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Physical Conditions Monitoring in Server Rooms Internet of Things

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Abstract: **Internet of Things is expanding the Internet to physical world around us and it forms a network by connecting everyday objects. Things will communicate with computers and with each other. The challenges in Internet of Things space include scalable architecture, performance and interoperability. The focus of our applications based on IoT platform is resource and process optimization applications. The scalable and inter operable Internet of Things platform is proposed and one case study on system of server room monitoring is described in this Paper. Apart from the server room monitoring with cold and hot aisle experiment results, the benefits of using the platform are also highlighted while describing the case study. The system allows producing alerts based on real time sensor information and performs correlation of various events along with analytics. The fine grain level of monitoring and control is possible with the Internet of Things platform that expands the horizon of existing infrastructure. Typical solutions like energy management, water management, asset monitoring etc. can be built rapidly in scalable manner using Internet of Things platform.**

Keywords: **Internet of Things, Server Rooms, IoT Application, Monitoring Systems, Machine-to-machine.**

I. INTRODUCTION

The Internet of Things (IoT) alludes to the interconnection of embedded computing-like devices which are uniquely identifiable within the actual Internet. IoT is expected to offer advanced connectivity of devices, systems, and services that goes above machine-to-machine communications and covers a variety of protocols, domains, and applications. The linkage of these embedded devices is needed to apply in automation in nearly all sectors, while also creating advanced applications like a Smart Grid.

Server Room serves a critical function in an organization because it controls the flow of data and the storage of such data for future use. A data center runs on a 24 hour, 365 days basis therefore it is always sustained with sufficient air conditioning system and uninterruptible power supplies. Due to ceaseless nature, a data center requires the excellent monitoring and data protection from defects caused from accidents to the Network Infrastructures [1].

The most usual environmental threats to server rooms are temperature, humidity, water leaks, intrusion, human error, power outage and vibration. Many threats are raised, like temperature and humidity, which complicates environment monitoring and enhances the need for an automated, sophisticated system.

These threats can deteriorate database, slow performance, and force hardware to shut down. The expenditure of environmental threats are:

- Restoration of damaged items.
- Lower worker potency due to spare time.
- Lost earnings from inaccessible server based applications, like customer service centers or e-commerce sites.
- Increased administrative time and funds to inspect and fix problems.

II. METHODOLOGIES

A. Server Room Conditions and Solutions:

There are various solutions based on IoT platform. One such solution is Server Room Monitoring Solution. Earlier server racks were simple metal cabinets with no designated air entry or exit points and air circulation was limited by using simple fans [5]. The solution described was used to monitor single domain parameter such as wither temperature, humidity or other ambient parameters [5]. To increase the cooling efficiency, the server racks are designated with cold air entry and hot air exit points. The server racks are aligned in alternate rows with cold air inlet facing one direction and hot air outlet the other. The cold air inlets are contained in a chamber with air conditioner output duct supplying the cold air. This chamber is called cold aisle and hot aisle is a similar containment of hot air exhaust of server racks and the air conditioner input duct. This kind of setup can host large density of servers increasing operational efficiency and space utilization. A vast array of different domain factors (server load, room design with respect to air flow inlet and outlet positions and power supply) act together to keep the servers at optimum temperature and humidity. An application version is built targeted at this deployment scenario using the IoT platform. Here IoT platform abstracts and simplifies application development bringing together different sensors and gateways. Sensor-Cloud infrastructure virtualizes physical sensors as virtual sensor on cloud [2]. The ineffective monitoring can lead to high operational costs as well as in-efficient energy consumption. This server room monitoring system integrates to Building Management System (BMS). Enterprise level industrialists nowadays are increasingly concerned about sharing information on the cloud as cloud based services has its own privacy and security threats [3], [4]. Also industrialists may not feel comfortable sharing all their appliance level data to a third party server hosted somewhere else. Hence a robust solution of creating stand-alone cloud server becomes necessity in such conditions.

B. Flow of Execution:

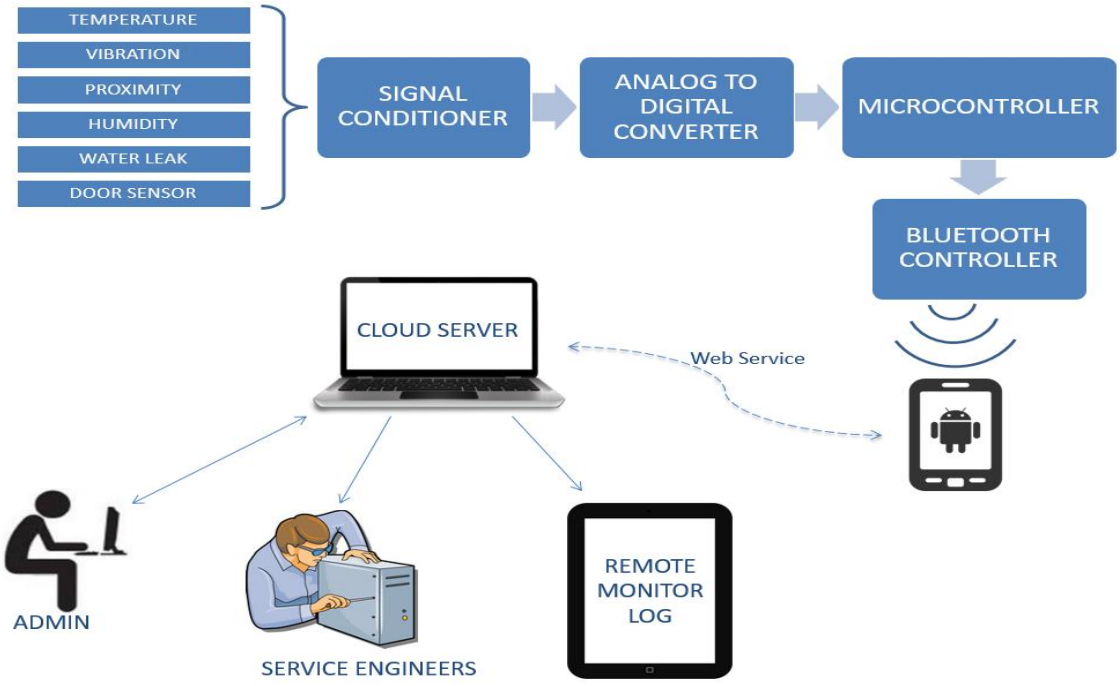

Fig. 1. Block Representation of Execution

The system is combination of hardware, middleware and standalone application built on top of the IoT platform. The hardware components include the temperature, humidity sensors and gateways to communicate the data from sensors to the server.

The web application is built on top of the IoT platform. The sensor data is processed in the middle-ware section and is stored in the database for analysis. The processed data is made available through APIs in the web application for user access. The data is visualized in a uniform central dashboard. The minimum and maximum temperature readings over a period of one week can be observed in the graph. The objective of this kind of hot and cold aisle setup is to save energy and maintenance costs by adjusting the air flow properly.

It is observed that a typical server room wastes up to 24% of energy used in cooling (HVAC) [6]. Automated and continuous monitoring of ambient parameters in a server room improves reliability and reduces accidents due to environmental parameters. Correlation of humidity and temperature can raise a signal for fire/smoke much in advance when compared to existing smoke detection system [7]. The first deployment was made using six sensors and one gateway in a server room. One is used in aisle rack to measure temperature, One sensor is placed at room level to measure humidity, One sensor is placed on the hard disks to measure vibrations, One sensor is placed near vents of the fans to avoid obstacle in ventilation, One sensor is placed on the floor to detect the water leaks, One sensor is fitted on doors of server room to keep watch on entries in room. The platform helped us manage this scalable deployment, viewing the alerts generated and viewing sensor data in real time on a unified central dashboard.

C. Review and Advantages of System:

i. Unified interaction for operators and administrators with rapid development of value-added, cost effective and end-to-end solutions for Database management activities.

ii. Automate and optimize Hardware management, provide new way into operations and better the decision-making.

iii. Raising alerts based on real time information, correlation of various events of the hardware along with analytics and off line analysis.

III. CONCLUSION

The research idea can be only sensing or both sensing and actuation based. In case of only sensing systems, the application can raise alerts to corresponding persons to take necessary actions. Whereas, in the actuation based sensor systems, the application can directly control the system based on the decisions made with business intelligence. There are various users such as administrators, operators, managers, technicians in any organization performing various activities in the particular department. This platform helps to incorporate all these requirements while developing Hardware monitoring systems. The areas such as environment monitoring, pollution monitoring, energy and water management are interlinked to each other. Comparatively, increasing the air condition temperature setting and decreasing the air flow level may save on energy bills but increase the pollution level in the building. Sensor systems deployed for monitoring temperature and humidity may generate real time data but the system developed can readily provide configurations to raise the real time alerts. It allows comparing different events and establishing correlation between various parameters to generate early warning signals such as indication of fire based on changes in the temperature and humidity levels.

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