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A SURVEY ON STRUCTURAL HEALTH MONITORING BASED ON INTERNET OF THINGS

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Abstract: Internet of Things (IoT) has recently received a great attention due to its possible and capacity to be unified into any complex system. As a result of rapid development of detecting technologies such as radio-frequency identification, sensors and the convergence of information technologies such as wireless communication and Internet, IoT is emerging as an important technology for monitoring systems. This paper review and introduces a framework of structural health monitoring (SHM) using IoT technologies on intelligent and consistent monitoring. This technology involved in IoT and SHM system implementation as well as data routing strategy in IoT environment are presented. As the amount of data generated by sensing devices are huge and faster than ever, big data solutions are introduced to deal with the complex and large amount of data collected from sensors installed on structures.

Keywords: Structural Health Monitoring, Wireless Sensors Network, Radio Frequency Identification

1. Introduction

The Internet of Things is defined as the physical devices, objects and buildings fixed with the software, electronic sensors, and network connectivity which facilitate these objects to collect the data and exchange data within them. IoT has fast become an attractive topic for researchers and industries. Its integration into

monitoring systems like SHM will be useful to Industries, businesses, consumers, environment, individuals, and society. The idea behind SHM is to collect data from multiple sensors installed on structures in order to process and abstract useful information about current state of the structure for maintenance and safety purpose.

The collective of data sampling that will be collected from smart structures will be so large and complex that it will become difficult to use the traditional data management systems to handle and process such data, hence the appearance of big data technologies, which can be used to store and process large amounts of monitoring data. Any objects able to sense, send or receive digital information are connected to the Internet using IP. In some case, an IP proxy or software able to convert IP into dedicated wireless protocol is used to ensure continuity between a sensing object that cannot support IP and Internet. IPs to communicate among themselves and share information about their environment anytime from anywhere. Wireless sensors network (WSN) is considered as one of key technologies of IoT .

2. Related Work

Objects connected to the Internet can be mobile phones, cameras, home appliances, city infrastructures, medical instruments, and plants or vehicles equipped with sensors. This concept is associated with the Internet of Things (IoT). The term, it is and "Things," where the Internet is known as the global system that use TCP/IP protocol suite to interconnect different computer networks, while Things refer to any objects that frame us and have the capability to sense and collect data about its environment. Therefore, it can be defined as a global system based on IP suite, in which objects equipped with sensors, radio frequency identification (RFID) tags or barcodes have a unique identity, operate in a smart environment and are effortlessly integrated into the information network by using smart interfaces.

L. D. Xu et. al., proposed Sensing devices are arranged in network to seamlessly collect and send in real-time raw data through the Internet to reach a data center. End users can remotely control the devices using Internet services. They can also access the data center via the Internet anytime from anyplace in order to retrieve, process, and analyze data [1].

S. Madakam et. al.,, proposed the development of IoT systems depends on standards and protocols stacks available for interconnecting small and low-power devices as well as a data agent or an application. Various technologies are involved in its paradigm [2].

M. R. Palattella et. al., used the advanced message queuing protocol, and message queue telemetry transport, which are effectively used to interconnect and control remotely IoT devices, broker or gateways as

depicted in [3]. semantically related to two words "Internet"

P. A. C. da Silva Neves et. al., proposed the limitation in resources of sensor networks based on IEEE 802.15.4 standard, the key contest that needs to be taken into consideration is how to successfully adapt IP stacks on WSN. Different solutions have been developed in recent years as showed in [4]– [6].

J. Ko et. al., proposed the another protocol proposed isknown as RPL, which is the acronym of routing protocolfor low-power and lossy networks [7], [8].

3. Proposed Work

It is simple to understand and interpret and able to handle both numerical and categorical data, which requires little data preparation, for possible to validate a model using statistical tests, performs well with large datasets. It is robust, which means that performs well even if its assumptions are somewhat violated by the true model from which the data were generated. The health care production has emerged the reliable early detection systems and other various healthcare related systems from the experimental and analytical data.

We propose the improved data mining algorithm such as AdaBoost classifier collection for healthcare systems. These results evaluated and our current system is accurately predicting the result from the large amount. of data. Finally our experimental result shows our proposed method can achieve. moreaccuracyresult. The proposed system improving the performance by retrieving the data without wasting the time. Some of the process are used they are 1. Preprocessing 2. Anomaly Detection 3. Clustering 4. AdaBooster classification algorithm.

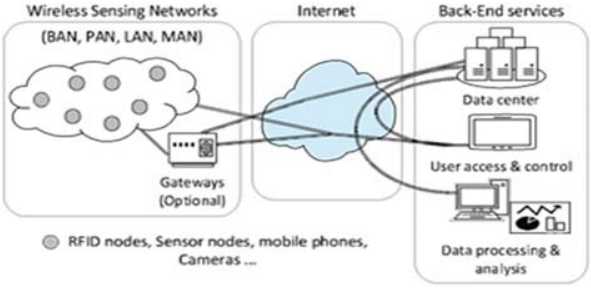

Fig 1: Public Auditing

3.1. Preprocessing

Pre-processing is a technique that involves transforming unprocessed data into a reasonable format. Real-world data is often incomplete, inconsistent and lacking in certain behaviours, and is likely to contain many errors. Data pre-processing is a proven method of resolving such issues. Data pre-processing prepares unprocessed data for further processing. Data pre-processing is used on database determined applications such as customer relationship management and rule based applications.

3.2. Anamoly Detection

In data mining, anomaly detection is referred to the identification of items or events that do not conform to an expected pattern or to other items present in a dataset. Typically, these anomalous items have the potential of getting translated into some kind of problems such as structural defects, errors or frauds. Using machine learning for anomaly detection helps in enhancing the speed of detection. Machine learning for anomaly detection includes techniques that provide a promising alternative for detection and classification of anomalies based on an initially large set of features.

3.3 Clustering

Clustering is the grouping of a particular set of objects based on their characteristics, aggregating them according to their similarities. Regarding to data mining, this methodology partitions the data implementing a specific join algorithm, most suitable for the desired information analysis. In the other hand, soft partitioning states that every object belongs to a cluster in a determined degree. More specific divisions can be possible to create like objects belonging to multiple clusters, to force an object to participate in only one cluster or even construct hierarchical trees on group relationships.

3.4. Anamoly Detection

Boosting is a used for recovering the presentation of a weak classifier by using it within an ensemble structure, the most significant AdaBoost method is used in this structure. In Boosting methods a set of weights is maintained across the items in the data set, so that items that have been complicated to classify because it obtains more weight, some of the forcing consecutive classifiers are focus on them. These methods work done repeatedly and running a learning algorithm on various distributions over the instruction data, and then combining the classifiers which are produced by the beginner into the single composite classifier. AdaBoost as classifier ensembles on categorization accuracy. The Consequences of choosing different base classifier are monitored. In our case we used a different type of decision tree algorithm, such as Decision Stump, J48, ADTree, LADTree and BFTree.

4. Conclusion

Despite the incredible technologies developed in recent years, there is further development including virtualization of sensors and IoT devices, scalability, heterogeneity, interoperability, and security to take full advantage of systems-based IoT. Furthermore, techniques for IoT integration into SHM in order to effectively achieve real-time data collection, data processing, event-driven, and real-time decision-making should be taken into account for future research. The next step of this paper will focus on remaining challenges and the development of an SHM application based on IoT by implementing and testing the framework described in this survey. In addition, various algorithms for damage identification purpose in structures will be proposed using Spark libraries, respectively, for machine learning and graph analysis.

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