability to sense process and transfer the data. IRIS mote which is invention of MEMSIC is intended specifically for low power wireless sensor networks it is a platform of high bandwidth and enhanced program reminiscence when related to MICA notes. It can conceal the distance of about 500 meters without necessitating any amplification. It is constructed to meet the IEEE 802.15.4 compliant with an RF transceiver through 2.4 to 2.48 GHz subsidiary data rate of 250kbps. Exploiting fully ascendable mesh networking, IRIS mote methods an adhoc network ascendable for the user [3]. IRIS mote takes support of 2X AA batteries with the external power of 2.7-3.3 V.

Flat based or data centric routing along with query based protocol is implemented in this work. The IRIS mote is having the capability to sense process and transfer the data. IRIS mote which is invention of MEMSIC is intended specifically for low power wireless sensor networks, it is a platform of high bandwidth and enhanced program reminiscence when related to MICA notes. The figure 1 shows the experimental set up of the IRIS mote along with the MIB520 gateway.

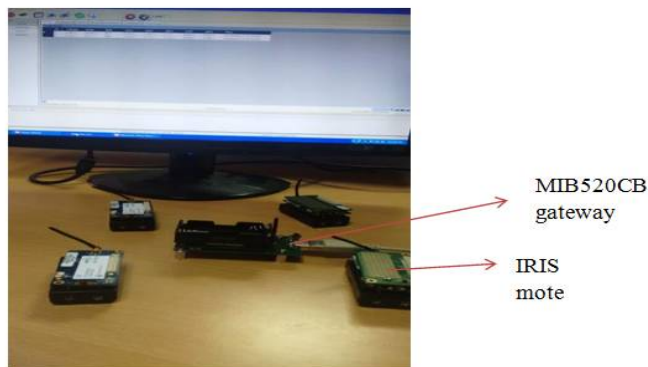


Fig 1: Experimental set up

MoteView acts as an interface between user and deployed network of wireless sensors. The health packets, forwarded packets, dropped packets, Number of retries, Battery voltage along with the quality which specifies the number of transmissions and retransmissions can be estimated. These values will thereby help in monitoring the health statics of the particular WSN network.

III. WIRELESS SENSOR NETWORK WITH IOT

The wireless sensor network is independent of internet and hence steps bear to be taken to connect the nodes to the internet. This can be done by various methods where the nodes are associated to the central device which stores

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the entire data stream and then feeds the data into the internet. The various integration approaches are stack based [4] and topology based approaches [5]. The stack based approaches can be classified into front end solution, gateway solution and TCP/IP solution. The topology based approaches consists of hybrid solution and access point solution [6].

The solutions includes the gateway node which is present and does the byte lessening process like 6LoWPAN where the edge router is present to lessen the total number of bytes of internet to less number of bytes suitable for wireless sensor nodes. Resilience, user authentication, security, protocols used and hardware constraints have to be considered [6,9]. The IoT should pave a way for the nodes to identify it and make the device to device communication more reliable and feasible. The security and user acceptance about the integration pose an important challenge [7]

IV. PROPOSED SYSTEM

The node is identified itself with the node id. IRIS mote along with MDA100 is hired to support various applications. MoteView avails in estimating the data, commands, topologies, and packets released packets received, RSSI, temperature and light sensitivity readings and the value is stowed in PostgreSQL database. It avails in retrieving the data when a query is being given to it. The values in the database are being fed into the cloud. The PostgreSQL is fed into the internet with the help of any servers available. PostgreSQL database stores data in a secure manner which facilitates in retrieving data later whenever a query is being requested. Initially the motes are all interconnected together to the base station. Depending on the applications the sensors can be used. The figure 2 gives the proposed system wherein the motes are connected via the gateway to the database and to the monitoring center.

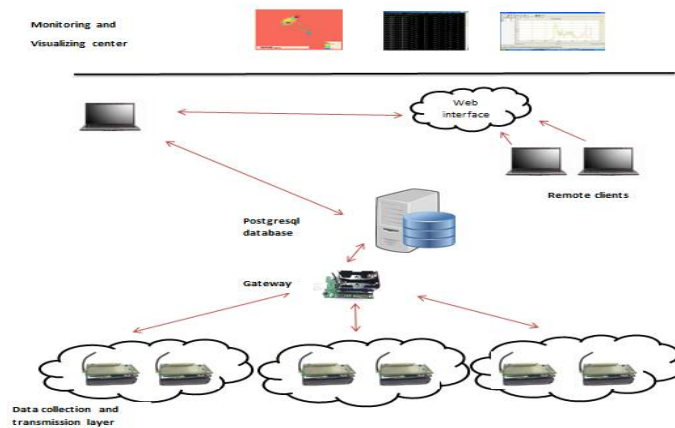


Fig 2: Proposed system

The above proposed method is implemented via http. The drawbacks of http demand the requirement of MQTT, which is implemented via raspberry pi. The raspberry pi is assigned an IP address and with the help of node red the nodes are dragged and the values are injected to the broker which tweets the value upon subscription.

V. RESULTS AND DISCUSSIONS

Whenever a particular threshold is reached a pop up message or alert mail can be sent to the respective users so that immediate actions can be taken to avoid disasters. As an example a threshold is being fixed stating that a pop up menu appears whenever threshold is reached as shown in fig 3. Sequential number is seen to identify the alert which is being assigned, with the duration which is also fixed.

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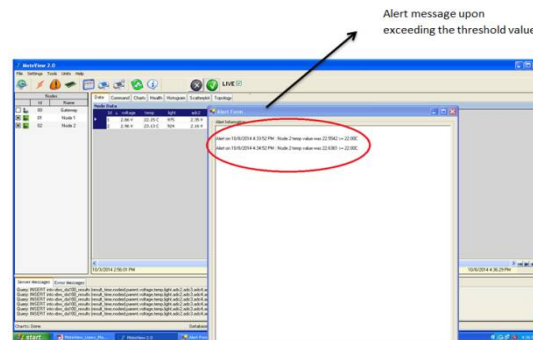


Fig 3: Alert form

The alert form will make acknowledge about the values which exceeds threshold and help to take necessary actions thereby keeping the values under limits. The figure 4 shows the MQTT implementation wherein the broker, topic, QoS and name can be found.

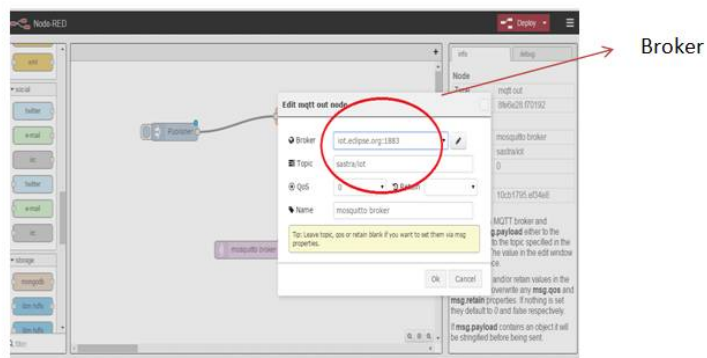


Fig 4: MQTT implementation

Zoho creator holds the database values. Zoho creator helps in producing a concentrated and a repository information. A space is made which allows the conversation between the collaborators and innovators across the world. The database can be connected directly by using the API of the respective database. The exported file can also be included in the zoho creator. The authentication can be set in the database which allows the limited access to the database. The raspberry pi can be used to implement MQTT. The values are published to MQTT broker which will transmit its value to the subscriber upon subscription [11]. The twitter id is used to show the output. Once the value is injected the value is displayed in twitter using MQTT broker [12,15]. Figure 5 shows the twitter message wherein the tweets are received via MQTT.

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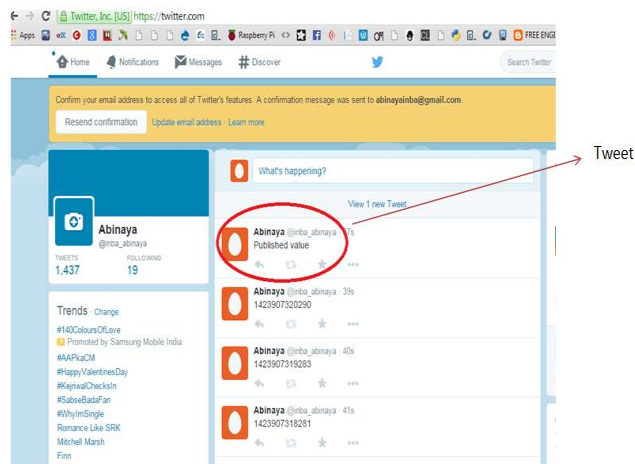


Fig 5: Twitter message

VI. CONCLUSION

Thus remote monitoring and control helps for measurement of heterogeneous devices from a remote location and ability to alter the device functionality. The history of data is also collected which helps in monitoring the devices functionality that will help user to know when and where error has occurred. This monitoring of database is provided with some authentication which helps in limited access of the database. MQTT is standardized by OASIS; TCP based asynchronous type of message supporting many to many communications

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