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Smart Home using IOT and Natural Language

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ABSTRACT: Building automation is currently undergoing rapid development of technologies and strategies to provide sophisticated management of residential, administrative or industrial building operational and technological features to decrease energy consumption, increased operating costs and improve comfort for occupants of those buildings. Those goals lead to Smart Home and Smart Home Care growth, innovation, and new implementation. The authors focus in this article on how to interconnect the Smart Home's standardized KNX system and the cloud-based IoT platform which serves as an integration layer. Discussing the IoT platform's drawbacks the authors come with new principles that can be used when dealing with the potentially enormous amount of events in the entire program. The latter part of this article describes a way in which the device is enhanced using cloud infrastructure with natural language interface. This helps the Smart Home to communicate in a way that is very similar to human behavior. The overall design of the Smart Home system is illustrated and addressed using all of the mentioned components.

KEYWORDS: Cloud, Internet of Things, KNX, MQTT, Natural Language, Smart Home, Smart Home Care, System Architecture

INTRODUCTION

For IoT-based control of Intelligent Buildings (IB) with KNX technology, it is important to select the appropriate IoT framework for monitoring, data analysis, data processing and optimal control of operational and technical functions in SH and SHC, based on the needs of the occupants. IBM Cloud and IBM Watson technologies have been used in many software applications for Internet search engines Big Data processing and analysis, to promote the independent life of AAL (ambient-assisted living) elderly, security in Hospitals, E-Health, or to highlight the need to ensure the protection of users in real-world Internet of Things (IoT) applications. Using IBM Watson for example as a dialog communication device in an interactive framework to promote the independent life of seniors. They also analyze the Watson methodology of the IBM, combine the approaches used with other artificial intelligence methods and create an interactive concierge program for the independent living of the elderly within easy-to-use interaction models based on the advancement of natural language processing.

Watson's training to understand relevant material in the technology industry and to use theoretical thinking, predictive analysis and machine learning techniques to advance work faster goes in the direction of improving the smart university model by using creative and intelligent tools to help lift a new generation of software engineers, but also to encourage and disseminate a new way for designers. They diagnose the presence or absence of heart failure disease by using little more than the electrocardiographic signal, especially via Heart Rate Variability analysis.

KNX Technology:

The KNX technology is a worldwide standard, modular bus system used to automate various operational and technological functions such as lights, sockets, pushbuttons, environmental sensors, blinds, HVAC (heating, ventilation, air conditioning), alarms, etc. In general, it provides a communication channel within a building for actuators and sensors in which up to 65,536 devices / nodes can communicate using 16bit addressing.

For the implementation of IoT in SH, the authors have available the MSDK wooden structure SH at V wohlSB – Ostrava Technical University, where lighting, blinds and sockets are managed using KNX technology. BACnet technology is used to power HVACs. Visualization of power, regulation of the building's organizational and technological functions, and documentation of the measured data in the database were generated using Desigo Insight software tool (Fig. 1). Communication between KNX devices is carried out via group addresses, which contain simple functions or information parts.

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LITERATURE REVIEW

A smart home is an implementation of omnipresent computing in which ambient intelligence monitors the home environment to provide context-aware services and allow remote control over the home. This paper offers a summary of past smart homework, as well as related technologies. A short overview is given about the building blocks of smart homes and their interrelationships. This defines collective knowledge about sensors, multimedia tools, communication protocols, and frameworks, commonly used in the implementation of smart home. Specific algorithms from various fields and their importance are described in the smart homes according to their scope of use. This paper also provides a clear guidance for potential researchers to follow in designing a smart home that is realistic and sustainable[1]. He has proposed a smart home energy management system which divides and assigns appropriate components to different home network tasks. It can incorporate diversified physical sensing information and monitor various consumer home devices, assisted by active sensor networks with components for both sensors and actuators. We are designing a new DMPR (Disjoint Multi Path based Routing) routing protocol to boost the efficiency of our ZigBee sensor networks. This paper presents the design of the proposed home energy control system which provides users with intelligent services. We are demonstrating its implementation through a real world[2]. The paper proposed a smart home energy management system which divides and assigns appropriate components to different home network tasks. It can incorporate diversified physical sensing information and monitor various consumer home devices, assisted by active sensor networks with components for both sensors and actuators. We are designing a new DMPR (Disjoint Multi Path based Routing) routing protocol to boost the efficiency of our ZigBee sensor networks. This paper presents the design of the proposed home energy control system which provides users with intelligent services. We are demonstrating its implementation through a real world[3]. The aim of this paper is to systematically review the smart home literature, and to analyze the current state of play from a consumer perspective. The analysis offers a detailed view of the definitions and features of the smart home, after reviewing the systematic approach. The research then turns to a study of the smart home forms, the amenities and benefits associated with them. After evaluating the current state of smart home benefits, the study would tackle the challenges and barriers to smart home adoption. This review ends with suggestions about future studies[4]. This paper designs definitions of smart home devices and best practices for "Smart Energy" applications needed for demand response and load management in a residential or light commercial environment based on intelligent technology. The application control domains included in this initial version are applications for sensing system control, pricing and demand response, and load control. This paper introduces smart home interfaces and system definitions to enable interoperability between ZigBee devices generated by various electrical equipment manufacturers, meters, and products enabling smart energy[5]. This research uses wireless sensor networks (WSNs) and power line communications (PLCs) to introduce a smart home control network. The goals are to reduce the effect of wireless interference on a smart home control network and a smart home's excessive energy consumption. In each room an isolated WSN with one coordinator is formed which is incorporated into the PLC transceiver. The coordinator is responsible for the transfer of environmental parameters that WSNs obtain through PLCs to the management station. The control messages for the home appliances are passed directly using PLCs instead of WSNs[6]. The paper presents Smart-BIM composed of smart objects that can react to user activities. The virtual space created with Smart-BIM is distinct from traditional 3D space. Since the resulting space represents smart objects with the ability to perform certain functions and respond according to the property sets of objects to user's interaction. The use of Smart BIM in a design process is proposed for a task-based interaction. Smart Design systems help end users experience their everyday behavior in a simulated world and understand the reactions in space. It can be used as a toolkit to improve contact between users and designers in design processes, in particular when designing smart environment[7]. This paper demonstrates the adaptability of the smart-home domain approach for three-dimensional gestures. It defines the elicited gestures and introduces the first implementation of a user interface based on such gestures[8]. Smart Home has promised to deliver better quality of life by linking devices in-house and tracking their use. Such platform-based configuration technology has demonstrated the potential for enhancing comfort, wellness, safety and security, and energy efficiency-both at home and in the workplace. In addition, because these innovations promote the independence of consumers, Smart Homes can be both a solution to an aging workforce as well as a potential market for an aging client base. Nevertheless, consumer penetration so far has been largely confined to the luxury segment and the more simple stand-alone technologies[9]. Global climate change, population transition and accelerating day-to-day mechanization will go hand in hand with new ways to live. Extreme temperatures, an aging population and higher demands for comfortable living would result in the introduction of sensor-based networks to establish reasonable and

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improved living conditions. Initially, the concept of a smart home mainly supported the efficient use of energy and the optimization of ventilation systems linked to new ways of building[10].

METHOD

Cloud Backend Services:
IBM Cloud was selected as a solution to ease implementation of the final application model. IBM Cloud, its application model for the Platform as a Service (PaaS), is entirely developed on Application Foundry, an open source technologies. There have been 5 data centers around the world as of today. This configuration allows the selection of the most suitable place for deployment based on a geographical location or need. IBM Cloud mediates access to Cloud Foundry containers where you can deploy applications written in multiple programming languages. There are also hundreds of utilities that can be used by IBM, third-party businesses, and by groups through a PAYG (pay as you go) model. Last but not least, the cloud provides complete support for the concepts of DevOps (development & operations) and CI (continuous integration) so that the entire lifecycle of application creation, construction, testing, automated delivery and management can be managed off premise in the cloud.
Internet of Things (IoT) platform:
The Internet of Things (IoT) platform is a layer of connectivity that enables multiple entities to interconnect together. These may be physical devices or sensors that emit interesting data, actuators for monitoring the world's surrounding states or entities without physical representation. In certain cases, certain program codes merely know these. If the physical device cannot connect directly to the IoT platform, another component is required which mediates this connection. Typically the part is called a gateway. It can be physical or dependent on application.

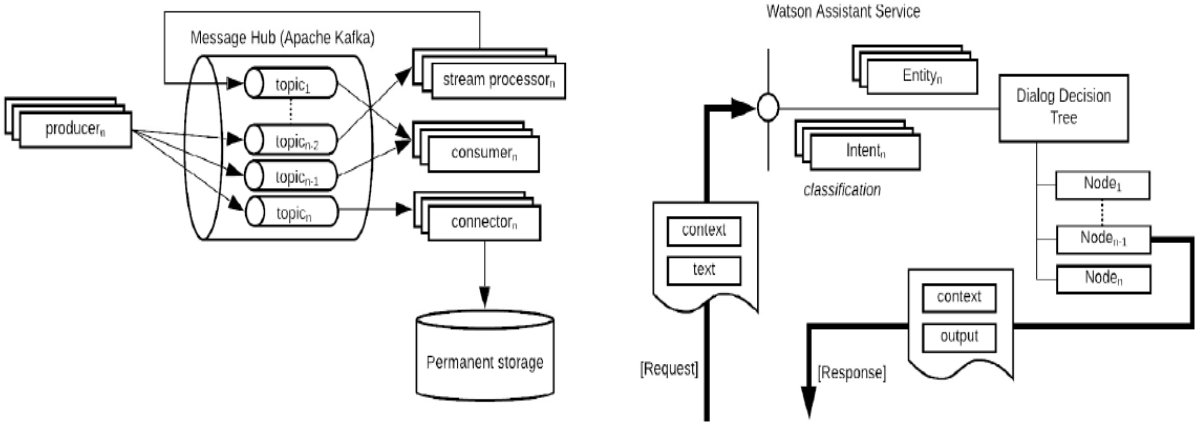

Fig.1: Simplified View on IBM Message Hub Application Service Which Sits on Apache Kafka

Message Hub:
With a Message Centre, it is possible to solve the problems with continuous storage and handling of the huge amount of messages in a scale able way. The Message Hub is an IBM Cloud application framework based on Apache Kafka, a high-through-source distributed messaging system that offers a low-latency platform for handling real-time data feeds. With respect to messaging, Apache Kafka manages the distribution model both for queuing and for publish-subscribe. In this definition a specific subject is understood more as a stream of messages that are published on one side by producers and consumed on the other by subscribing consumers. The posted messages are stored persistently in a collection of broker's retention time for each topic can be defined separately and thus windows of incoming messages can be managed which the topic is able to store persistently. A concise description of how the Message Center routes the producers 'messages to consumers.
Since Apache Kafka is not only a messaging program, but it also provides streaming capabilities, messaging streams can be easily processed as they occur, and all typical operations want to be reduced or aggregated, which can result in some table. In addition, various operations such as map, filter, or join can be performed on the table and resulting data can be transformed back to a stream and routed to Apache Kafka again. This approach significantly enriches message processing and allows the Smart Home input control system to be easily built or anomalies detected.

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Last but not least, Apache Kafka also provides a Connector API, which allows the development of a custom client that moves data into permanent storage – server, SQL database, NoSQL / Document database or Hadoop Distributed File System (HDFS). In addition, data analytics can be used in these data stores.

Natural Language Interface Services:

In particular, cognitive computing and IBM Watson are applied to engineering and science professionals as advisors or assistants by interactions using natural language. One use case pattern, which IBM Watson services solve, is called Involvement. Engagement includes holding a dialogue with end-users to answer the questions and communicate in a manner that is very similar to human behavior.

Human interface devices:

Because the cloud holds the most details about the Smart Home, it allows a user interface (UI) to be installed on multiple human interface devices (HID). The Smart Home's overall architecture is presented. The user interaction with the Smart Home can be achieved through an integrated control panel that either applies its own logic or simply displays the cloud control center. The same holds true for laptops and mobile phones. There may be hardware-dependent, native applications or open web browsers prepared in responsive design with the Cloud Control Center.

CONCLUSION

The article explains the Smart Home practical implementation, based on standardized KNX technology. KNX is the transparent organization, offering few ways to integrate it with other structures. These are being discussed. The main component of the proposed framework is the cloud-based IoT platform that provides an interface layer for all sensors and actuators mounted in the Smart Home Nonmatter, whether linked through the KNX bus, directly to the IoT network through the Internet, or intermediately through the IoT gateway (e.g. Bluetooth-based sensors).

Message Hub software, which wraps the open source Apache Kafka – a distributed fault-tolerant streaming and storage platform suitable for real-time data analytics and processing, has enabled data processing on the cloud site. It helps us to link many types of staff from the IoT platform that deal inside coming events. By sending commands back to the IoT network, notifying end users via email, etc., the staff will influence the Smart Home sys-tem. The implementation of Apache Kafka a streaming platform generally offers new possibility-itie display toper shape processing of IoT data from various sensor forms.

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