Business Intelligence Platform for Projects Related to the Internet of Things

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***Abstract* —**

The exponential growth in the number of connected objects is evidence of a particularly impactful trend in the digital world, driven by the uses of the general public. This innovative technological trend will also have a strong impact on companies, bringing changes to the management of the large amount of data that comes from connected objects. To ensure better management of this data, we have proposed a business intelligence platform called tGRC (Governance, Risk Management and Compliance related to IoT) as a suitable solution for this area.

We believe that this platform is much more important for connected objects because of the heterogeneity of objects, the more or less controlled access to their data and the way their data can be used. Moreover, it is essential that a significant part of the tasks is effectively automated in order to guarantee homogeneous operations when making decisions in compliance with the rules and controlling the risks.

Keywords: Internet of Things, Business Intelligence, tGRC (Governance, Risk Management and Compliance)

I. INTRODUCTION

Increasingly, the Internet of Things (IoT) is invading our daily lives. Connected objects make our lives easier in the rainy domain.

Today, the Internet of Things (IoT) is experiencing accelerated development since the Covid-19 health crisis, the confinement and the new lifestyle habits of users.

The IoT will never stop; billions of objects connected to the Internet will collect data and be at the origin of a flood of information. The problems that arise are the management of this large mass of data collected by these billions of connected objects, the processing of events and computing power, and also the security and confidentiality of personal data.

In order to overcome these problems, we will adapt as a solution the tGRC approach that simplifies the management of the network as well as the management of the huge amount of data from connected objects to meet the needs.

The expected goal is to have a tGRC platform, which can support all decision-making processes from the extraction of data from the database to the dissemination of reports, with the aim of offering decision support and allowing managers to have an overview of the activities processed.

II. INTERNET OF THINGS

The Internet of Things (IoT) refers to all sensors and objects – excluding smartphones and tablets – connected to the Internet to inform the user of the status of the device with which they are associated. But the concept is not limited to the hardware – the device – it also includes connectivity, which depends on the uses to best transmit the data, as well as the software to perform the analysis of this data on a cloud platform.

Connected objects are deployed as well to the general public, to allow the user to manage his home or health, and to manufacturers to optimize their business processes. [1]

A. What is a connected object?

It is an electronic device that can communicate with a smartphone, a touchscreen tablet, a watch, a computer or a television. Communicating means that it can send and receive information, through a wireless, Bluetooth or Wi-Fi link. [2]

According to Thierry Fabing, Deputy Digital Director, AXA France:

"Objects connected to the Internet network which, on the one hand, are objects that have already existed for a long time but are now becoming intelligent and are able to interact and which, on the other hand, are more recent objects in full swing through the contribution of connectivity".

Connected devices (IoT)) rose to (20.35 billion in 2017 from 15.41 billion in 2015 and are expected to reach 51.11 billion by 2023, given the huge surge in investment by technology providers through continuous research and development. To use this increasing number of connected devices and machine-to-machine connection in the manufacturing industry, the need for control and monitoring should become more important; this can be attributed to the increase in devices and systems connected and controlled by the network. [3]

B. connected objects and the Covid-19 crisis

The Covid-19 crisis and the confinement have had an unprecedented impact on society and the economy. Consumer behaviors and expectations have evolved. The adoption of digital technology to overcome the constraints of confinement has accelerated and not only to allow teleworking.

According to the third barometer, French people and Connected Objects, conducted in September 2020 by IFOP

for Boulanger, French people no longer consider connected objects for their security utility or to save time, but as real objects for the improvement of the quality of life. The IoT is closer and more "human".

"There is a shift in the image of connected objects from performance to comfort, timeshare quality and entertainment. The connected object makes it possible to reclaim one's home. Beyond the Covid effect, it is indeed a sustainable trend that seems to be setting in motion. The French are refocusing on their homes and anticipating the increasing time they will spend at home, whether through the deployment of teleworking, or the relocation of leisure activities within the home," says Claire Verbrugge, Marketing Director at Boulanger.

According to the figures, 17% of French people bought a connected object during the confinement. Nearly half of French people who bought a connected object during the confinement did so to improve the comfort of their home, 36% to keep in touch with their relatives. [4]

To ensure effective management of the large amount of data recovered by these connected objects, Business Intelligence (BI) techniques are necessary.

III. BUSINESS INTELLIGENCE (BI)

Business Intelligence refers to the set of technologies that allow companies to analyze data for the benefit of their decision-making. The term Business Intelligence (BI) refers to applications, infrastructures, tools and practices that provide access to information, and to analyze information to improve and optimize the decisions and performance of a company. In other words, business intelligence is the technology-driven process of analyzing data to uncover information that can be used to help business leaders and other end users make more informed decisions. [5]

A. Restitution tool and data analysis

To facilitate access to information for all users according to their business profiles and to extract decision elements to boost overall responsiveness in the company, some tools have been made available to decision-makers, including:

1) Dashboard: in business intelligence dashboards are used in companies to allow the visualization of raw data that aims to make them more accessible and understandable. This visualization gives meaning to this data by using different visual representations and different types of data prioritization.

A good dashboard sheds light at a glance on trends, performance and the path to travel to achieve the objectives that the company has set itself, and reduce any risk taking. [6]

2) Reporting: Reporting is "the set of reports allowing a company to monitor its activity and allows it to evaluate itself through the periodic creation of reports and analytical reports of its activity. These reports are often intended for the manager or the executive body."

The purpose of these regular reports and balance sheets is to make a punctual point on the company's strategy and thus make it possible to evaluate the means implemented. But they also provide decision support for the strategic and economic choices of the company.

B. OBJECTIVES OF BI

The reasons why companies use a decision-making system are common despite the variety of their fields of activity:

• Easy and fast accessibility to information.

• Consistency of information: system data is credible and of high quality.

• Adaptation to changes: Existing data should generally remain unchanged. When technology or needs change, data must be changed by making all users of the system aware.

• Presentation of information on time: Information must be available at the right time in order to react quickly.

• Protection and security of information: the system must allow access control to this confidential information.

• Conversion of the mass of data into a business value: the system, through analysis tools, makes it possible to identify a value that helps in decision-making.

• BI applications facilitate end-user access to information and enable the extraction of data needed for decision-making. [7]

The dashboard is a management tool, reporting is a control tool. some large companies have felt the need to detect and correct risks, also to protect confidential data and especially to have a means of helping to make major strategic decisions.

To do this, business leaders have adopted in-depth initiatives of Governance, Risk Management and Compliance, which is the concept (GRC).

BI centralizes the information and knowledge generated by the GRC approach that provides companies with an in-depth view of all aspects of corporate governance, risk management and compliance to provide a holistic view of business activity as well as decision-making support.

IV. WHAT IS GRC?

GRC is a synchronized approach to three areas, avoiding duplication of effort and ensuring the effectiveness of the approaches used.

GRC refers to an overall governance management strategy, enterprise risk management and regulatory compliance. To better understand, GRC should be seen as a structured approach to aligning IT with business objectives, while effectively managing risk and meeting compliance requirements.

A well-planned GRC strategy has many benefits: improved decision making, optimal IT investments, elimination of silos and reduced fragmentation between divisions and departments, to name a few. GRC can help you align your IT activities with your business goals, requirements, effectively manage risk and stay on top of compliance. [8]

In 2019, there were eight billion connected objects in the world, according to US research firm 451 Research, which predicts that number will be 13.8 billion devices by 2024. [1]

Behind connected objects lies an even larger universe: that of data. And while there are undoubtedly challenges in

designing connected hardware, it is in the data that the real potential of the IoT lies.

To ensure that this data is managed and that these networks of objects function properly, it seems more promising to us to integrate these functionalities into a more general framework of governance, risk management and compliance, which is the tGRC approach.

V. THE TGRC APPROACH

The definition of tGRC follows the principle of classic GRCs, adding the specific features of loTs and adding, in particular, the loT project management part in the governance part and diagnosis and corrective maintenance in the risk management part. In addition, it only integrates processes that can be automated.

GRC + IoT + BI = tGRC

Here is a more precise definition of the three dimensions of tGRC:

A. Governance

Governance concerns the management of the Internet of Things project, and also defines the modes and tools for monitoring the system during its operation in real time, as well as the adequate metrics to evaluate the indicators for strategic decision-making and reporting by BI tools, for example. This level also implements automatic mechanisms for readjusting the system to meet predefined risk levels and compliance with standards and regulations.

B. Risk

Defines how to manage technical or management risks. This dimension must be able to identify, assess, analyze and respond to the various risks involved.

C. Compliance

Ensures the alignment of the IoT project with the various regulations and standards, the respect of the law, the security rules, the privacy rules, the internal rules of the organization. In this dimension, business rules are defined.

VI. BI AND THE TGTR APPROACH

Business Intelligence centralizes the information and knowledge generated by the tGRC approach, which provides companies with an in-depth view of all aspects of corporate governance, risk and compliance to offer a global view of the company's activity and support for decision-making.

This tGRC approach is fed by data processed by a business intelligence platform and feeds the same platform with risk and compliance analysis results and guidance from the governance side.

To illustrate the integrated tGRC approach, we opted for a real case study in the context of "Algerian Water" organization.

VII. PRESENTATION OF THE HOST ORGANIZATION « ADE »

A. Knowing the ADE

The **Algerian Water** (ADE) is a national public establishment of an industrial and commercial nature with legal personality and financial autonomy. It was created by the executive decree n° 01-101 of 27 Moharram 1422 corresponding to April 21, 2001. The establishment is placed under the supervision of the Minister in charge of water resources, and its head office is located in Algiers.

B. Missions

The establishment is responsible for:

Within the framework of the national development policy: to ensure the implementation of the national drinking water policy throughout the national territory, through the management of production, transport, treatment, storage, conveyance, distribution and supply of drinking and industrial water as well as the renewal and development of the related infrastructures.

In this respect, it is responsible, by delegation:

The standardization and monitoring of the quality of distributed water; initiating any action aimed at saving water, particularly by improving the efficiency of transfer and distribution networks; introducing any water conservation technique; the fight against wastage by developing information, training, education and awareness-raising actions for users, the design, with the public education services, of school programs disseminating the culture of water saving; to plan and implement the annual and multi-year investment programs. [9]

VIII. STUDY OF THE EXISTING SITUATION

In order to have the right information and come up with a clear study of the existing of the ADE, we worked in collaboration with the following sources:

- The person in charge of the follow-up of the water quality (in charge of quality of the center).
- The director of the Laboratory of analysis and quality control (Oum El bouaghi).

A. Critique of the existing

The problems posed at the level of the ADE are:

- The storage of information

The problem of data storage exists in this organization, since these data are transmitted to the company by agents on sheets, and for the storage the employees use programs like EXCEL tables. This situation becomes unnecessary with the evolution of the strategies.

- Procedure: Management of non-conformities

In case of non-conformity, ADE follows the following procedure:

- The head of the center or the sector of the incriminated place must come on site to note the degree of water pollution on the network or at the customer's place.
- The head of the concerned center must isolate the network as soon as a health risk is noticed.
- The center manager must inform the unit manager, the Laboratory.

- The Center shall take corrective action and request a retest from the Laboratory.
- The Center shall take steps to inform of the restriction of water use for domestic purposes only and specify the alternative means for drinking water that will be implemented. This information is done by posting or door-to-door.
- The center informs the commune by fax or simple letter.
- As soon as the analyses indicate the return of the conformity of the water, the decision to put the network back into service is taken by the Head of the Center.
- The center must inform its subscribers of the return to service of the network.

It can be seen that these provisions are followed in an operational way (classic, traditional).

B. The Proposed Solution

After seeing the difficulties that ADE encounters, connected objects represent the most adaptable solution to this domain. For this reason, we think that the integrated tGRC approach is much more important for connected objects because of the heterogeneity of the objects, the more or less controlled access to their data and the way their data can be used. Moreover, it is essential that a significant part of the tasks are effectively automated in order to guarantee homogeneous operation when making decisions in compliance with the rules and by controlling the risks. When tens of billions of objects will be deployed, some data that must remain confidential will be accessible. It would be essential to have automatic tools that would enable networks of objects that meet specific needs.

We are convinced of the need to develop this type of tools for the IoT and we think that tools such as tGRC associated with business intelligence tools with a connected object that can measure or detected the concentration of one of the parameters in the water has been proposed to facilitate one of the activities of the procedure for managing a non-conformity of this organization, are good candidates to ensure these tasks, In order to concretize this approach for this area and to prove the automation of some tasks of this organization by the tGRC platform, and to ensure effective management of the recovered data.

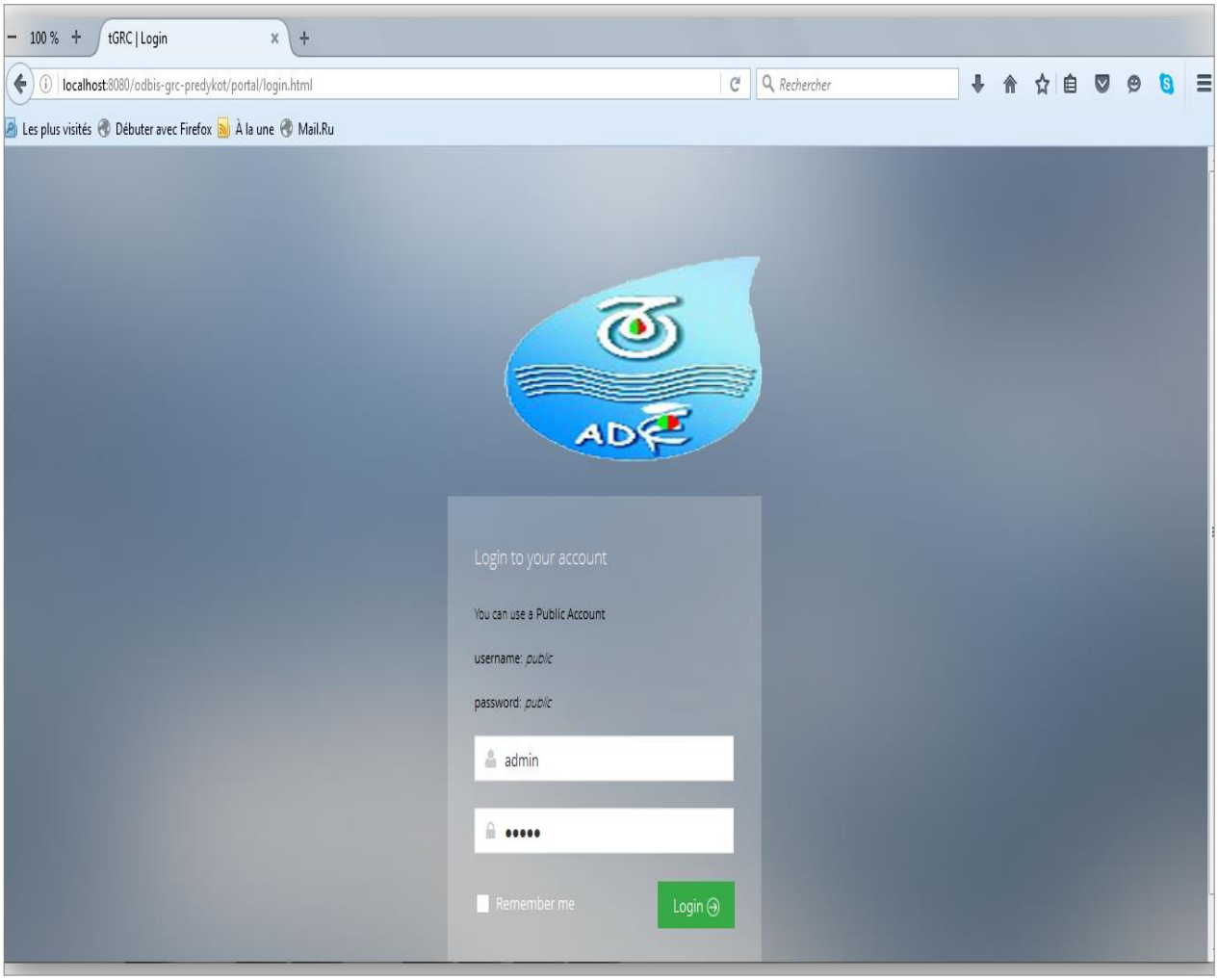

Fig. 1. system authentication page

C. *System objectives*

tGRC gives users an overview of the current situation of the targeted problems. It can be the starting point for a data overview. Users do not have to search for information through pages of useless data that are not meaningful. Instead, through certain predefined parameters, the data is logically organized and displayed through different types of graphs and tables on the dashboards. Users can make informed and evidence-based decisions based on the information on the dashboard, as the dashboard can identify and show the data calculated by the right parameters directly. Overall, the dashboard steering is like a compass, which allows users to analyze large amounts of complex data with visual and graphical reports. In addition, the dashboard direction also provides features such as data source management, define management, dashboard management and report data management. Users can create their own data source to connect to their databases. After that, they can define the dataset. This way, users can retrieve the data they are interested in through SQL queries.

Finally, users can create their own dashboard with their defined data. Data tables and different types of charts are supported by the dashboard. In addition, users can download reports with the reporting module and export these reports in different types of formats, including Word, Excel, pdf, power point and so on.

One of the goals of this project was to design a business intelligence platform that helps decision makers and managers make decisions based on the data received and interpreted in the form of a graph in what is called a Dashboard.

D. *Dashboard management*

- **Add a table:** Click on the "New table" button to add a table to this dashboard. Choose a dataset and the columns you are interested in. Then click on the "Preview" button to preview the table. Save the table. If you can't save check the table name field, as required. Click "show" to verify the table.
- **Add a chart:** click on the "New Chart" button to add a chart, we can add different types of charts

Choose a dataset, the category field and the value field you are interested in. Preview the chart and save it. If you can't save it, check the name of the graph, as required.

- **Edit the dashboard.**
- **Delete the dashboard.**
- **Previewing the dashboard:** To allow decision makers to view the data received from a connected object permanently and make decisions you should take a look at the dashboard by going to the "Governance" menu and choosing "Dashboard", the page below will be displayed:

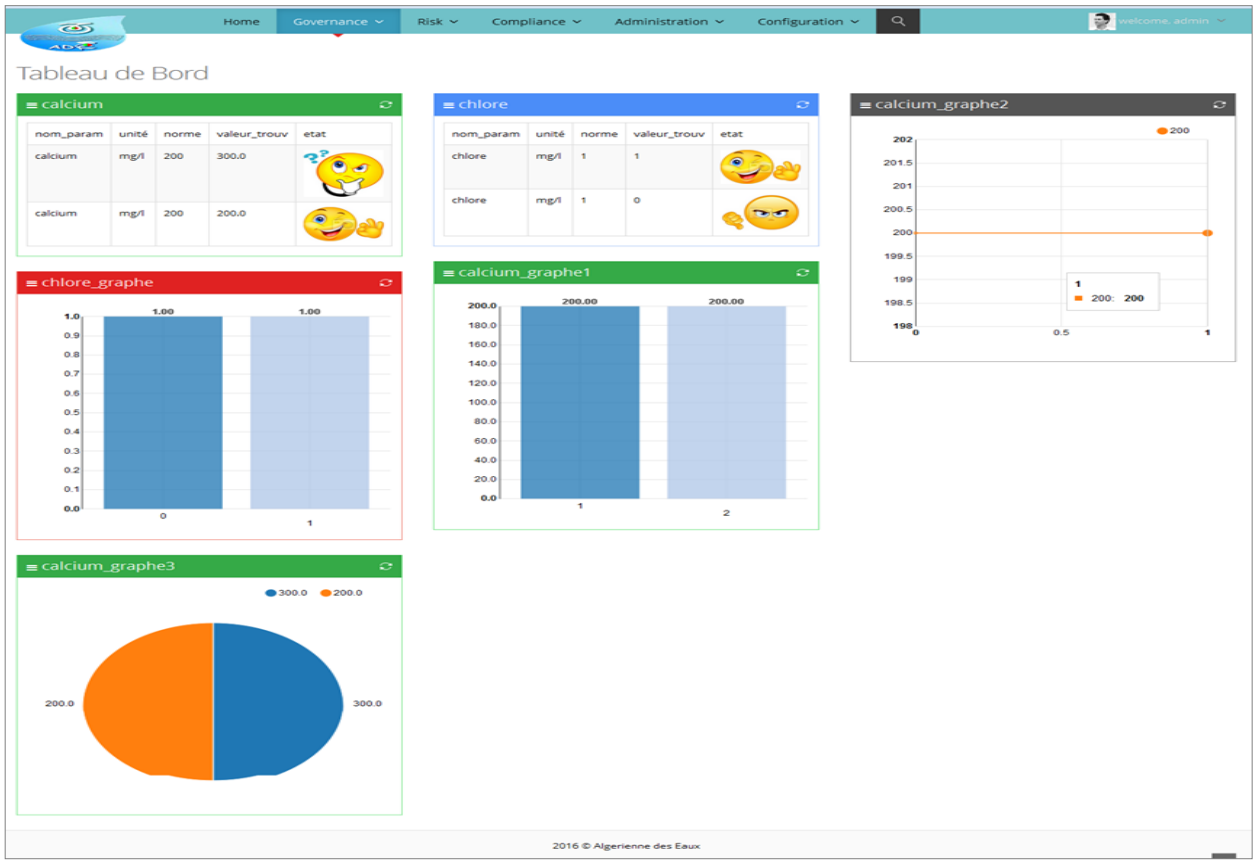

Fig. 2. An example of a dashboard on the tGRC platform

These smileys are presented as indicators to show that the result is good or not.
This platform is also designed to use another business intelligence tool which is reporting.
From this page you can do the following:

Download the report: click on the "Browse" button or drop the file on the empty area to download a new report.
After choosing a report, it will be downloaded automatically. And it will be presented in the following list.
View the report: you can click on the "view" button to display the report.
You can also click on the export button to export the report in Word, power point or PDF format.
Delete a report: in the list of reports, click on the "delete" button, a dialog box will appear to confirm the deletion.

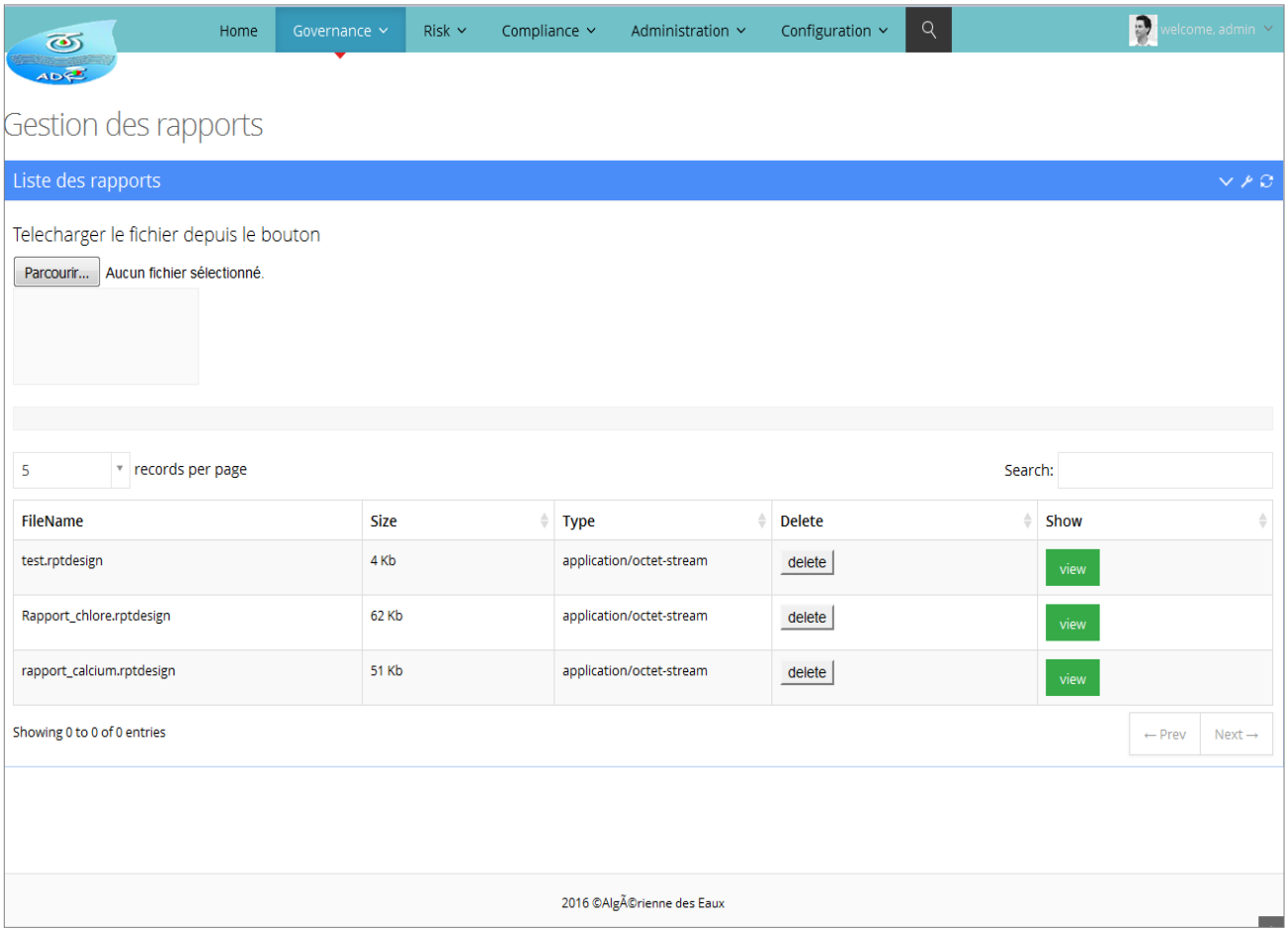

Fig. 3. An example of a report on the tGRC platform

IX. CONCLUSION:

Internet of Things (IoT) technology has tremendous and growing potential to connect objects, visualize data and interact with connected people in an efficient way. Recognizing this, a large volume of data is being generated which is constantly increasing.

The tGRC (Governance, Risk and Compliance for IoT) approach offers a better management and processing of this mass of data, with the aim of simplifying the decision-makers to have useful information that can help them to pilot more efficiently, and help them to take strategic decisions and react quickly, through the services offered by the Business Intelligence (BI) techniques

Several research and implementation perspectives are emerging from this work. Indeed, the realization of our tGRC approach has allowed us to identify several work perspectives:

- Exploiting Big Data techniques to manage and secure the large amount of information disseminated by connected objects.
- Exploiting Cloud Computing technology to migrate our application as a Cloud service (SaaS: Software as a Service).

Our work will always be open to criticism and suggestions that could readjust it, especially to improvements that could be brought to it by further studies. Our ultimate hope is that it will help users and that this study will be a model for others.

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