IoT-Fog- Cloud based for Smart Classroom

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***Abstract*—** *Here, we present a prototype of a smart Classroom using newly surfacing technologies like IoT (Internet of Things), fog and cloud. The demand for everything smart is increasing daily, but the main stumbling block is its high price. So, our aim is to improve the standard of living in home and in office with newly improved working facilities where the whole system will be automatic, efficient and will be under the control of the user via his/her smartphone or computer but the cost will stay within the budget of a common man. All these are done by the incorporation of IoT, fog and cloud. The assimilation is done using open source hardware's and software to reduce the cost dramatically than the other existing solutions and implement it in an impressive and ingenious way without compromising QoS (Quality of Service) of any of the functionalities provided by other existing solution*s

***Keywords*—** **IoT, Fog, Cloud, Smart Classroom, Automation, Intelligent Control, Energy Efficient.**

I. INTRODUCTION

The word smart is a buzzword nowadays and used to denote a feather to our standard of living. In this busy world, automation is needed to simplify our daily life. Today's people want to monitor and control appliances effortlessly. A smart Classroom is a Classroom that is equipped with different electrical and electronic devices that can be monitored and controlled by smart phones or PC. So, to make them smart is a great step towards smart city.

In this busy world, automation is needed to simplify our daily life. Today's people want to monitor and control appliances effortlessly. A smart Classroom is a Classroom that is equipped with different electrical and electronic devices that can be monitored and controlled by smart phones or PC. So, to make them smart is a great step towards smart city. In this project we used fog computing technologies to automate or classroom to get fit into IOT world. Fog computing is a medium weight and intermediate level of computing power. Fog computing facilitates the operation of compute, storage, and networking services between end devices and cloud computing data centers. All the data and events get store more frequently on fog where decision making happen to control appliances. Cloud is used here for permanent storage of sensor values.

II. LITERATURE SURVEY

1. *Wellness Sensor Networks: A Proposal and Implementation for Smart Home for Assisted Living*

In recent times, wireless sensor networks (WSN) have become the backbone of many systems. Smart-homes based on WSN protocols are used to provide an assisted living environment to humans. The currently reported smart home systems based on generalized WSN protocols suffer from complexity, large data handling, and data transmission delay. This paper has reported a new protocol especially developed to address smart homes for assisted living. The whole purpose of a smart home is to provide a safe environment for the well-being of its inhabitants. Ergo, the protocol is named as Wellness Sensor Networks. The developed protocol has been used in an old home built in 1938 which was converted into a smart home with the use of sensing technologies.

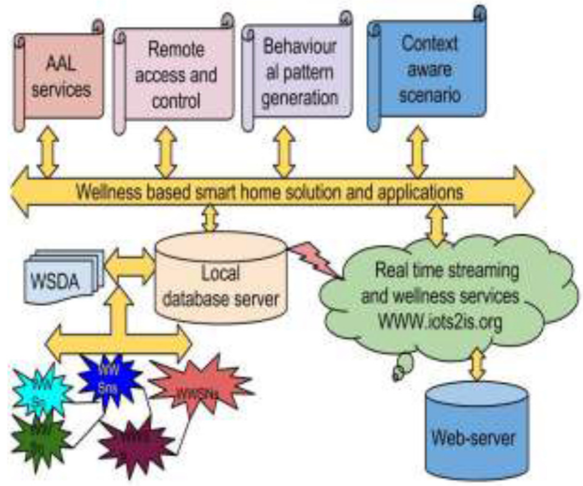

Fig 1: Functional Description of the Developed Smart Home Monitoring System

DESCRIPTION OF WELLNESS PROTOCOL:

The Wellness Protocol targets an event and priority-based communication. It offers reasonable packet delivery metrics and large data handling. This protocol covers complete smart home solution, starting from the sensor node to real-time analysis, data streaming, decision-making, and control. Fig. 1 represents the architecture of Wellness Protocol based smart home solution, where WSDA stands for Wellness Sensor Data Acquisition.

The sensor alone is not good enough to process the data with the support of a XBee RF module, so an Intel Galileo Board was used. The sensor data is sent to Intel Galileo where it is processed by two algorithms, one is packet encapsulation, and the other is intelligent sampling and control. The packet encapsulation algorithm is common for all sensor nodes in a network while the intelligent sampling and control algorithm is designed separately according to sensor type and its application.

As such, it is clear that the several header fields of the ZigBee stack are superfluous for ambient assisted living. For example, ZigBee uses 64-bit headers for addressing, so the packet structure has been redesigned. Wellness Protocol includes the basic role fields for successful data processing and delivery. These fields are as follows.

Data recovery:
Start and end delimiter [16 bits]: To identify every new packet, data extraction logic needs the starting and ending signature.

Loss detection:
Frame count [4 bits]: This frame count is the counter to count the number of packets sent by an end node and received at coordinator-receiver; the 4 bits can count 16 data packets. This field is important for lost packet detection.

Routing:
Source and Destination addresses [8 bits]: Single as well as multi-hop communication devices require the routing path that is identified according to source and destination addressing.

Error detection:
Checksum [8 bits]: The urban home environment is a medium with significant path losses caused by the interference of other devices and attenuation of different materials present in the vicinity. These losses provoke error, although it is possible to minimize these losses but cannot bring these losses to zero. To detect the error in the received packet, the checksum field is essential.

Context, priority and event-based information:
Sensor type or event priority [4 bits]: Another field indicating type of sensor data has been allocated before the sensor data payload field. . This field contains a unique number to represent the type of event and its priority. Every unique number has a separate definition that decides its priority during analysis for decision-making. This decision-making offers the context-aware features.

On the contrary, our proposed wellness packet encapsulation is a compact approach that takes care of packet size; event and priority based data processing, and additionally offers the context-aware scenario. Fig.2 represents packet encapsulation at the end-device station with the event and priority based architecture, where CTR stands for the container. The protocol can encapsulate wellness data packets with less data bytes as compared to Digi XBee Mesh protocol to build the wellness in the system from the fundamental level.

2. Monitoring ambient light conditions of a school using IoT

Internet of Things (IoT) is a concept that connects real world physical objects to the Internet. Each object is given a unique identity to digitally identify it all across the Internet. Each object has sensing and communication capabilities by which it collects information and forwards the collected information to the Internet. Objects also communicate among themselves to perform a common goal by means of Internet protocols. In this project, an application of IoT that helps in monitoring and maintaining the ambience light of a classroom is discussed.

3. Design and Implementation of Smart Home Control Systems Based on Wireless Sensor Networks and Power Line Communications

Wireless sensor networks (WSNs) and power line communications (PLCs) are used in this work to implement a smart home control network. The goals are to reduce the impact of wireless interference on a smart home control network and unnecessary energy consumption of a smart home. An isolated WSN with one coordinator, which is integrated into the PLC transceiver, is established in each room. The coordinator is responsible for transferring environmental parameters obtained by WSNs to the management station via PLCs. The control messages for home appliances are directly transferred using PLCs rather than WSNs. According to experimental results, the impact of wireless interference on the proposed smart home control network is substantially mitigated. Additionally, a smart control algorithm for lighting systems and an analysis of illumination of a fluorescent lamp were presented. The energy saving of lighting systems relative to those without smart control was evaluated. Numerical results indicate that the electricity consumption on a sunny or cloudy day can be reduced by at least 40% under the smart control. Moreover, a prototype for the proposed smart home control network with the smart control algorithm was implemented. Experimental tests demonstrate that the proposed system for smart home control networks is practically feasible and performs well.

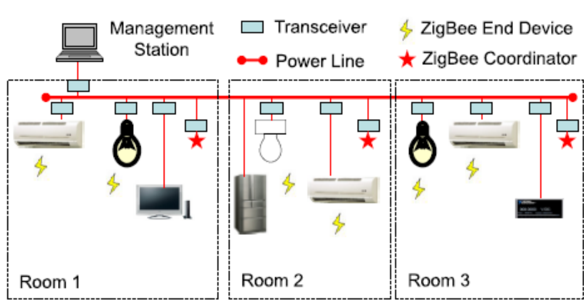

Fig. 2. Architecture of proposed smart home control network.

4. *An Integrated Cloud-Based Smart Home Management System with Community Hierarchy*

This paper presents a smart home management system in which a community broker role is used for integrating community services, thereby reducing the workload of community management staff, providing electronic information services, and deepening the community's integration with the surrounding environment. At the home end, a home intranet was created by integrating a fixed touch panel with a home controller system and various sensors and devices to deliver, for example, energy, scenario information, and security functions. The community end comprises a community server and community personal computers, and connects to devices (e.g., video cameras and building automation devices) in other community systems and to the home networks. Furthermore, to achieve multiple in home displays, standard interface devices can be employed to separate the logic and user interfaces. This study also determined that the message queuing telemetry transport protocol can provide optimal home control services in smart home systems, whereas hypertext transfer protocol is optimal for delivering location-based information integration services1.

III. CONCLUSION AND FUTURE WORK

This project proposes prototype of a smart classroom using newly surfacing technologies like IoT, fog and cloud. Using this system we can control the appliance of classroom automatically on the basis of sensor values.

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