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NAVIGATING DATA MANAGEMENT CHALLENGES IN INTERNET OF THINGS. A DEEP DIVE INTO HETEROGENOUS DATA STORAGE SOLUTIONS

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Abstract: The Internet of Things is a networking standard that connects various hardware, including digital, physical, and virtual things that may communicate with one another and carry out user-requested tasks. Traditional database management methods cannot be used in this entity because of the variety, large volume and heterogeneous data generated by them. The rapid growth of heterogeneous data can only be managed by distributed and parallel computer systems and databases. When it comes to handling vast amount of diverse data, most relational databases have a variety of drawbacks because they were designed for a certain format. One of the most difficulties in data management is investigating such heterogeneous data. Consequently, IoT data management system design has to be considered with some distinct principles. These various guiding concepts enable the suggestion of various IoT data management system strategies. The solution should provide a unified format for the conversion of various heterogeneous data which are generated by the sensors. The integration of generated data is made simple by some middleware or architecture-oriented solutions. Other methods also offer effective storage of the unified data generated. This paper surveys the challenges of IoT Data management and provides a survey about the storage of heterogeneous data and the type of data used.

I. INTRODUCTION

The Internet of Items (IoT) is a live, expansive network infrastructure in which things are recognisable, independent, and self-configurable [2]. The subsystems can interact with one another by exchanging data that is produced through sensing and responding to control the physical world by starting operations [1]. The sources of data, the collecting of data, and the processing of data are just a few of the different characteristics of data in the IoT [2][3]. As shown in Figure. 1, these design primitives are arranged into three primary categories: data collection, data management system design, and processing. The detection and identification of Things and subsystems—which may be stationary or mobile—are the primary goals of data collecting elements. The IoT data repositories will receive the acquired data. The architecture of the data management system and the manner in which data will be archived are both covered by data management system design elements. The actual access

to data repositories is dealt with by processing components.

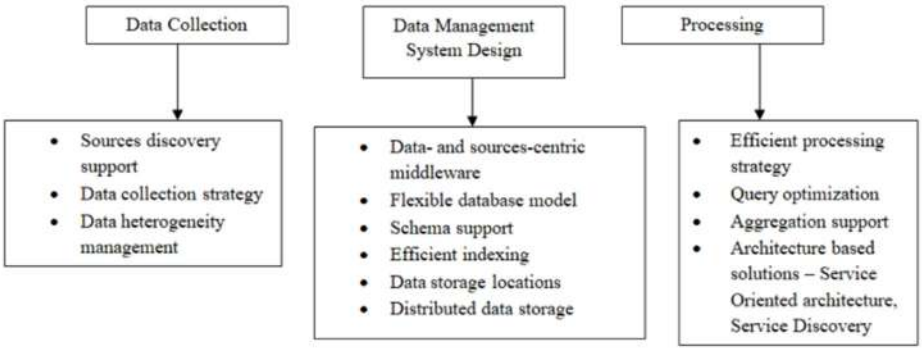


Figure 1. IoT Data Management Solution

This qualitative, phenomenological study's objective was to comprehend the many difficulties associated with managing IoT data. This demonstrates that IoT data management is the process of shifting through all available data to extract the most important information. Large amounts of mixed information are sent by many different devices for many different uses. Controlling all of this IoT data needs the development of new architectures, policies and procedures for collecting the data, transforming and analyzing the data which provides better results to the users of the application. Also this study helps to understand, how the various frameworks are storing the raw data from various sensors and other IoT devices.

II. LITERATURE SURVEY

Data management for the internet of things: design primitives and solution

Authors: M. Abu-Elkheir, M. Hayajneh

The Internet of Things (IoT) is a networking paradigm where interconnected, smart objects continuously generate data and transmit it over the Internet. Much of the IoT initiatives are geared towards manufacturing low-cost and energy-efficient hardware for these objects, as well as the communication technologies that provide objects interconnectivity. However, the solutions to manage and utilize the massive volume of data produced by these objects are yet to mature. Traditional database management solutions fall short in satisfying the sophisticated application needs of an IoT network that has a truly global-scale. Current solutions for IoT data management address partial aspects of the IoT environment with special focus on sensor networks. In this paper, we survey the data management solutions that are proposed for IoT or subsystems of the IoT. We highlight the distinctive design primitives that we believe should be addressed in an IoT data management solution, and discuss how they are approached by the proposed solutions. We finally propose a data management framework for IoT that takes into consideration the discussed design elements and acts as a seed to a comprehensive IoT data management solution. The framework we propose adapts a federated, data- and sources-centric approach to link the diverse Things with their abundance of data to the potential applications and services that are envisioned for IoT.

Data management techniques for Internet of Things

Authors: Bassirou Diène

Internet of Things (IoT) is a network paradigm in which physical, digital, and virtual objects are equipped with identification, detection, networking, and processing functions to communicate with each other and with other devices and services on the Internet in order to perform the users' required tasks. Many IoT applications are provided to bring comfort and facilitate the human life. In addition, the application of IoT technologies in the automotive industry has given rise to the concept of Industrial Internet of Things (IIoT) which facilitated using of Cyber Physic Systems, in which machines and humans interact. Due to the diversity, heterogeneity, and large volume of data generated by these entities, the use of traditional database management systems is not suitable in general. In the design of IoT data management systems, many distinctive principles should be considered. These different principles allowed the proposal of several approaches for IoT data management. Some middleware or architecture-oriented solutions facilitate the integration of generated data. Other available solutions provide efficient storage and indexing structured and unstructured data as well as the support to the NoSQL language. Thus, this paper identifies the most relevant concepts of data management in IoT, surveys the current solutions proposed for IoT data management, discusses the most promising solutions, and identifies relevant open research issues on the topic providing guidelines for further contributions.

Data Management Mechanisms for Internet of Things: A position paper

Authors: Ousmane Diallo

Internet of Things (IoT) is a network where several and various interconnected, smart objects continuously generate a large amount of data transmitted over Internet. Several efforts and research works in IoT focused on hardware constraints, low-cost, application design, as well as good communication technologies. However, due to the intrinsic characteristics of diversity, heterogeneity, large-scale, dynamic and large volume of data generated and various IoT applications needs, using traditional database management mechanisms and analytics architectures is not generally suitable. Then, it is challenging to provide efficient IoT data storage and query processing mechanisms for satisfying IoT application needs. This paper identifies the main specifications and mechanisms of data and query management for IoT and classifies them. Moreover, this work presents advances on data and query management mechanisms on IoT, shows their advantages and limits and discusses the challenging open research issues that need to be addressed for providing guidelines for further contributions.

III. SYSTEM ANALYSIS

Existing System

Framework that stores the large number of data on cloud with less storage space. This framework is provided with several data compression techniques such as AES encryption methods with the increase in data security. Additionally, the framework demonstrates how data interacts with reporting and analytical tools via the cloud.

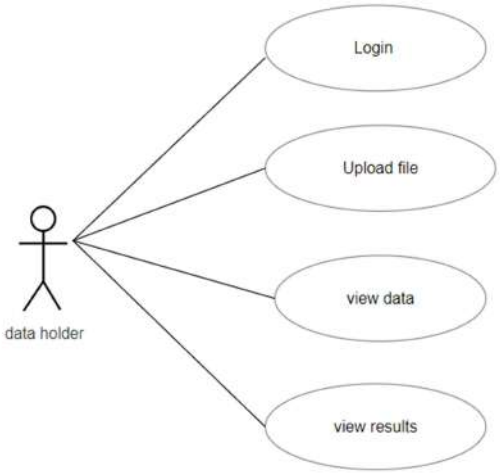
IV. SYSTEM DESIGN AND DEVELOPMENT

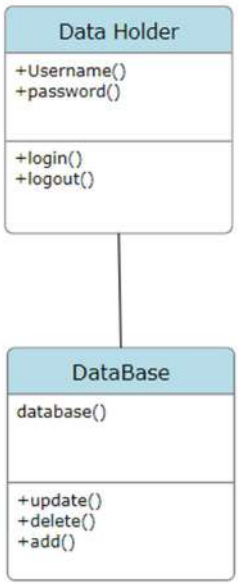
INPUT DESIGN

Input Design plays a vital role in the life cycle of software development, it requires very careful attention of developers. The input design is to feed data to the application as accurate as possible. So inputs are supposed to

be designed effectively so that the errors occurring while feeding are minimized. According to Software Engineering Concepts, the input forms or screens are designed to provide to have a validation control over the input limit, range and other related validations.

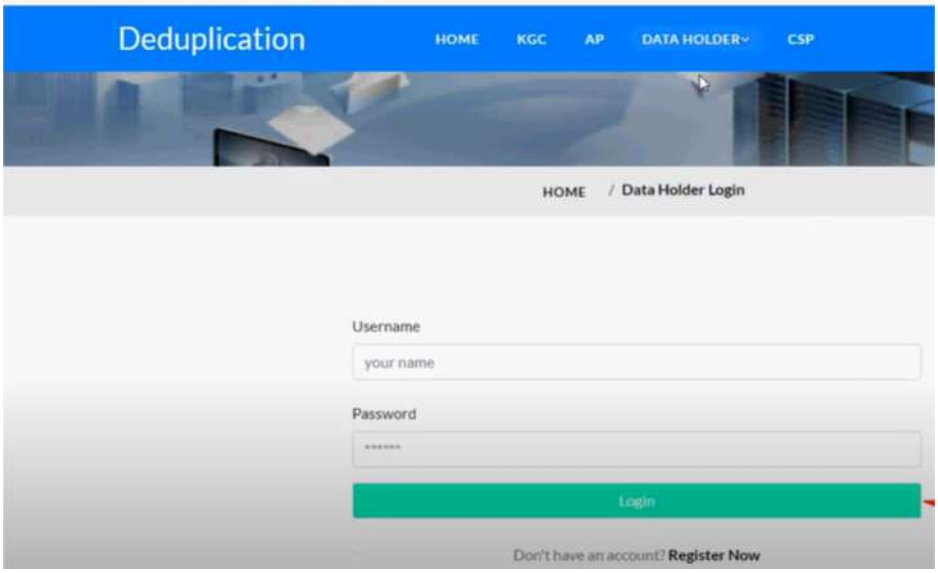
This system has input screens in almost all the modules. Error messages are developed to alert the user whenever he commits some mistakes and guides him in the right way so that invalid entries are not made. Let us see deeply about this under module design.

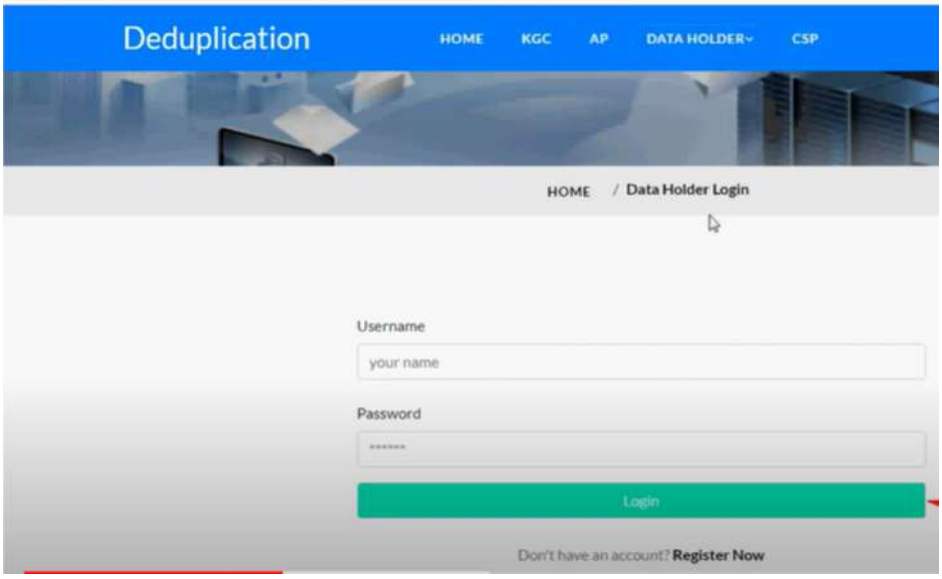




RESULTS OF THE STUDY

This study contributes to the discovery, that traditional data management solutions cannot handle the vast volume of data produced by diverse IoT devices. The data available from the various connected sources are in different formats. The time can be saved by considering the unified data format for processing the data received from the connected objects. A storage management solution has to be identified with the needed algorithms to increase the speed of the analysis in order to get the proper results of the applications. Also found that the task can be automated which can save the time of processing. Some of the tools are identified which helps to collect, transform and process the data.

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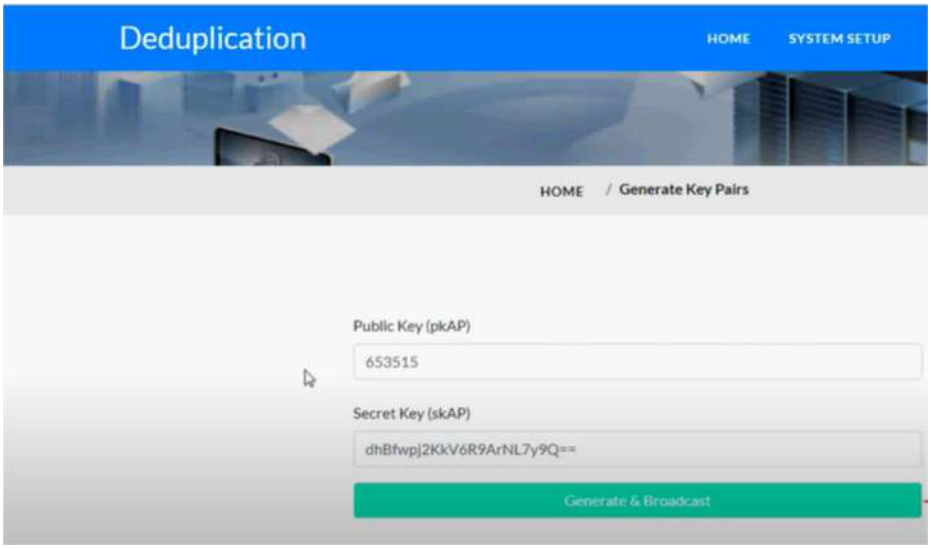
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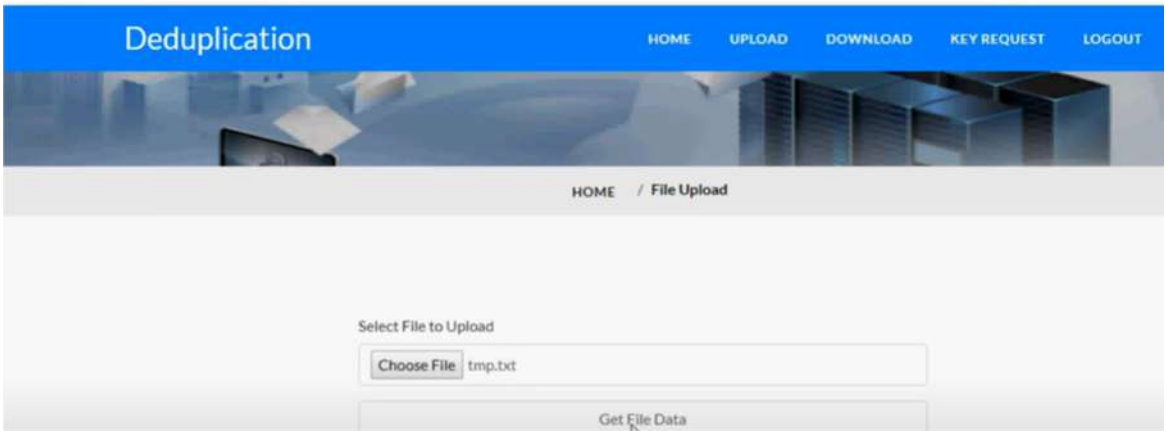
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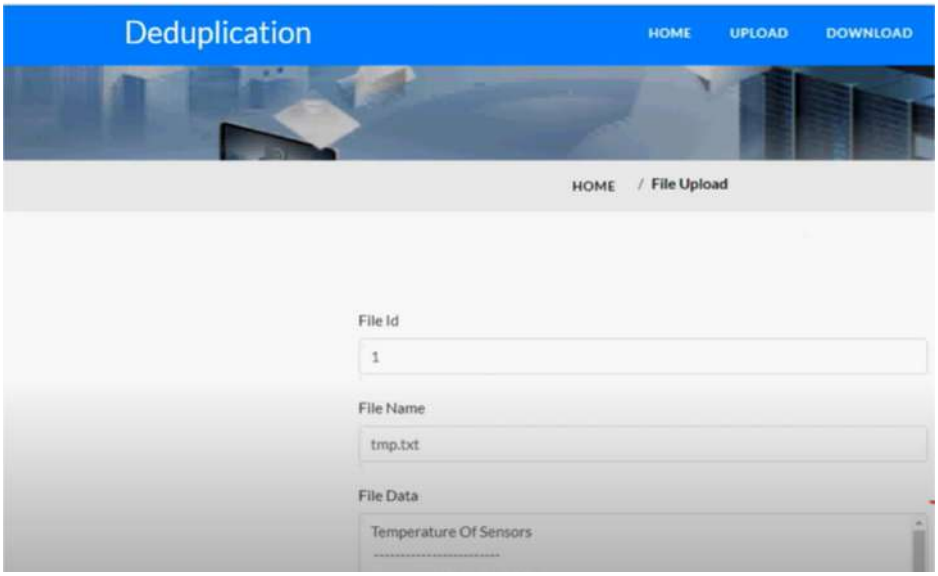

V. CONCLUSION

The issues of managing IoT data are discussed in this study, along with a survey on how heterogeneous data is stored. Various frameworks presented give the detailed description about the storage of the data from the IoT resources.

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