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Real time Management of Resource Constrained Sensor Devices in Internet-of-Things

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Abstract— Managing and maintaining industrial device with the help of wireless sensor network is the challengeable task. Also it is the future requirement of industries to manage and maintain their devices wirelessly and within an efficient time. So this can be possible using Internet-Of-Things (IOT) and using Real-Time-System (RTS). To allocate specific time to the network forming devices for managing and maintaining their task in network we will able to develop Real-Time-System for industrial devices.

Keywords— Real-Time-System(RTS), Internet-Of-Things(IOT), Wireless sensor network, Time allocation, Resource constrained devices management and maintain.

I. INTRODUCTION

Internet of Things (IOT) is raising technology in recent years. It plays an important role in development, communication and interaction with system. It is nothing but “Things” OR physical object, embedded with electronics sensor software and network connectivity, which is responsible for exchange and collection of data. It results in the generation of enormous amount of data that have to be stored, proceed and presented in seamless manner. It gives direct interaction to physical world and computer base system.

It is supporting new forms of collaboration between people and things, IoT adds a new element to the information and communication. The main strong point of the IoT indication is the high impact it will have on several aspects of everyday-life and manners of potential users. The point of view of a private user, the most obvious effects of the IoT introduction will be visible in both working and domestic fields. IoT has been defines as the universal existence about us of a range of "things" or "objects", similar to Radio Frequency identification (RFID) tags, sensors, mobile phones, actuators which Over exclusive addressing schemes, are able to interact with each of one and cooperate with their adjacent "smart" modules to reach common goals. Some real-world implementations in one kind of smart sensor. As well usual wireless communication, elaboration capabilities and memory, this sort of sensor is also equipped with new potentials and capabilities such like autonomous and proactive behaviour, collaborative communications, context awareness and elaboration. It will act as one of atomic components in the deployment of IoT[2]. There are some technologies that can be used to implement the concept of Internet of Things. In this paper, we discussed the following knowledge: Radio Frequency Identification (RFID), Near Field Communication (NFC) Vehicle-to-Vehicle Communication (V2V), Machine-to-Machine Communication (M2M).

Sensor systems concentrated on node hardware constraints and very limited energy resources. But nowadays, that new applications need data handling with sequential constraints in their tasks; then one of the new challenges faced by wireless sensor networks (WSNs) is control real-time storage and querying the data they process. Two main approaches to storage and interrogating data are generally measured warehousing and distributed. The warehousing approach stores data in a essential database and then queries may be performed to it. In a distributed approach, sensor devices are considered as local records and data are managed locally. The data collected by sensors must represent the current state of the atmosphere; for this reason they are subject to logic and time limits. A real-time computer structure must react to motivations from the controlled object (or the operator) within time intervals read out by its environment. The direct at which a result is produced is called a deadline. If the result has utility even after the deadline has delivered, the deadline is categorized as soft, otherwise it is firm.

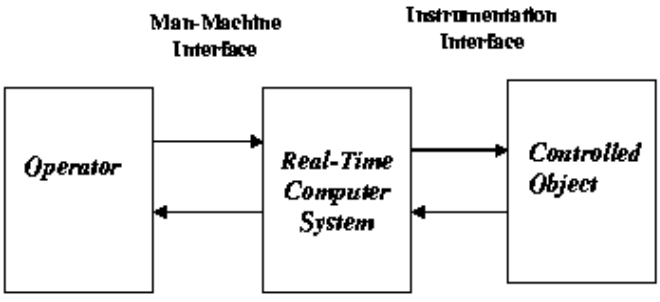

Fig. 1: Real time system

Main features of real-time systems are: Priority scheduling, Programmer defined interrupts, Multi-tasking, Support of real-time clock .Similarly Real-Time-System (RTS) plays important role in support of Internet-Of-Things (IOT) with combination of this we will able to develop and operate an communicating embedded system. RTS is an information processing system which gives proper and finite output within an allocated time. It is able to control and processing data and gives results quickly. It has four patterns. Hard real time system, soft real time system, firm teal real time system and weakly hard real time. So with respect to real time system, we will manage and maintain industrial devices using IOT. In this we will assign a specific time to the devices for their operations and performance assurance. Also we will able to see and compare the performance of devices graphically on IOT client system[5].

They can be classified in two basic types: **Soft and Hard**

(A) Hard Real-Time Coordination are having very hard deadline i.e. entire deadlines must be met otherwise catastrophic state may arise. Flight control system and Nuclear power plant are example of hard real-time systems.

(B) Soft Real-Time Coordination is with soft deadline. It requires that serious tasks get priority over less prior task. In this system, missing an irregular deadline is undesirable but never the less unbearable. Multimedia is an example of soft real-time systems. Mostly all the real-time systems in presence use pre-emptive action and multitasking. Real-time scheduling techniques can be broadly divided into two categories: Dynamic and Static.

II. LITRATURE SURVEY

As the survey of some existing system they were able to manage and maintain the device with the COAP server and various protocols. Like CoAP(Constrained Application protocol), RPL(Routing Protocol for Low Power and Lossy Network), Zigbee and WAVE2M, TCP/IP, 6LoWPAN (IPv6 over Low power wireless personal area networks), SNMP(simple network management protocol). In those systems they assign a unique ID's to the devices and they connected to the CoAP based server with naming and addressing also [1].

2.1 CoAP(constrained application protocol): CoAP is a specialized web transfer protocol for resource constrained nodes and networks. It treats all objects in a network as resources. And each node had Unique Recourse Identifier(URI) with the help of this they were able to operated stateless, including GET, PUT, POST, DELETE and all other operations. In order to form connection CoAP used UDP (User Datagram Protocol) to ensure reliable transmission.

2.2 RPL(Routing Protocol for Low Power and Lossy Network): RPL is a distance-vector routing protocol, in which nodes construct a destination oriented Acyclic Graph (DODAG) by exchanging distance vectors and root information with a "controller". This protocol is having ability to select the current working and networking node in a required area. In a stable state each node having number of parents and they forward packets to the next node.

2.3 Zigbee and WAVE2M: IEEE 802.15.4 is a radio technology standard for low power and low data rate applications with a radio coverage of only a few meters. It having capacity of data rate of 250kbps with maximum output power of 1mW. This helps to save energy in network smartly that is when there is no traffic in a network they turn off the node and turn on when there is traffic.

2.4 6LoWPAN (IPv6 over Low power wireless personal area networks): The main motive of this protocol is to optimization of IPV6 over a network using IEEE 802.15.4. There are two reasons for applying this protocol over a network. First is maximum frame size is supported by IEEE is 127 bytes and second is that minimum value of maximum transmission unit (MTU) specified by IPV6 is 1280 bytes.

2.5 SNMP (Simple Network Management protocol): This is important and unique protocol for network management. Used to develop framework of CoAP based device management solution for WSN. And develop management functions regarding with devices. It included Representational. State Transfer (REST) in which lightweight web server can embedded in resource constrained sensor devices. In client side collect the data, perform operation and execution of query and update to the server take places. While in server side inquiry and reporting was takes places. Server side had some functions regarding with management like registration, provisioning, management service, observing and application data transmission.

- **Registration:** It is the initial and important function of sensor device to register or de-register to the remotely managed server.
- **Provisioning:** it was deal with information sharing with sensor devices to the server.
- **Management services:** after the confirmation of device connectivity to the server management services allocated to the device like status inquiry, parameter management, connection diagnose.
- **Observing:** It was important feature of CoAP to observe the device that is to follow the presentation of device and keep this presentation updated after some interval of time continually.
- **Application data management:** it contains application data which are collected and delivered to IOT.

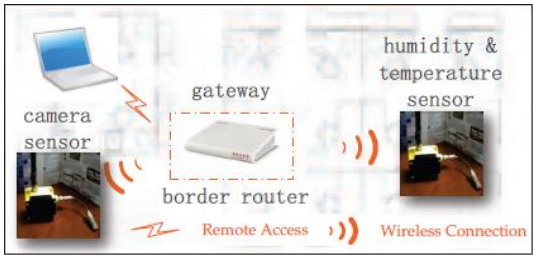

Fig. 2: Network topology of the prototype system. A laptop acts as a client to retrieve sensor resources via gateway.

2.6 Restful web services vs. "big" web services: Making the right architectural decision. C. Pautasso, O. Zimmermann, and F. Leymann, apr. 2008[3][6]: In this paper it used architectural principles and decisions as a comparison method to illustrate the conceptual and technological variances between Restful Web services and WSDL/SOAP based "Big" Web services. The operation of RESTful Web Services in the context of the Internet of Things (IoT). It introduced a promising, RESTful web transfer protocol named CoAP, which is like to HTTP but has been re-designed and optimized especially for machine-to-machine (M2M) applications in excess of constrained environments on the IoT. According to recent studies, it look like that the use of criteria (e.g., CoAP and EXI) and web paradigms are the key success factors for extending the Internet to constrained environments and building the vision of the IoT become reality [7].

2.7 Security protocols and privacy issues into 6lowpan stack: A synthesis, C. Hennebert and J. Dos Santos, Oct 2014[10]: With the development of the Internet of Things (IoT), many devices organized into network, communicate by themselves on the Internet, and send information or private data on the web. It is essential to secure the transmitted data and the characters that may be disclosed to make these new technologies accepted by the largest number of citizens. However, the security apparatuses that are widely used on the Internet are too heavy to be integrated on small constrained objects. This paper defines the recent protocols and security solutions that can be deployed in constrained resources. It shows the profits and the boundaries of each scheme-the security extension of IEEE 802.15.4e in time-slotted channel hopping (TSCH) mode, compacted IPsec, datagram transport layer security (DTLS)-embedded at different levels of the OSI model into the 6LoWPAN stack.

III. PROPOSED SYSTEM

While considering any system time plays an important role regarding with its performance, operation execution, data collection, response to query, notification about security and risk handling. So while designing our system we will takes less time in to the consideration to management and maintains the devices through IOT client and server. We will allocate less response time in the required rang and small need of device resources. With the help of this we will also able to measure the each device performance and gives graphical view on IOT client to compare and compute values for analysis. In case if there is any problem occurred in device then it will detect that problem and send report to the client system about that problem. For the connection formation and communication within the device we will use various protocols which are used in existing systems and more advance protocol also. So while designing this system rang doesn't make any matter. Only the basic need is that it will able to perform their operations within allocated time to it [9].

We will integrate all IOT devices together. All resource constrained devices are connecting to each other. The information regarding with that devices is stored on internet so when we want to retrieve all information or any data from that devices they will firstly sense that client device and retrieves the information from the internet which is already stored and this information will show on our device. This can be possible with the help of IOT. We will also assign some particular time to that operation. That it is must for that device to show their information with assigned time to it [8].

To develop such a system we will use the IOT kit. Witch gives the platform to develop our own system it contains power supply, USB connection, Ethernet connector, sensors, and processor.

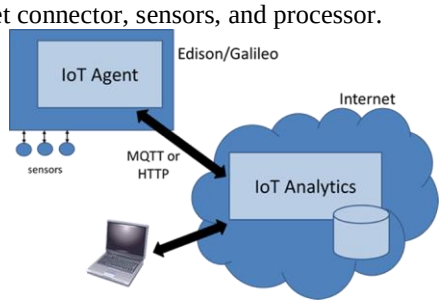

Fig. 3: IOT kit with internet connection and client.

Intel IOT Version for Intel Galileo Gen 2 Developer Kit is a complete hardware & software solution to help you explore the IOT space and make inventive projects. It is a starter kit for Intel Galileo Gen2, best choice for IoT developer to develop potential of Intel Galileo Gen2 and construct prototype built in Galileo 2. Here are a collection of sensors, actuators and shields that we will have success using with Intel Galileo Gen 2. Here also comes the software resource, IDE Dev Environment (Yocto ADT), OS Boot Image (Galileo only).

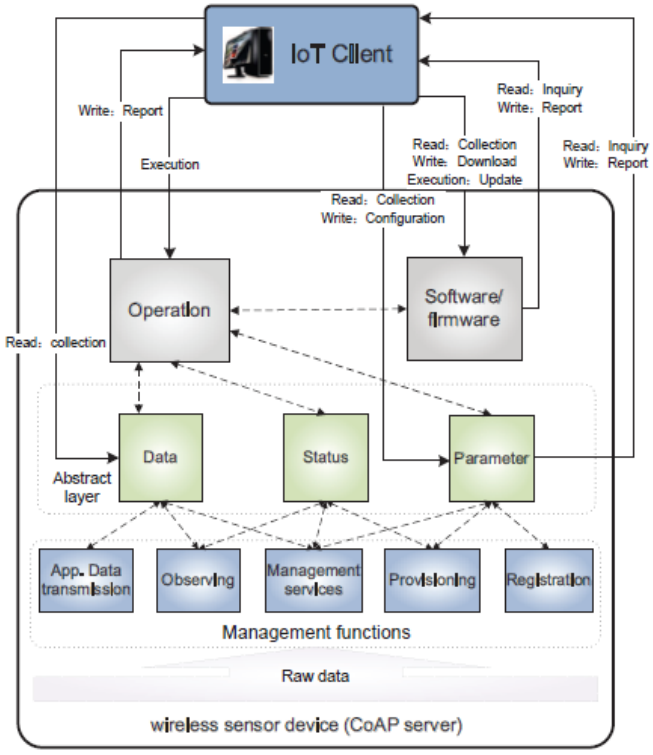

Fig.4: A system architecture of IOT device management including management function, abstract layer and interconnection with client.

IV. CONCLUSION

With respect to proposed system, final conclusion comes that it is future need of the industrial devices to allocate and perform their proper job within allocated time, detection of problem in less time and monitor it to the client. With the help of this data and time synchronization will takes place, which results in future time saving for service allocation and maintenance. With the help of IOT, proper information of devices can be obtained which are connected to the internet. It can observe how the sensors activate and perform their task with respect to internet.

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