International Journal of Sustainable Development and Planning
Vol. 18, No. 2, February, 2023, pp. 621-626
Journal homepage: http://iieta.org/journals/ijsdp

The Sustainable Logistics: Big Data Analytics and Internet of Things

Hendy Tannady[1*], Johanes Fernandes Andry[2], Suriyanti[2]

[1] Department of Management, Universitas Multimedia Nusantara, Kabupaten Tangerang 15111, Indonesia
[2] Information Systems Department, Universitas Bunda Mulia, Jakarta Utara 14430, Indonesia

Corresponding Author Email: hendy.tannady@umn.ac.id

https://doi.org/10.18280/ijsdp.180232

Received: 23 August 2022
Accepted: 3 February 2023

Keywords:
Internet of Things, big data, globalization, logistics, transportation, operational efficiency

ABSTRACT

The presence of IoT technology in Indonesia has made many industries grow rapidly, especially in data management in large companies. The aim of this journal is to discuss one of the 'smart' solutions that can be recognized as an innovative solution in both the technology and organizational fields presented by a telecommunications company in Indonesia. This solution can be implemented in the logistics industry, which in the era of globalization plays a very important role. But not only in the logistics industry, the smart logistic solutions discussed can also be used in several other industries such as retail, warehousing, transportation, manufacturing and mining. The feature of the smart logistic device already uses big data analysis which is known to process and use real time data. All of the features carried by the smart logistics are not only aimed at reducing distribution costs but also optimizing the distribution system of goods. The direct impact felt by user companies is that their productivity has increased dramatically because they can set delivery destinations that have been adjusted according to the zoning system, look for traffic-free paths, and so on. The pace of modern economic development encourages companies to introduce more new solutions, resulting in innovations that drive market progress. This research aim is to discuss about how to resolve the problem that was encountered by logistic companies by of implementing logistics IT solutions which consists of Big Data Analytic and Internet of Thing. So big data IoT like that requires an appropriate analytical framework to generate knowledge to measure operational efficiency, distribution, machine renovation, and so on inside the enterprise. The research method used in this article is library research or literature review, this research begins with the problem identification, hence looking source and information, data collection and information, analysis and processing the gathered information and create a conclusion. One of conclusions of this research is All the features of the Nextfleet application as well as the development of Advanced Driver Assisted System (ADAS) technology and Intelligent Telematics Surveillance enable the Nextfleet application to be applied not only to the logistics industry but also other industries such as retail, warehousing, transportation, manufacturing, and mining.

1. INTRODUCTION

A developing quantity of groups depend on numerous and continuously evolving strategies of extracting valuable statistics thru massive statistics and large information evaluation (BDA) for business intelligence (BI) to make higher alternatives. The term “large statistics” refers to large quantities of statistics or records at a high-quality factor in time and within a selected scope. However, massive data have a quick lifecycle with a rapidly decreasing powerful fee, which makes it tough for instructional research to maintain up with their fast pace [1, 2].

The facts show that it has no limits on its type, shape, or scale, and its scope is so large that it can be narrowed down to the location chosen for viewing. Big information also shows that it provides a large amount of information that is so complex, that its type, characteristics, scale, class, and intensity vary depending on the capabilities and goals of each organization [3]. The same is true of the reliability and usefulness of consequences gathered from an in-depth analysis of information. Previous research usually agrees on three main spaces that define big information, namely quantity, speed, and variety, or “3Vs” [4].

The IoT objects can be described as any tangible aspect related to entities that exist in the real world along with guy, system, and animals, having particular identification and self-directed facts transfer capability over the community. To technically assemble an IoT item, three tiny additives along with sensing chip, electromagnetic coil, and regulating capacitor are to be embedded into a completely small sized box that could without difficulty location into any actual global entity associated with the IoT packages; but, the technical configuration in fact relies upon on varieties of entities and packages. Greater mainly we will outline IoT item as a sensor or RFID device or any clever object having internet connectivity over physical IP and capable to transmit the statistics to the community autonomously with none human interference [5].

The IoT technology integrates with the huge-records method with the reason of regulating smart commercial

enterprise automation application [6]. In a large scale commercial enterprise automation applications, heaps of automatic machines are fabricated with such trillions of IoT chips to technically gather the IoT items and the networks of such trillions of IoT gadgets may also additionally additionally represent a big scale business IoT environment, from in which huge primarily based, semi-based totally and unstructured IoT huge-facts are produced in a real timescale [7]. Because of excessive elasticity, flexibility, and dynamicity, the IoT gadgets penetrate into each and every actual-time tracking software application together with commercial enterprise, medical, industrial enterprise, fitness care, agriculture, animal farming, transportation, and masses of more. So such IoT huge-data wishes appropriate analytic framework to produce information that allows you to diploma the operational overall performance, load distributions, device upkeep, and so forth in enterprise automation application [8].

Systematic and green logistics carrier has emerge as one of the core guide services of e-agencies, and plenty of modern-day strategies were proposed [9, 10]. Globally expanding net and e-businesses have delivered new business fashions with tons much less distribution layers ensuing in patron-primarily based logistics internet-based logistics, logistics for small-batch manufacturing, and zero-inventory logistics [11, 12].

Businesses who operated their very own logistics community began to outsource element or all in their logistics function to the 3 birthday celebration Logistic (3PL) organizations who supplied expertise in solutions of logistic systems, transportation, warehousing, freight consolidation, distribution, stock control, and logistics records structures [13-15]. This research aim to propose the use of big data analytic and internet of thing to elevate performance of logistic industry.

2. LITERATURE REVIEW

2.1 Big data analytics

In digital generation with developing rate of statistics manufacturing, big information has been added, which is known with the useful resource of large amount, range, veracity, pace, and high price. It brings hardness in reading with itself which entitled organization to installation a latest technique and gadget in analytical elements to overcome the complexity and massiveness of different styles of records (based, semi-established, and unstructured). So, a complex technique that goals to deal with complexity of massive facts by way of studying a big quantity of records is referred to as massive records analytics [16]. Big data analytics for the number one time have become coined by research that conducted by Chou and Thedja [17] who talked about the relation among organization intelligence and analytics that has robust ties with information mining and statistical evaluation [17]. The time period “massive facts” has currently been applied to datasets that develop so huge that they end up awkward to paintings with the use of traditional database control structures. They may be records units whose length is beyond the capability of typically used software gear and garage structures to capture, save, control, in addition to manner the information inside a tolerable elapsed time [18].

In their research, Delen and Demirkan [19] stated that big data provide the capability to perform a 3rd type of analytics, referred to as perspective analytics, which mixes facts from the two previous kinds and makes use of real-time out of doors facts to advocate a motion that should be taken within a nice time to attain desired final results [19]. So, there are many types of analytics (see Figure 1), and there's a need to put together the one types to understand their makes use of.

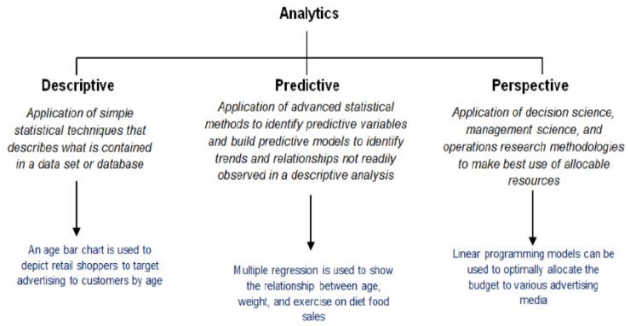

Figure 1. Types of analytics [20]

Types of analytics are divided into three as follows: implementation of descriptive analytics, application of perspective analytics and implementation of predictive analytics.

1. Descriptive implementation is a simple statistic that describes what is contained in the data set or database Age bar chart used to describe retail buyers to target ads to customers based on age,
2. Predictive application of advanced statistical methods to become aware of predictive variables and construct prediction models to perceive tendencies and relationships that aren't effortlessly determined in descriptive evaluation of a couple of regressions used to expose the relationship among age, weight, and workout on diet meals income,
3. Perspective software of choice technology methodology, management technology, and operations research to make the high-quality use of allotted resources Linear programming model may be used to allocate finances optimally to diverse advertising media.

2.2 Internet of Things

The net of things is a novel paradigm shift in IT location. The word “net of factors” which is also speedy as IoT is coined from the 2 phrases i.e., the number one word is “internet” and the second one phrase is “matters”. The Internet is an international gadget of interconnected laptop networks that use the standard net protocol suite (TCP/IP) to serve billions of users international. According to previous research that was conducted by Madakam et al. [21], it's far a network of networks that consists of tens of hundreds of lots of private, public, educational, enterprise companies, and government’ networks, of nearby to global scope, which may be linked by means of a huge array of digital, and optical networking era [21].

The layered structure in context of IoT has five layers named commercial enterprise, utility, middle, community, and belief layers [22] as shown in Figure 2:

1. Business Layer: It gets the records from the software program layer. This accretion for reading the records can also build the commercial organization model, use drift graphs, graphs, and lots of others. It additionally decides the success rate and destiny of the business. This manages all styles of such obligations.

2. Software Layer: This does the general item version based totally on information acquired from the middle ware. The programs may be clever health, city, smart delivery, and navy and social internet sites' operations.

3. Middleware Layer: It transports statistics from sensor to govern rooms for processing the facts correctly. It serves the requests taken from the network layer. There's records base which can be used if needed to perform ubiquitous computing and preference making approximately the consequences. The SOA architecture of IoT has packages, provider management, issuer composition, item abstraction objects [23]. Other than this it goals a do not forget, privateness, and protection control.

4. Network Layer: this layer sends facts from sensor to records processing systems through a stressed out and wi-fi medium.

5. Belief Layer: This keeps the physical items and sensors and offers within the item identification. This collects data from the sensor to the community layer.

According to previous research that was conducted by Da Xu et al. [24], logistics is one location in which IoT is anticipated to have an extremely outstanding impact, as transportation systems evolve and automobiles are ready with a developing diploma ultra-cutting-edge sensing, networking, and verbal exchange capability, permitting cars to interact with each fantastic and their surroundings. Fagnant and Kockelman [25] in their research conclude that a sensory technology turns into trendy cars may be anticipated to interact with their surroundings, using several sensors, cameras, maps, and radar gadget to perform quite duties, including using themselves, warding off affects and collisions, detecting pedestrians and animals, and finding parking regions.

The possibilities for the logistics organisation are manifestly limitless. However, as with BDA, case examples that describe the actual-life usage of IoT technology within the logistics enterprise are lacking. Therefore, this observe is aimed at exploring and documenting realistic packages of BDA and IoT generation, by means of using investigating a case example of a logistics enterprise who have efficiently carried out tasks in those regions.

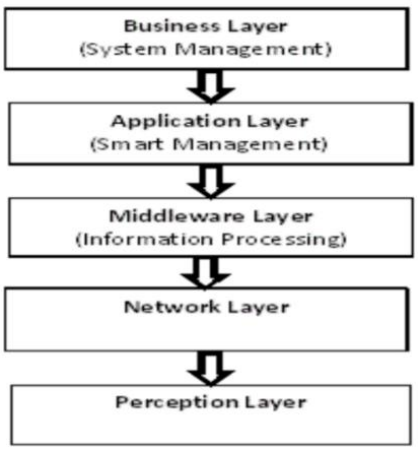

Figure 2. IoT architecture [22]

3. METHODOLOGY

The research method used in this article is library research or literature review. Andry et al. [26] said that the literature review is the result of research that has been published without providing a description of the scientific methodology. Furthermore Andry et al said that at least in writing articles using literature review, there are two approaches, namely traditional and systematic approaches. In the traditional approach it can be a critical approach, a state of art review, a conceptual review, a scoping review and also an expert review [26]. Literature research is different from qualitative research which has to conduct in-depth interviews or observations and is also different from quantitative research which must go down to field for distributing questionnaires. However, it needs to be understood that library research is not research based solely on relevant literature books, but more than that literature study emphasizes collecting information on data from internet networks which aims to obtain research data such as through online journals, text books, online libraries.

The steps that must be taken in library research are identifying the problem to be studied, looking for sources that can provide factual information, either from journals relevant to research, the latest reading books or from the opinions of experts to be used as extracts [27]. The research we do even though we use library research can be justified because indeed the data presented comes from reliable sources such as industrial practitioners and firm's secondary data. Figure 3 shows the Research Methology used in this study.

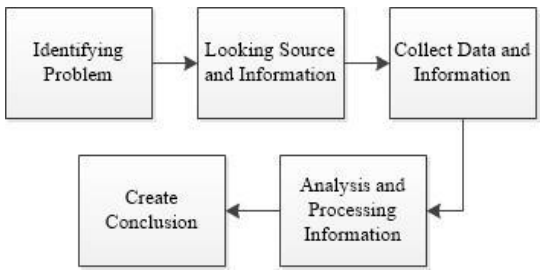

Figure 3. Methodology research

4. ANALYSIS AND DISCUSSION

An Indonesian company engaged in the telecommunications sector presents a product called Nextfleet which is an IoT device that supports the logistic and e-commerce industry in Indonesia. The IoT device is a solution that can support every logistics company to optimize and save on shipping travel costs by utilizing mobile applications and other IoT devices. Table 1 shows the advante of Nextfleet in logistic industry.

Table 1. Nextfleet advantage in logistic industry

Task	Advantage
Predictability Visibilty	• Real-time control • Report & analytics
Cargo Guardianship	• Accurate sensors & measurement • Door sensor • Temperature sensor • Ultrasonic sensor
Time & Cost Efficiency	• Shipment management module • Route & time schedule • Car dispatch management • Fuel level sensor
Ensure Safety	• Panic button • Unit identification driver • Fuel tank safety

Nextfleet optimizes the distribution process from planning, scheduling, assigning, to accurate and real time fleet monitoring so that the operating costs of companies using this device are more efficient and productivity increases simultaneously.

In the development of these devices, it is not only a solution for the logistics industry but also for other industries such as retail / warehouse, transportation, manufacturing, and mining. Also, to enhance driving force safety and performance, company prepares ADAS (Advanced Driver Assisted System) technology, and Intelligent Telematics Surveillance which can be applied for environmental monitoring, such as cargo monitoring, parking & gate systems.

Three Personas

A feature that is different for Fleet Manager, Driver, and Customer for that device. The three personas can coordinate and monitor the process of distributing goods, according to the needs and desires of the information you want to get. Fleet Manager will arrange delivery schedules, types of goods, estimated delivery routes, to determine the driver. Next, the driver becomes the party responsible for the condition of the vehicle and trip, so that the goods delivered are safe and according to initial estimates, while from the customer side, they can directly monitor the distribution of their goods, and ensure that the goods are delivered according to the order.

Real Time

The next feature is that the Fleet Manager and Customers can directly monitor the position of the driver and distribution activities during the delivery of goods. When the goods have been received, the process of receipt can be done simply through the mobile application. All information displayed on Nextfleet is real times online, including the location of the truck, cargo, to the speed and driving behavior of the driver.

Multi Destination

Another feature is that the Company can conduct distribution activities to several destination locations at the same time, which have been adjusted to the traffic situation, and the distance traveled by each destination, so that it will run effectively and efficiently.

Customized

The last feature on the device is where the company can be more flexible in designing and modifying this application, according to regulations and company requirements.

The quality of Nextfleet is intensively supported by the 4G network, where the official company that launched the device has expanded the coverage of the 4G population from only 44% at the end of 2017 to nearly 90% in 2019 as well as significantly improving the quality of connectivity throughout Indonesia.

Nextfleet also uses the telco agnostic concept, which means it can be run outside the telecommunication company's network and does not require consumers to become customers first to enjoy its products. Apart from the telco agnostic concept, a bundling version is also held, so that it is offered the most economical use if you are also a corporate customer.

Big Data Pilots

Big Data processing telecommunication company prefers collaboration with other companies. The collaboration aims to make the IT department focus on connectivity providers so that there are respective experts in the telecommunications, device sensors, and applications section. Indosat collaborates with Qlue and Alibaba Group in presenting smart city, hybrid cloud, and big data. With this collaboration, Nextfleet becomes a smart logistics that uses real time predictions and reports and analysts directly on the device.

Based on the information obtained, Nextfleet is a second-tier vertical product development from the previous IoT platform, namely NexThing, which was launched at the end of 2015. NexThing connects various business applications and supporting devices in one ecosystem. So Nextfleet is directly connected to the Big Data application which is a collaboration with other companies. However, details regarding the Big Data application are not known because the company does not share detailed information about the Big Data application used.

Data series and analysis of the resulting Big Data are used as decision making regarding:

1. Identify fuel purchases to optimize costs as well as suitable location distances
2. Proactive and predictive maintenance of vehicles to ensure vehicles are safe to use.
3. Track and trace customer goods in real time which can be done by managers or customers
4. Dynamic scheduling and job transfer so that goods are delivered orderly and efficiently
5. Planning of pick-up and delivery times to increase job effectiveness
6. Activities in the warehouse are carried out in real time

IoT with Big Data Analytics

There are several ways the IoT can power a fleet. The records will come from various gadgets established inside the vehicle. The records obtained are as follows:

1. Engine records: this is facts approximately engine situation, gas level, tire strain, washing fluid degree, and so on.

2. Gas information: This additionally includes the gasoline degree, but also the consumption fee and the way frequently the tank is filled.

3. Geographical records: that is statistics regarding the place of the GPS tool, the speed and acceleration of the automobile.

4. Driving force conduct facts: that is more specific statistics approximately driving styles and how the driving force acts - braking, rushing, hovering and so forth.

5. Extra information: this may be some other form of statistics that comes from other sensors set up inside the same machine inside the car.

IoT technology with Big Data Analytics usually has a way of working with 3 main aspects as follows:

1. Records collection: With environmental sensing gadgets and software program built into them, IoT technology are starting to gather all types of data. It could assist tune important records inclusive of temperature adjustments, box door open / close fame, late exit / access sites, power ranges or unusual interest. It does not count if it's miles a truck, field, or warehouse.
2. Statistics evaluation: After retrieving statistics, it's miles transferred for reporting often in actual-time. In some instances, the statistics is automatically analyzed and the IoT software gives the outcomes proper away. As an example, after scanning quick thru a course map and calculating the high-quality way to keep gasoline, drivers could make the right choices on the road. In other instances, information is reported handiest to the tracking team.

3. Forecasting / optimization: All records, that is accrued and suggested via IoT is saved automatically. The system owner uses it for later research and broader estimates. and that's how records become the most critical part of the technique. For instance, if the box proprietor reveals out each time the field door is opened, he can later song down any cases of theft or unauthorized unlocking. Or if inventory software video display unit's statistics and predicts elevated call for, the warehouse prepares it as wanted.

5. CONCLUSION

An IoT application that is engaged in logistics with the ability to collect information in real-time, which aims to respond to incidents and requests quickly and understand the obstacles that occur to get an effective and efficient solution. Using real-time big data analytics will help enterprise users improve existing operational inefficiencies, provide outstanding service, and reduce safety and security risks.

The Nextfleet application uses 4G network technology and has several features, namely:

1. Three Persona which provides different features for fleet managers, drivers, and customers.
2. Multi Point Distribution to carry out distribution activities to several destination locations.
3. Real-time to monitor real-time position and distribution activity.
4. Customized which can be modified according to the needs of the customer company.

All the features of the Nextfleet application as well as the development of Advanced Driver Assisted System (ADAS) technology and Intelligent Telematics Surveillance enable the Nextfleet application to be applied not only to the logistics industry but also other industries such as retail, warehousing, transportation, manufacturing, and mining.

IoT devices in the logistics industry by using big data analysis work starting with data collection such as engine data, fuel data, geographic data, driver behavior data, and other additional data used to analyze problems related to the company user of the device which is then based on the results of the analysis. Get prediction results related to risks and opportunities that can be used by the company to consider the decisions that will be made later.

Therefore, the use of these devices really helps logistics companies to optimize performance and efficiency inside the logistics industry in addition to several industries which are supported by using these gadgets.

We also suggest to any logistics industry to keep update and upgrade with the advancement of technology, so that industry could manage their advantage among the competition and able to give their best in form of effectively works and customer satisfaction. Further research could use other kind of methodology to enhance and make the discussion more sharper.

REFERENCES

[1] Laney, D. (2001). 3D data management: Controlling data volume, velocity and variety. META Group Research Note.

[2] Andry, J.F., Tannady, H., Limawal, I.I., Rembulan, G.D., Marta, R.F. (2021). Big data analysis on youtube with tableau. Journal of Theoretical and Applied Information Technology, 99(22): 5460-5469.

[3] Darmawan, J., Wijaya, A.H., Hakim, L., Tannady, H. (2021). Comparing freeman chain code 4 adjacency algorithm and LZMA algorithm in binary image compression. Journal of Physics: Conference Series, 1783(1): 012045. https://doi.org/10.1088/1742-6596/1783/1/012045

[4] Wang, Y., Kung, L., Wang, W.Y.C., Cegielski, C.G. (2018). An integrated big data analytics-enabled transformation model: Application to health care. Information & Management, 55(1): 64-79. https://doi.org/10.1016/j.im.2017.04.001

[5] Lee, M.V.W., Wella, W. (2018). ITIL 2011: The maturity of IT service operation in Universitas Multimedia Nusantara, Indonesia. IJNMT (International Journal of New Media Technology), 5(2): 90-94. https://doi.org/10.31937/ijnmt.v5i2.914

[6] Mishra, N., Lin, C.C., Chang, H.T. (2015). A cognitive adopted framework for IoT big-data management and knowledge discovery prospective. International Journal of Distributed Sensor Networks, 11: 718390-1.

[7] Peng, Z., Jingling, Z., Qing, L. (2012). Message oriented middleware data processing model in Internet of Things. In Proceedings of 2012 2nd International Conference on Computer Science and Network Technology, pp. 94-97. https://doi.org/10.1109/ICCSNT.2012.6525898

[8] Sitorus, T., Tannady, H. (2021). Synergy, system IT, risk management and the influence on cyber terrorism and hoax news action. Journal of Theoretical and Applied Information Technology, 99(8): 1802-1814.

[9] Utomo, P., Budiastuti, D. (2019). Practiced culture toward firm competitiveness performance: Evidence from Indonesia. Pertanika Journal of Social Sciences & Humanities, 27(1): 113-124.

[10] Madyatmadja, E.D., Liliana, L., Andry, J.F., Tannady, H. (2020). Risk analysis of human resource information systems using COBIT 5. Journal of Theoretical and Applied Information Technology, 98(21): 3357-3367.

[11] Lee, W.B., Lau, H.C.W. (1999). Factory on demand: the shaping of an agile production network. International Journal of Agile Management Systems, 1(2): 83-87. https://doi.org/10.1108/14654659910280901

[12] Gunawan, F.E., Andry, J.F., Tannady, H., Meylovsky, R. (2019). Designing enterprise architecture using togaf framework in meteorological, climatological, and geophysical agency. Journal of Theoretical and Applied Information Technology, 97(20): 2376-2385.

[13] Rabinovich, E., Windle, R., Dresner, M., Corsi, T. (1999). Outsourcing of integrated logistics functions: an examination of industry practices. International Journal of Physical Distribution & Logistics Management, 29(6): 353-374. https://doi.org/10.1108/09600039910283587

[14] Sink, H.L., Langley Jr, C.J. (1997). A managerial framework for the acquisition of third-party logistics services. Journal of Business Logistics, 18(2): 163-189.

[15] Madyatmadja, E.D., Marvell, M., Andry, J.F., Tannady, H., Chakir, A. (2021). Implementation of big data in hospital using cluster analytics. In 2021 International Conference on Information Management and Technology (ICIMTech), pp. 496-500. https://doi.org/10.1109/ICIMTech53080.2021.9535015

[16] Nurprihatin, F., Andry, J.F., Tannady, H. (2021). Setting

the natural gas selling price through pipeline network optimization and project feasibility study. Journal of Physics: Conference Series, 1811(1): 012008. https://doi.org/10.1088/1742-6596/1811/1/012008
[17] Chou, J.S., Thedja, J.P.P. (2016). Metaheuristic optimization within machine learning-based classification system for early warnings related to geotechnical problems. Automation in Construction, 68: 65-80. https://doi.org/10.1016/j.autcon.2016.03.015
[18] Andry, J.F., Liliana, L., Chakir, A., Tannady, H. (2021). Online voucher E-commerce testing using ISO 9126 model. 2021 International Conference on Industrial, Enterprise, and System Engineering (ICOIESE), AIP Conference Proceeding.
[19] Delen, D., Demirkan, H. (2013). Data, information and analytics as services. Decision Support Systems, 55(1): 359-363. https://doi.org/10.1016/j.dss.2012.05.044
[20] Sedkaoui, S. (2018). Data Analytics and Big Data. John Wiley & Sons.
[21] Madakam, S., Ramaswamy, R., Tripathi, S. (2015). Internet of Things (IoT): A literature review. Journal of Computer and Communications, 3(5): 164. https://doi.org/10.4236/jcc.2015.35021
[22] Bharati, T.S. (2019). Internet of Things (IoT): A critical review. International Journal of Scientific & Technology Research, 8(10): 227-232.
[23] Atzori, L., Iera, A., Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15): 2787-2805. https://doi.org/10.1016/j.comnet.2010.05.010
[24] Da Xu, L., He, W., Li, S. (2014). Internet of Things in industries: A survey. IEEE Transactions on Industrial Informatics, 10(4): 2233-2243. https://doi.org/10.1109/TII.2014.2300753
[25] Fagnant, D.J., Kockelman, K. (2015). Preparing a nation for autonomous vehicles: Opportunities, barriers and policy recommendations. Transportation Research Part A: Policy and Practice, 77: 167-181. https://doi.org/10.1016/j.tra.2015.04.003
[26] Andry, J.F., Tannady, H., Nurprihatin, F. (2020). Eliciting requirements of order fulfilment in a company. In IOP Conference Series: Materials Science and Engineering, 771(1): 012023. https://doi.org/10.1088/1757-899X/771/1/012023
[27] George, J.M., Jones, G.R. (2011). Understanding and Managing Organizational Behavior.