

Integration of IoT, Data Analytics and Mobile Application towards Digitisation Facilities Management: A Case Study

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Irwan Mohammad Ali¹(✉), Mohd Nasrun Mohd Nawawi², Md Yusof Hamid¹,
Fazly Izwan A Jalil³, Baharinshah Hussain⁴

¹Universiti Teknologi MARA Cawangan Perak, Perak, Malaysia

²University Utara Malaysia, Kedah, Malaysia

³Chulia Technology Sdn. Bhd., Kuala Lumpur, Malaysia

⁴Al Nabooda Chulia Facilities Management Co. L.L.C, Dubai, United Arab Emirates
i.airwan9471@uitm.edu.my

Abstract—Facilities Management (FM) industry players must be mindful of the current economic digitisation. It aims to empower the community and industry players with digital skills and digital-based businesses. Positively, this also will benefit FM industry players. Therefore, many FM organisations are starting to take advantage on IoT, big data analytics and mobile phone application in their activities. This paper utilised a literature review to discover the application of IoT, big data analytics and mobile application in FM processes. Then, a case study on Al Nabooda Chulia Facilities Management Co LLC (AN.C) success story as the recipient of Urbanise Smart City Pioneer Award 2017 were cross-examined on the tools they use in digitisation FM. The novelty from the integration of IoT, big data analytics and mobile phone application towards digitisation FM has significantly reducing management costs and improving facilities performance and service quality. The paper highlight an example of digitisation of FM activities that successfully optimising and innovating the current FM practices with the paradigm shift from cost management towards value creation in the future.

Keywords—internet of thing, data analytics, mobile application, digitization, facilities management

1 Introduction

In this digital era, most developed country is keen to be the champion of digital power. This new narrative of economic digitisation aims to empower the community and industry players with digital skills and digital-based businesses. This includes introducing new technologies considered essential tools in the digital economy.

Definitely, economic digitisation will also benefit Facilities Management (FM) industry players [1]. Generally, FM encompasses a wide range of disciplines. Its ultimate goal is to ensure the functionality, comfort, safety, and efficiency of the environment [2]. The process is developed by integrating people, places, processes, and technology.

Implementing economical and sustainable FM is very important for most organisations. This is achievable by optimizing expenditure costs, energy efficiency, reducing energy and water wastage, increasing staff productivity, as well as increasing the value of return on investment [3], [4].

This issue becomes more complicated with most of the existing building facilities becoming outdated and requiring complex observation and care. The most challenging part, building occupants and tenants always demand better, faster, and high-quality services. Therefore, the use of innovative devices and solutions that leverage real-time analytical data, is very helpful in operational decision making [5].

Recent studies show that it helps improve the operational efficiency of FM and adds value to the service provider. In other words, FM industry players demand a drastic transformation towards digitisation to keep relevant and competitive. Therefore, they need to build and develop capabilities in making operational decisions based on real-time analytical data in service delivery.

2 Facilities management (FM)

Generally, Facilities management (FM) is a multidisciplinary profession that integrates people, location, process, and technology to assure the built environment's functionality, comfort, safety, and efficiency [2]. According to [6], FM is the process by which an organisation provides and maintains support services that emphasis on the quality ecosystem to meet their strategic needs.

The FM ecosystem primarily is a hybrid management discipline, which blends the management of people knowledge, building and process [7]. In advance, FM is an integrated approach to maintaining, enhancing and adapting an organisation's buildings in order to encourage a productive ecosystem that supports its primary goals through effective decision making [8]–[10].

Hence, it will helps an organisation to improve and achieve a long-term sustainable and operational strategy [11], [12]. Moreover, it creates good business environment, improve building and facilities based on current business environment [10], [13]–[15]; in the context of FM digitisation. However, the variety of FM tools remains to be a challenge to the FM sector's adoption of digitisation technologies [16].

3 Internet of things, data analytics and mobile application

Over the last few years, the explosion of social media, smartphones, electronic and sensing-equipped devices, the Internet of Things (IoT) and big data analytics have changed lifestyle. Big data analytics, and IoT are just a few of the emerging areas of science and technology [17] that are creating the next generation of artificial intelligence-based computing systems [18], [19].

IoT is the evolution of the internet where processing devices embedded in routine ecosystems are able to send and receive data themselves [20]. Innovations in IoT and big data analytics have boosted the establishment of particular activities along with flexibility, precision and efficiency to business processes [21]. In addition, monitoring, controlling, and analysis are some of the applications of IoT in this industry [22].

Traditional data warehouses struggle to handle and analyse big data because of the 4Vs of big data: length, velocity, variety, and veracity. The term “big data” refers to the recent flood of various forms of data from various sources. Analytics is the analysis of data in order to discover important and significant patterns and trends [23].

Both support comprehensive real-time computations network by connecting humans, systems, services, devices, and things that empowering digitisation business operation [24]–[26]. Therefore, many FM organisations are starting to take advantage of the power of sensors, engage human resources equipped with mobile phone, cloud computing, high-speed networks, and data analytics [25].

However, keep in mind that IoT devices, data analytics and mobile applications has significant technical challenges as these devices are from different types, vendors, and product models [27].

4 Integration towards digitisation FM

At the moment, FM industry is experiencing a significant transformation of practices, processes, tools, and references. This is due to the application of innovative smart solutions including IoT, data analytics and mobile phone application which currently have capacity to enhance the conventional FM activities [28], [29].

Several FM organisations are already witnessing the potential of digitisation that can help them expand their business value [30]. The integration towards digitisation FM is not just a technological shift at the operational level, but also involves the strategic level of the top management that focuses on the different aspects of the built environment [31]–[33].

The interest at this time is not only to improve operational effectiveness alone but also to re-strategy processes, procedures, and activities that can predict events rather than to respond to them only. The current business condition significantly force them to migrate from conventional FM to new paradigm of predicting future trends through digitisation FM [28].

This is the turning point at which corrective or planned maintenance change to preventive and predictive maintenance with the aid of smart solutions. Therefore, FM performance must be attained and supported as much as possible through data analysis, failure predictability and optimised and standardised processes [28]. In fact, exploiting the digitisation FM requires a radical thinking in order to meet the client needs, ensuring their competitiveness and increasing their value.

5 Method

Primarily, this paper utilised a literature review to discover the application of IoT, big data analytics and mobile application in FM. Then, a case study on Al Nabooda Chulia Facilities Management Co LLC (AN.C) as the recipient of Urbanise Smart City Pioneer Award 2017 were cross-examined on the tools they use of IoT, data analytics and mobile application towards digitisation FM.

A case study being selected as the main research strategy to study and investigate the realism phenomenon of FM performance within single settings [34], [35]. Later, AN.C

performance is used to rationally discover the significant value and benefits of integrating IoT, data analytics and mobile application within the organisation.

6 Case study

Al Nabooda Chulia Facilities Management (AN.C) is an Integrated Facilities Management (IFM) service provider based in Dubai. AN.C was assigned to manage the operation and maintenance of Al Nabooda Automobiles’, a well-known automobile dealership. Working with high rank vehicles requires AN.C to execute equally high-quality FM services.

In 2017, Urbanise has awarded AN.C ‘Award of Smart City Pioneer’ for demonstrating that digitisation of FM can improve and add value to both, service providers and clients. They have improved their customers’ experience, strengthened their efficiency, increased energy saving and performance of the buildings and facilities they manage. It shows that they have already helped their client to realign focus on the core business activity [36].

AN.C FM teams optimistic that today is the “New Era” of service integration, energy management, business productivity and smart technology. FM service providers must be creative in order to stay competitive in the FM industry. Thus, digitisation FM is the smart solution to complement the excellence in the FM service delivery in conjunction with a paradigm shift from cost management towards value creation.

Figure 1 show AN.C strategies in order to excel in moving towards digitisation FM. The transformation from conventional FM practices which is move in silos, and then improve as consolidate practices. Later, FM activities and data were archived then integrate with data analytics tools to automate smart solutions.

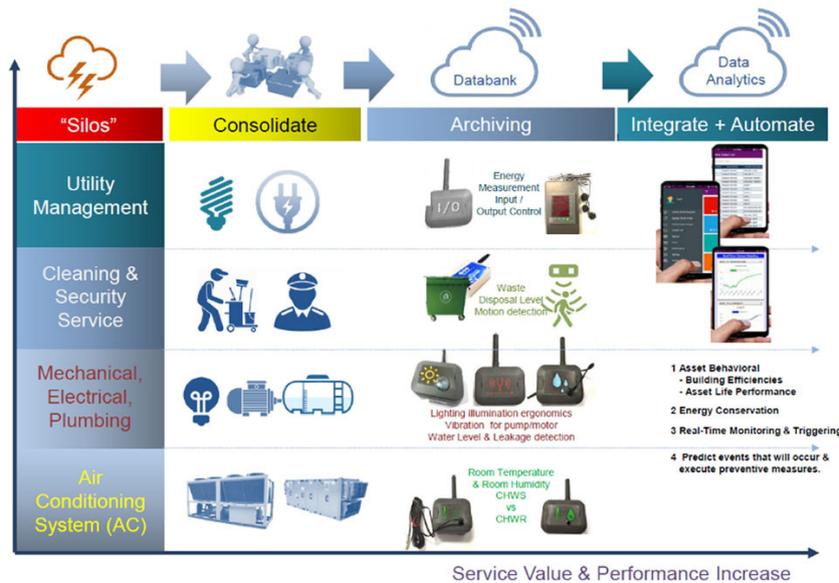


Fig. 1. Digitisation FM [37]

Being a leading FM Company, AN.C continues to expand its value-added offerings through innovation and technology advancements. As a result, AN.C had seen a huge opportunity to use the Urbanise IoT sensors to improve environmental and energy efficiency by real-time tracking and near process management with advance tools.

In the case of Al Nabooda Automobiles' showroom, sensor devices are used to monitor and manage lighting illumination and thermal comfort in the building. This is to ensure that brand compliance, customer comfort and equipment optimisation. Besides, flood sensors are often used to track sump tanks and sensitive IT installations.

Meanwhile, vibration sensors are used to monitor rotating equipment. Any abnormality automatically triggers alerts to the technical team on a real-time basis. Data analytics generate valuable evidence-based business insight that solves problems and improves business operations and efficiency. Hence, business intelligence has enhanced, service levels have improved, and made smart decisions for better investment [36].

6.1 Urbanise technology

Key building systems are equipped with small wireless sensor devices. It will detect changes in a given set of parameters and send out real-time data to Urbanise's central computing platform in the cloud. It can detect changes in a given set of parameters and submit real-time data to Urbanise's central computing platform in the cloud.

When a sensor moves beyond the set profile range, the cloud platform sends alerts to building maintenance personnel via mobile application and email. This allows the maintenance personnel to immediately identify the problem, respond and fix it.

The FM provider will use this data to implement a condition-based maintenance strategy that will minimise cost for service delivery. The following are some of the smart solutions initiatives implemented by AN.C at Al Nabooda Automobiles' showroom.

6.2 Wastewater frequent overflow

Connecting flood sensors in the wastewater tanks will facilitate to prevent wastewater become overflowing. This is a frequent event and major operational issue in most FM activities. When the wastewater reaches 80% of its capacity, this device sends alerts to maintenance staff.

Later, the maintenance team will coordinate specific times for wastewater clearance. This procedure absolutely eliminates the possibility of wastewater overflow while also reducing the expense and inefficiency of onsite inspection and maintenance. After the flood sensors (see Figure 2) were installed, customer reports have been completely eliminated.

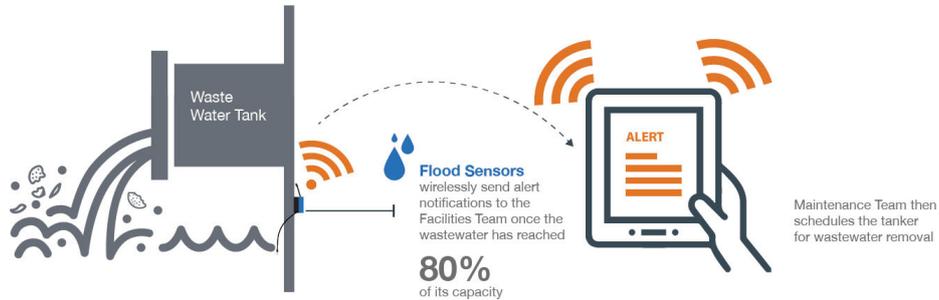


Fig. 2. Flood sensors [37]

6.3 Optimising customer comfort in showroom common areas

Currently, it is common to see showrooms constructed with glass façade. Unfortunately, in Dubai, the heat can reach the glass façade and significantly increase the temperature up to 50°C during summer. As a solution, the temperature sensor devices (see Figure 3) installed in strategic locations in the showrooms to track the exact temperature in the space.

Subsequently, this device will facilitate the HVAC system to adjust the temperature to reach an optimum comfort. This has provided the client with the possibility of a long-term saving in terms of lower energy and reduced maintenance costs. The most important thing has increased customer comfort and experience in the showrooms.

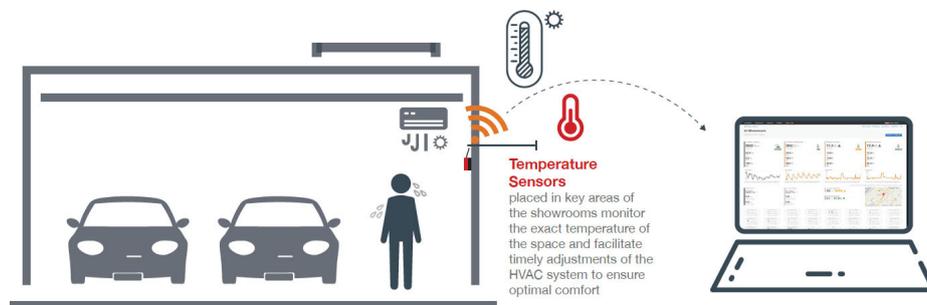


Fig. 3. Temperature sensors [37]

6.4 Improving safety in server rooms

Water leaks are common in server rooms (see Figure 4), particularly if the space is used chilled water air conditioning systems. In other situations, water leaks also may result from the failures of service pipes installed on the ceiling compartment. As a solution, this server room was installed with flood sensor devices to detect any potential water leaks that could damage server room equipment and data.

Simultaneously, ambient temperature sensor devices will monitor these section 24 hours a day. It will assist the maintenance team with real-time ambient temperature data that is used to measure the air conditioning performance. At the same time, it will help to avoid expensive equipment damage in the event of a power outage or equipment failure.

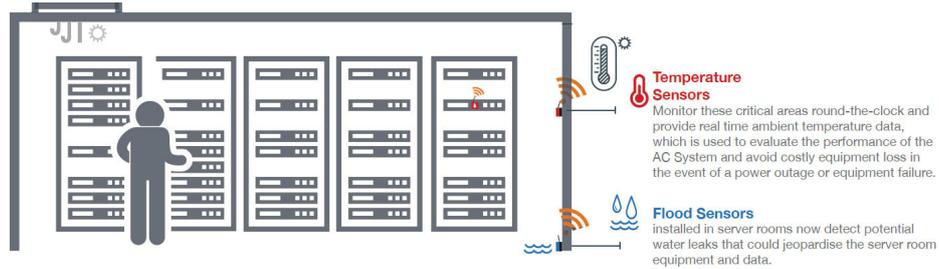


Fig. 4. Sensors in server rooms [37]

6.5 Ensuring standard lighting requirements

The installation of lux sensor devices (see Figure 5) in the showroom will keep an eye on light levels to make sure that lux levels comply with brand requirements. As result, the sensors help to track the life cycle of the lights. All data is recorded including the time spent for switch “On” or “Off”. This will help in indicating the amount of time spent and energy consumed from a maintenance budget standpoint.

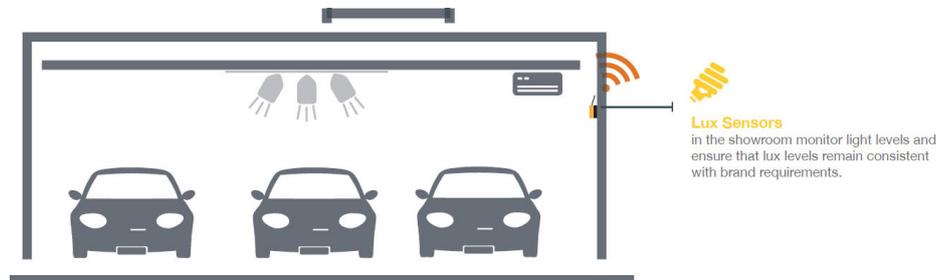


Fig. 5. Lux sensors [37]

Al Nabooda Automobiles’ showrooms and service centres now rank world-class. This achievement become reality throughout practical digitisation of FM. Customers are benefiting from the operations and maintenance. Meanwhile, the clients benefited from a conducive working environment.

Through high-quality data and an evidence-based approach to maintenance, now they will collaborate with the client to reduce the operation and maintenance costs. However, improving asset life and performance is always the main goal.

7 Conclusion

It is no doubt that FM digitisation would not happen overnight. Therefore, FM industry players need to formulate a radical transformation strategy towards digitisation FM. In addition, ongoing studies based on a real case study are essential to explore the digitisation ecosystems, especially in Malaysia.

The novelty from the integration of IoT, big data analytics and mobile phone application towards digitisation FM has resulted in substantial reductions in management costs as well as improved facilities performance and service quality. The integration will facilitate energy analysis and optimisation, and the real-time data obtained from sensors provides facility managers with irrefutable proof that can be used to justify critical work and maintenance budgets.

This paper presents an example of digitisation of FM operations that effectively optimises and innovates FM practices in the future, with a paradigm shift from cost control to value creation.

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10 Authors

Irwan Mohammad Ali is a senior lecturer in the Department of Built Environment and Technology at the School of Building Surveying. He is currently the Coordinator of the Industry, Community and Alumni Network of Universiti Teknologi MARA Perak Branch. He holds a Certificate and Diploma in Building Services Engineering from Kuching, Sarawak Polytechnic and Sultan Abdul Halim Muadzam Shah Polytechnic, Kedah respectively. He then continued his studies in Bachelor of Building Surveying and Master of Facilities Management at Universiti Teknologi MARA, Selangor Branch. He also holds a Doctor of Philosophy in Design and Built Environment from Universiti Teknologi MARA Perak Branch. His research and consulting activities focus on the areas of space management, facilities management, and building surveying practices. E-mail: airwan9471@uitm.edu.my

Mohd Nasrun Mohd Nawi is specializes in the area of integrated design and construction management. He holds a PhD the field of Construction Project Management from the University of Salford, UK. As an academician and a fully qualified Building Surveyor, he has been active in research and consultation works relating to the areas of Industrialised (offsite) and Modern Method of Construction, Integrated Design Delivery Solution (i.e. Integrated Project Delivery, Lean Construction, Building Information Modelling), Sustainable (green) Construction, Life cycle costing & Value Management, Building Performance (i.e. Energy Management and Audit) and Management of Technology. Besides being involved actively in various academic activities, he is also an active author with various publications especially in the area of Construction and Technology Management. E-mail: nasrun@uum.edu.my

Md Yusof Hamid is a professor in the Department of Built Environment and Technology at the School of Building Surveying. He is currently the Rector of Universiti Teknologi MARA Perak Branch. He holds a Diploma in Estate Management and Bachelor Degree in Building Surveying from Universiti Teknologi MARA. He then continued his studies in Master of Science in Integrated Construction Project Management from Universiti Teknologi MARA. He also holds a Doctor of Philosophy in Built Environment from University of Salford, UK. His research and consulting activities focus on the areas of space management, facilities management, and building surveying practices. E-mail: yusof344@uitm.edu.my

Fazly Izwan A Jalil is a General Manager at Chulia Technology Sdn. Bhd. Currently heads Chulia Group of Companies in technology and FM innovation. He is the key member in the AN.C JV company formation in 2014. He was also responsible for moving Chulia Group of Companies into the era of Industry 4.0 internet-of-things and data analytics. E-mail: fazly@chuliafm.com

Baharinshah Hussain is a Board Member and General Manager at Al Nabooda Chulia Facilities Management Co LLC (AN.C) in Dubai, United Emirates Arab. He is a United States-based trained engineer. His contributions for AN.C being awarded 2017 Dubai Smart City Pioneer Award; demonstrating technology can streamline business processes, improve financial performance and value adding client. Previously, he served in several senior management positions in the United States and European-based Multinational Companies (MNCs). E-mail: baharin@chuliafm.com

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