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System Support Decision Making in Data Centers

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Abstract: *The purpose of wireless sensor networks is to establish smart environments, which is constantly censusing the environment for automatically operating devices adapt the environment according to the needs of people and equipment present is actuated . It is desirable that in such environments exist autonomous mechanisms that allow constant monitoring of the operation of the sensor network, so that in the event of failure of one of them, mechanisms of self-reconfiguration and synchronization is activated. The purpose of the sensor network is that census data acquisition never stops. In this work, we propose an ontology model in order to help in decision making at site monitoring using environmental sensors.*

Keywords: *decision making, ontology, smart environment, wireless sensor network, monitoring.*

I. Introduction

In recent years, wireless networks have become more relevant because of the portability of communication devices, the need to work remotely, remote monitoring, business monitoring, security systems and high level of complexity. In short, it is necessary to perform the above activities anytime and anywhere.

A wireless sensor network consists of a set of geographic or spatially separate nodes, where nodes represent wireless devices with the same or different computing capacity in the network, these nodes work in a coordinated or synchronized manner and are autonomous. A group of wireless networks, WSN (Wireless Sensor Networks), in which the nodes in the network are sensors that have different goals such as:

- Environmental monitoring of air, water or soil.
- Monitoring of machinery.
- Monitoring processes.
- Monitoring and asset tracking.

One of the most important aspects in wireless sensor networks is synchronization and coordination of the nodes; since they depend upon the efficient performance of tasks or processes that will be performed by each node. The purpose of wireless sensor networks is to establish intelligent environments, which is constantly censusing the environment for automatically operating devices adapt the environment or environment according to the needs of people and equipment present is actuated. It is desirable that in such environments exist autonomous mechanisms that allow constant monitoring of the operation of the sensor network, so that in the event of failure of one of them, mechanisms of self-reconfiguration and synchronization is activated. The purpose of the sensor network is that census data acquisition never stops.

Moreover, in recent decades, has proliferated the use of ontologies as a mechanism for generating knowledge from information, clear examples are the semantic web, the internet of things and ubiquitous computing, one of the reasons why ontologies have become more relevant these days is monitoring constantly changing situations or dynamic environments where it is necessary to make decisions based on past experience or the complete analysis of a situation by reasoning.

Data centers should be designed with a series of specifications that revolve around security, stability, redundancy and even care for the environment. Wiring must be structured and perfectly well identified, should not obstruct the passage of people or equipment, must have fire suppression systems, as well as an evacuation plan, you must have several elements of hardware and software of the same type to perform a task in common and that if one fails another element to take responsibility for the tasks performed element that failed in order that the service offered is not interrupted at any time, the above is called redundancy.

Among the application fields of wireless sensor networks there is a tendency in common and is saving energy, which can generally be electrical or mechanical. Today there are smart spaces such as homes, workplaces, schools, supermarkets, which depend on sensors, motion, smoke, gestures to release a number of operations and actions should make this place to adapt to circumstances where it is or the needs of its inhabitants.

Claims, unforeseen changes, adjustments and adjustments in data centers require a comprehensive approach to decision making, starting points usually are the needs, damages, costs and technical parameters and input to a particular business in this work the environmental conditions of temperature and humidity for the preservation of the integrity of computer equipment within the data center in order to keep all the services and benefits staying in that place working properly reviewed. With a view to an intelligent system plans to build an

ontology directed to notify the need for changes in temperature or humidity data center, this ontology will depend on the census of environmental data, which will be done by the sensors.
Optimization of spending power is perhaps more likely the application today, the WSN are a target to perform this task and all its sensors do not spend more energy than they need to perform their functions.

II. Heading s

I INTRODUCTION give a general idea of the project using WSN to monitoring data centers in a smart environment, in III STATE OF THE ART different central topics as Ontologies and Monitoring Systems are shown in detail, in IV DESCRIPTION OF THE PROBLEM, current difficulties in data center monitoring are described and possible solutions are focused, in V OBJECTIVES targets and expected results are described, in VI METHODOLOGY are described different phases of this project to solution data center monitoring.

III. State of The Art

III.1 Ontologies

This section provides a brief overview of some work that has been done so far based on ontological models in order to monitor environments, or establish a logical model for reasoning and decision making.

The computation based on ontologies today is one of the fundamental tools for ubiquitous computing and semantic web, ontologies have gained importance because the context information has a very wide range, generally grouped into different subdomains [1] . An ontology is a representation of a set of concepts that belong to a domain and the relationships of these concepts are used to thinking about the domain properties and perhaps even fulfill the function of defining the domain [2].

The logic has played an important role in building ontologies, as it provides inference mechanisms and allows you to use other tools such as the semantic similarity that can be expressed through algorithms, such is the case of CACOnt [1]. Common components of an ontology are: individuals, classes, attributes, relationships, functions, restrictions, rules, axioms and events. Bayesian networks are a mechanism used to structure an argument in contexts that are unclear, are fuzzy or uncertain [2].

Action plans, decision making or generating suggestions depend on effective systems and these in turn have their origins in the accurate recognition of the activities performed within the system which results in semantic relationships that have the ability to express the feasibility of developing specific activities in a specific environment, this allows the accuracy of an intelligent system is high [3].

You can make predictions using statistical recognizing specific activities, Claudio Daniele Bettini Riboni and propose the implementation of COSAR (Combined onto- logical / Statistical Activity Recognition) a module able to make predictions by stats activities, so mechanisms of accurate census are used to gather information from the different elements of context as environmental sensors, behaved in clothes individuals, etc. [3]. In academia we have done some work ontologies developed by research oriented to the promotion of profiling within educational institutions; an ontological model for academic and institutional context has the function to identify not only the profile of teaching institutions and research centers but identifies the variety of characters, places and activities of these institutions and what profiles are involved in each activity, the statistical results contributes knowledge and trends of an institution [4].

On the other hand they have also been used to populate ontological models academic profiles from texts in Spanish where the focus is to find individuals with scientific publications and their relations with other publications and researchers. The system model consists of labeling texts, extraction of ontological elements and the town of ontologies [5].

III.2 Monitoring Systems

R.K.Z. Sahbudin, Lee Choong Hooi, Tan Chin Guan and Ling Siong Liet in 2003 presented a work based on microcontroller programming Motorola basically works in two parts: the microcontroller Motorola MC68HC11A8 and a system called Eyewatch, these two parts together make up a system security that provides the status of the door of the data center to see if it is open, closed or blocked [6]. IPAM (Intelligent Power Monitoring Alarm) was developed by Lionel Silverman in 2006, it is the design of an intelligent monitoring system data center which aims to provide stability in energy consumption [7].

Swaytha Sasidharan, Fernando Pianegiani and David Macii made a comparison between what the network topologies that meet the three main requirements of WSN (Wireless Sensor Networks) and protocols such networks implement looking aimed at reducing latencies transmission , the number of lost packets and power consumption [8]. SCOUT is a project to be in distance vision of the data center based on a previous work called FalconEye, the principle of SCOUT is to have mobile robots within the data center to patrol all over the place and are able to perform parameter readings the environment of the site or server racks, was developed by Woong Choi, Ki-Woong Park and Kyu Ho Park [9].

Li Yang, Changyin Liang and Linfang Yang developed an intelligent alarm specially raised for data centers where it was not staff working in monitoring it, they called MDF Incoming Power Disturbance Alarm, the purpose of this system is to have units or modules fault detection warning the module that collects the information to alert personnel responsible for maintaining the data center with sufficient time to evaluate the problem, get to the place and fix the fault, this model consists of a classification of alarms that can help to fault identification and classification of alarms is the severity of the fault and alarm duration [10].

Changzhu Chen, Ling Sun, Yeqin Shao, Zuhui Hu and Quan Shi developed IEMS (An Intelligent Enviroment Monitoring Systm of Server Room) project consisting of a large number of sensors that rely on a network structure called RS-485 found in a client-server model whose objectives are to achieve a low cost, low complexity and achieve a more reliable and stable intelligent environment. Monitoring is real time, as it can be accessed anytime and anywhere as it has the advantage of being consulted via the Web, the system performs monitoring of temperature, humidity, smoke, power outages and water leaks [11].

Sunil Kumar Vuppala, Animikh Ghosh, A. Patil and Ketan Kumar Padmanabh desarrolaron a solution of predicting events for monitoring data centers, this work is very important to establish standards for the values of the environmental conditions of the site, as values will be forced to stay very close to the standards because experimentally found that the variation of one degree Celsius in the case of temperature represents 4% of excess energy expenditure, other important data that monitors the system airflow to know whether it is correct or not, and how it affects the temperature above enables the system to be able to anticipate the presence of smoke or fire [12]. In 2013 Wang Xiaodong, Wang Xiaorui, Xing Guoliang, Jinzhu Chen, Cheng Xian Lin and Chen Yixin develop an intelligent system of sensors to monitor the biggest problem of data centers; thermal monitoring of the site, a model is proposed for the accuracy of census is greater, this in order that optimize energy expenditure and the number of sensors in the network [13].

Genetic algorithms also has a proposal developed by Liu Huaping Rahul Khanna and using a model promises to avoid network collisions using a genetic algorithm, it is an MCN which ensures low transmission latency. The algorithm follows the principle of natural selection in which represents each of the network nodes as a chromosome [14].

Sabrina Fassbender proposes an intelligent model monitoring and power management for data centers, consists of a modular architecture, where the main module is the Power Manager (EM - Energy Manager), this module receives signals from all sensors and determines the next action to be performed. The system power management not only makes management administrator, but keeps all customers with low power consumption, it is able to manage wind and solar energy, can monitor the lifetime of a battery to anticipate replacement or recharge, you can manage the thermal status of the site as well as access control and alarms within results suggested that the delivery of results to the end user either through SMS [15].

The wireless sensor networks have been useful for problems tool whose solutions require census, monitor, track, etc., are not only a technological tool, but for their applications resource optimization, energy expenditure, computer equipment [39] it represents a solid way to make improvements in the economy of a company or institution, development of a centralized monitoring system power consumption and battery with high precision turns out to be an effective solution to adjust costs. System modules are: Unit parameter sensor, transmitter module, receiver and GUI module, this proposal Haaris Rasool, Aazim Rasool, Urfa Rasool Ali Raza and Waqar Ahmad differs from the rest because it has a GUI that It shows the results to the end user so you can make decisions about the behavior of the data center [16].

The range of energy consumption for air conditioning in data centers is growing exponentially because there are few automatic tools that give reliability to the user to monitor the environmental conditions of the site, and do it manually, although the values are taken into account parameters such as temperature, humidity, smoke, etc., also has a cost, generating energy in excess, so Zhongming Luo, Huaze Liu and Zhuofu Liu proposed a system in which not only properly manage consumption power to the air conditioning, but it is stable and can provide the inhabitants of the site (Data Center) a comfortable place to work but safe for company assets in their study concluded that one of the most significant parameters of both for information security and for the comfort of people is the humidity [17].

Wireless solutions are found in almost all sectors of our environment, and of course are providing efficient results and economic benefits to companies that decide to implement, however it is necessary to consider that for implementation is secure, reliable and available at any time must consider physical aspects that could affect transmissions via a wireless, such as via: the correct distribution and installation of the sensors in place, building materials, communication, etc., the number of sensors needed to build necessary to reach the objectives infrastructure, not considering the above points can trigger phenomena on sensor networks as the density of sensors that can create neighborhoods with conflicts that generate interference communications or high probability that there are delays in shipment packet noise in the data center which could create large latencies package delivery or even losing them, delays in the delivery of information which is caused by the effect on transfer rates of data to be I can talk of a real-time system [18].

IV. Description of The Problem

One of the biggest challenges of the companies responsible for data centers to find the best way to maintain the environmental conditions under ideal conditions having intelligent monitoring systems that provide real-time information without the need for someone to constantly monitor in person. High temperatures and humidity levels directly affect the performance of computer equipment as they generate overheating, on the other hand, if you have low temperatures and lack of moisture it can be generated even freeze both computer equipment and the same equipment refrigeration. The problem of monitoring the physical space of a data center that will be addressed in this project will cover the following aspects: temperature, humidity, light intensity and detection of human presence.

This monitoring will be done through strategically placed within a data center wireless sensor temperature and humidity provide information relevant to the integrity of computer equipment, communications and cooling, while light intensity and the detection of the presence generate information it is important to place safety as well as to make consumption more efficient electricity because the lighting is turned on if no one is in the physical space is not necessary.

To create a monitoring system is necessary to make a wireless sensor network (WSN) topology it is one of the aspects most relevant in this work, because the latencies of transmission from one sensor to another are directly dependent on network topology, on the other hand if the data transmission is not efficient in network spending unnecessary electricity will be generated giving rise to one of the most frequent problems of sensor networks; energy management. It is necessary that the system is real-time and monitor the factors change constantly, so the reading of the securities should be available anytime and anywhere by those responsible for the data center.

Finally, although there are several proposals on alarm systems, or sometimes even the inside data is monitored manually by an operator only data manually recorded in logbooks are collected, which make no contribution to decision to preserve the integrity of the data center so that in this work it is proposed that creating relationships between different factors to monitor and safety ranges that are defined they can predict and classify events to consolidate libraries of knowledge through documentation failures, setbacks, variations in the ranges, etc.

V. Objectives

V.1. General Objective

- Implement an ontological model of support for decision-making based on the monitoring of environmental conditions of a data center and the records generated by the computer equipment found inside.

V.2. Specific objectives

- Implement a network of sensors (temperature and humidity) for the acquisition of data from the central data space.
- Design and implement an ontological model representation of event data extracted by the sensors.
- Implement data acquisition services and a service-based inference rules for correlating event logs and specification sheets manufacturer of equipment located in the data center.
- Implement a monitoring interface space by presenting real-time data and notifications.

VI. Methodology

The project requires an interface capable of extracting data from the sensors, a management system capable of interpreting the information and represent a model of data representation, the model must store all types of possible events within the data center, the programming interface monitoring events that present values and data center with two different GUI's one for web and one for the android operating system mobile devices.

Census sensors: A data extraction module for temperature and humidity sensors are programmed by Arduino UNO card, this module only extract the information without giving any further processing. On the other hand the different event logs sensors will be obtained.

System Data Management: This module will be programmed in Java and in it the data from the sensors will be received and the corresponding conversions are performed so that the temperature is handled from this stage onwards as a value expressed in ° C (Grades Celsius) and humidity is expressed in percent (%). The events collected from the sensors will be processed as error number or event its description and the date and time it happened, all it expressed as text.

Data representation model: collect the information processed by the data management system and stored in the following types of data; temperature numerical expressed in ° C, humidity: Numerical expressed as a percentage and events in text, the control panel is the module that refer to this database.

Monitoring interface: Its objective is to check the model data representation to display the temperature and humidity in real time as well as if there is an error, problem or notice at that time, the monitoring interface is

presented via web and application android in case of remote monitoring, only the data that are essential for monitoring and graphics quality without any animation, audio that can generate incompatibility with devices will be presented this because what is relevant to the application is its ability to report the user and a very robust GUI can make the main objective is lost and even consultations fail.

Additional information: The arduino sensors censused environmental parameters every 2 seconds, which will be used to present information in real time, the control board will be possible to view the events at the time of the query and that day only, without But a search engine is programmed in the control panel to find records of previous days.

VII. Conclusions

Decision-making within the data center is critical to any activity, however poor control over environmental conditions can cause the entire data center or a fundamental element out of operation. The application of ontologies and sensor networks is fSorward-looking in the field of monitoring, intelligent environments, artificial intelligence, health and Biomedical Engineering.

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