

# A review of An Intelligent Framework for Improving Emergency Patients' Satisfaction Based on Internet of Things (IoT)

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## Abstract

The internet of things and Artificial intelligence become the main engine of trade in the world in recent years, so the results obtained by recent authors have a paramount role in internet of things. The main objective of the paper is to study the role of Internet of Things (IoT) applications in achieving patients' satisfaction in Egyptian hospitals, A review of artificial intelligence and its role in improving patient satisfaction are supported as a review of recent published papers. The findings suggest that the previous literature is largely focused on internet of things, thus leaving the research screening at a very limited level. The second stage presents the literature on the application of artificial intelligence and how it will improve patients satisfaction. The most remarkable finding is that most studies ignored the theories related to the issue of artificial intelligence and internet of things. Additionally, the previous works show a lack of adoption of certain types of artificial intelligence in the hospitals especially emergency patients. Consequently, the studies of the impact of artificial intelligence on health sector remain unexploited as it is based on a bibliometric review. In this case, it is recommended that researchers study other types of artificial intelligence on internet of things that develop a systematic review of the impact of artificial intelligence on health sector, and link theory and practice.

**Keywords:** Artificial intelligence (AI); Internet of things (IOT); Health sector ; Patient satisfaction

## 1. Introduction

Internet of Things (IoT) was presented as a concept in 1999. It has provided a platform to connect to deferent hardware and mobile devices, so that different people can be connected to each other. The networks can be on the local wide area networks subscribed to each organization, or wireless networks, or both. IoT can also collect data via wireless sensors, and then connect to its central servers for processing and storage. Similarly, it enables people to connect to the internet and other people's mobile devices via central servers and/or wireless sensors. The efficient use of IoT can improve operational efficiency due to its capability to gather and explicate big data, as well as automate connections among machines. The IoT can be applied in several areas such as smart cities, smart homes, education, agriculture, health, wearables, and industrial automation. It provides enormous benefits to the society as a whole. We can see the effect of IoT in cars with built-in sensors, health-monitoring systems, search and deliverance devices, smart washer/dryers which use Wi-Fi for remote monitoring, etc. There will be almost twenty billion devices on the IoT by 2020. IoT also has a huge impact on marketers since it provides them with the access to accurate big data. (Abdel-Basset et.al; 2018)

Marketers can track and record products, estimate the number of customers daily, analyze purchasing behaviors and understand the individual uses of products. A major function of IoT is to collect data to

produce better decision making or controlling (systems). Data life cycle includes the following phases: capturing, storing, sharing, maintenance (processing), active use, publication, archiving, and purging. One limitation is small device with low battery and constrained computation/storage capability. Hence, typical IoT applications first transmit the data a device collects, and use some external systems/sub-systems for storing/sharing data. (Tseng et.al 2020) Using IoT can significantly make users' day to day activities more convenient since many services can be accessed on their mobile devices. It also improves inventory management, tracks product usage, monitors selling rates and locations. Also, the IoT can improve the customer services to allow real-time communications. Additionally, it can allow businesses to forecast possible customers' concerns and cases, and proactively provide solutions. By doing so, it can achieve a better customer satisfaction. As a result, IoT can also save time, reduce costs and also human errors. ( Nguyen and Simkin, 2017) IoT is defined as internal communication or interconnection between physical objects and computing devices, it was also defined it as a wide range of emerging technologies such as virtual power plants, smart transportation systems, and smart cars. In other words, IoT is a communication between two ends of the devices or between a device and a person, and they all communicate over the Internet (Decker R, Stummer C.2017) The research confirm that Internet of Things (IoT) is one of the most important factors and tools to achieve and enhance patients' satisfaction, as it helps hospitals keep pace with developments in the technology, and showing flexibility and effective response in dealing with patients' needs (Nematizadeh, 2017)

## **2.1 Studies related to (Internet of Things IOT):**

(Al-Nahar, et al., 2019) investigated the impact of the Internet of things on the quality of financial services in Jordanian commercial banks. Data were collected through a questionnaire applied to a random sample (367) questionnaires were distributed to senior and middle management and employees who work in (5) commercial banks in Amman, (295) questionnaires valid for statistical analyses. In addition, the study used the (SPSS) program for descriptive statistics purposes. To answer the research questions, the study used frequencies, means, standard deviations, and Cronbach's alpha test to examine the consistency and reliability of the data collection tool. The study concluded that there is an impact of the Internet of Things on the quality of financial services in banks. In addition, there is a strong impact of the Internet of Things (expected performance, expected effort, social impact, ease of use) on the quality of financial services. The results show that the expected effort is the highest impact followed by the social impact on the quality of services. The study recommends a better understanding of the quality of services as well as holding training courses in various programs for employees, including management, who would help to develop better solutions for the performance of banks in general and in the employee in particular to avoid any performance inconveniences resulting from quality.

(Argyropoulou, et al., 2019) illustrated the use of empirical data to examine the hierarchical impact of the Internet of things capability on supply chain integration (SCI), supply chain capability (SCC) and firm performance (FP) in the UK retail industry. A deductive approach was employed to carry out this research. Structural equation modelling (SEM) was performed using the partial least square method (SmartPLS 3.3.3) to test theoretical predictions which underlie the relationships among Internet of things capability (IoTC), SCI, SCC and FP. Data are collected using an online survey completed by senior executives of 66 large, medium and small firms within the UK retail industry. The empirical results of this research reveal that IoTC has a significant positive effect on the UK retail industry FP through the mediating role of SCI and SCC.

(Bani Araba, 2019) explored the uses of Internet of Things applications in the medical sector, and its role in raising the level of medical care services in health institutions. The Internet of Things improves the quality of health services provided. The study is based on a purely descriptive approach by analyzing the literature published in this field. The results of the study indicate that the application of the Internet of Things in health institutions will help in obtaining correct and accurate diagnoses for patients, which will be reflected in the quality of service provided to the patient, and will also lead to a reduction in the periodic patient reviews of the hospital from By relying on IoT applications in remote diagnosis, as well as its application in health institutions will contribute to providing correct data for the diseases that patients suffer from, and thus employing them in the preparation of scientific research to obtain more accurate results.

(Shenkoya, 2019) examined the impact of IoT on the Japanese society. While previous studies have largely been qualitative in nature, in this study, a quantitative approach was used. A multi-dimensional analysis was carried out and the statistical method known as the one-way analysis of variance was used to process the data obtained during this study. The results show that indeed the IoT has a positive impact on the daily lives of the Japanese people, however the change it brings are mainly incremental change and not radical. Furthermore, rather than reducing job opportunities, it has created more opportunities and simplified operation processes.

(Al-Hussain, 2021) presented a proposed system for organizing Internet of Things (IoT) in Saudi Arabia. First, an initial list of the proposed legislative system for IoT systems in Saudi Arabia is developed based on articles of laws, legislations, and guidelines of related existing systems of IoT applied in other countries. This study then uses content analysis approach to prepare a preliminary list of the basic aspects of IoT, and lastly Delphi technique is adopted as a basic approach to develop final list of the proposed legislative system for IoT systems in Saudi Arabia. This study identifies five aspects as major requirements for IoT systems. These aspects are ordered according to their importance from perspective of experts as following: Infrastructure, IoT Security, Transparency and IoT Data Quality, and Privacy. This study shows in both rounds of Delphi analysis the consensus of all phrases in all aspects with ratio equal or greater than 80%. The study concludes with number of recommendations including the encouragement of future research to study separately each identified aspect from legal and informational side; and the importance of having implementing regulation or guidelines for the use of IoT and its services in the governmental, private, and third sectors.

(Al-Muzayen, 2021) identified the reality of using Internet of Things applications in academic libraries, its requirements, advantages, and challenges. The study covered the libraries of Tanta University (Libraries of the Colleges Complex in Saber Bay). The study adopted the descriptive analytical approach to identify the characteristics of the study community, by relying on a questionnaire and personal interviews to obtain data related to the subject of the study. The study found a number of results, including the lack of sufficient information related to the Internet of things among non-specialists, and that Internet of things applications contribute to improving the image of the library by transforming it from a traditional library to a smart library capable of providing more advanced services to a larger number of beneficiaries in less time., and from anywhere, and libraries face great challenges if the Internet of Things is implemented, and the most important of these challenges is the scarcity of workers with expertise in the field of Internet of Things. The study recommends the need to pay attention to holding more specialized courses, workshops, and discussion panels to clarify the role of the Internet of Things in libraries and information institutions, and to take the advantages of the Internet of things in academic libraries to develop their services and introduce new services.

## **2.2 Studies related to the dependent variable (Patients' Satisfaction):**

(Al-Araji, 2018) investigated the relationship between patient satisfaction and dental anxiety, as well as their relation to demographic variables such as gender, age, number of visits, and cultural level. The study was applied on a random sample of dental clinics in Baghdad city with total of (200) patient (108 male and 92 female). Two scales were used in this study, patient satisfaction scale PSS (included 9 aspects, constructed by authors) and Iraqi dental anxiety scale DAS (Salem& Muslim, 2015). The results explained that there is an inverse significant correlation between patient satisfaction and dental anxiety. Moreover, there are two demographic variables that have predicted with dental anxiety which are age and number of visits to dental clinic. While there are four aspects of patient satisfaction are predicted to dental anxiety, which are satisfaction of (overall appearance of the clinic, the reception, patient information, and services with safety). The research came out with some of recommendations and suggestions.

(Ahmad, 2020) identified the effect of patients' satisfaction with the health care provided in Bashayer

Hospital, identifying the level of quality of health care services provided in the hospital, presenting recommendations and results that help the hospital administration to lay the foundations for reform to improve its services in order to achieve patient satisfaction. In this study, the researcher used the analytical descriptive approach to the correlational relations, as he believes that it is the appropriate approach for the study, as it describes and identifies the relationships and differences between two different variables using the statistical package program (SPSS). The researcher reached a number of results, including that, and that the quality programs do not find the required support from the upper management, that there is a shortage in the provision of medicines in all departments that the research is conducted on, that cleanliness is acceptable but does not rise to the level of quality, that the medical staff deals with patients in a good spirit, the hospital staff strives to provide the best services despite the difficulties they face.

(Al-Jaafreh, 2020) studied the basic factors for the satisfaction of hemodialysis patients in Jordan. The study was conducted in dialysis units of 13 Jordanian governmental hospitals. The study population consisted of all Jordanian patients who were undergoing dialysis in those hospitals. 100 voluntary hemodialysis patients participated in the study. The study concluded that Jordanian dialysis patients; First: they are satisfied. Second, there were no statistically significant differences in the perceptions of the respondents because of their gender, age, duration of dialysis, or number of dialysis times per week. Third, regression analysis for each dimension of the questionnaire and demographic and personality variables was insignificant and could not predict levels of satisfaction. Finally, the validity and reliability of the developed questionnaire provides a tool for measuring the satisfaction factors of Jordanian dialysis patients.

(Al-Zaidi, 2020) examined the relationship between health service quality and patient satisfaction between inpatient, outpatient and emergency departments in a general hospital in a southern region of the Kingdom. on patient satisfaction at King Fahd Hospital in Al-Baha. The author uses descriptive and analytical methods to collect and analyse data. The study is cross-sectional in nature, comparing patient satisfaction with service quality. Data was collected through a questionnaire. The research found that there were significant differences in satisfaction among patients of different departments in Al-Baha Hospital. The research study also concluded that there is a fundamental difference between the expectations and the reality of the services provided in the hospital for all three dimensions, which are product service, service delivery service and finally environmental service.

(Attia, 2020) illustrated the level of food services provided in Minia public hospitals and the views of the patients about the level of food services provided. also, identifying the efficiency of food services providers in Minia public hospitals through patients' comments. This study was applied to Minia public hospitals. The sample was consisted of all hospitals in Minia Center. The researcher took 118 samples of hospitals' patients. This sample was selected randomly from Minia public hospitals. The researcher designed one tool for the sample: a scale to measure patients' satisfaction. The results indicated that the patients were not satisfied in regards to the meal choices and the serving method. Factors like temperature and hygiene conditions were not always in a way that fulfils the necessary prerequisite requirements. In addition, food service providers do not care about help patients in their wards. Thus, patients do not have comfortable and satisfaction.

(Al-Enezi, 2021) examined the extent of patients' satisfaction with hospital services in the Kingdom of Saudi Arabia. The study population consisted of all patients in governmental and private health institutions in the Kingdom of Saudi Arabia, whose number reached (30615) thousand, and who were identified from patient records. To achieve the objectives of the study, the researcher prepared a questionnaire to measure the level of patients' satisfaction with hospital services in the Kingdom of Saudi Arabia. The results of the study showed that the level of patients' satisfaction with hospital services in the Kingdom of Saudi Arabia is (8.09) to a large extent, also the level of patients' satisfaction with hospital services in the Kingdom of Saudi Arabia varies according to the field that achieves patients' satisfaction in hospital institutions in the Kingdom of Saudi Arabia, there are statistically significant differences in the responses of the study population according to the variables of age, gender, educational level, length of stay in health institutions, reason for

admission to health institutions, and number of admissions to the same health institutions.

(Al-Khafaji, 2021) assessed patients' satisfaction with the quality of health care services provided to them in the burns unit in Al-Sadr Medical City in Al-Najaf City. The descriptive study was conducted in the burns unit/ Al-Sadr Medical City in Al-Najaf city. A non-probability (purposive) sample consisting of (30) patients was selected from among the patients admitted to Al-Sadr Medical City / Burns Unit for the purpose of treatment. The data were described and analysed using the descriptive statistics method (frequencies, percentages, and mean scores). The results of the study showed that the vast majority of the sample are females, and the results indicate that patients are satisfied with the quality of health care services provided in the burns unit, especially in the dimensions of reliability, responsiveness, and empathy, while in the dimension of assurance and after tangibility, patients are satisfied with some services.

(Al-Mahmudi, 2021) identifying the health service marketing policies applied at the University of Science and Technology Hospital and the extent to which they achieved patient satisfaction. The research was carried out on a sample of 205 patients in the hospital (170 patients from the outpatient department and 35 from the back section). The questionnaire was used as a tool for collecting preliminary data from the sample. The research found a number of conclusions, the most prominent of which is that there is a high level of satisfaction among the majority of the sample (patients) about the delivery and marketing of the health service. There is also a statistically significant positive relationship between the marketing policies of the health service in all its dimensions and patient satisfaction at the University of Science and Technology Hospital. The study showed that there were statistically significant differences in the respondents' responses to the customer's personal characteristics (gender, age, educational level, income level, place of service, and health insurance).

(Hroub, 2021) studied patients' psychological satisfaction with the quality of nursing care at the National center for Diabetes, Endocrinology and Genetics in Amman. **METHODS:** The study was a facility-based descriptive cross-sectional study. The study samples were (305) randomly selected patients. There were personal interviews with eligible patients, and their level of psychological satisfaction with the quality of health care was measured by analysing both self-administered and managed questionnaires, which were analysed by the integrated statistical analysis program. The study concluded that most of the patients agreed that there is no system for measuring patients' psychological satisfaction with the nursing services they received. In addition, this study found that there is a moderate level of psychological satisfaction. **Recommendations:** The administration should focus on improving the communication skills of its employees. A good system for measuring patients' psychological satisfaction and benefiting from feedback is adopted, and a continuous training system is adopted to improve the performance of the system.

### **2.3 Review Results**

By reviewing previous studies, the researcher found the following:

- Some studies linked the independent variable, which is Internet of Things (IoT), with other dependent variables such as organizational culture, employee empowerment, organizational performance, and total quality.
- So many scholars have studied IoT, but they have paid little attention to the dimensions (Intelligence, Connectivity, Dynamic Nature, Enormity, Sensing, Diversity and Security) and its impact on patients' satisfaction.
- After reviewing many IoT literatures, it has come clear that the studies that deal with the IoT in the medical field are quite few.
- This study laid down some comparisons between the IoT in the medical sector and some other sectors, such as industrial sectors, all was done in the light of the few existed studies that the researcher could depend on.



- As a comparison, this research touched upon the impact of the IoT on patients' satisfaction.
- In this context, the study focused on seven dimensions that are related to the IoT and how these dimensions have positive impact on patients' satisfaction in the medical field.
- The researcher followed both descriptive and analytical approach to dissect all these dimensions and point out the importance of each one for the IoT and ultimately their reflections on the patients as being the service receptors.
- Some other studies that dealt with the IoT in other sectors, in a way or another, fell short in studying the IoT in its all dimensions.
- The previous studies agreed on the methodology used, most of them used the descriptive analytical approach, some of them used the standard analysis approach, and the researcher used the descriptive analytical approach due to its suitability to the nature of this study.
- Most of the previous studies were conducted in different environments, whether foreign or Arab.
- Therefore this study might be the first of its kind that sheds light on the impact of internet of things (IoT) on patients' satisfaction in Egyptian hospitals.
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## **2. IoT importance in Digital Transformation:**

- The potential of IoT is massive for users. Companies can not only achieve savings and optimizations through intelligent automation and control rather, but new product concepts can also be generated through information evaluation, and cross-company collaboration can be made easier. In the middle of the IoT strategy and use cases are the platforms with which the processes can be digitized quickly (Birkel, 2022).
- The biggest benefit is the shortened time-to-market. Instead of building up time-consuming in-house expertise through many large investments, the IoT systems can be used as a central key technology in different dimensions. Companies do not have to be active in terms of development technology and reduce their total costs of ownership. In addition, the platform providers promise cybersecurity, since they already deal extensively with ensuring extensive protection of the data centres and data handling. Companies also benefit from the platform ecosystem, consisting of partners and developers who drive innovation. It is therefore highly recommendable to use these numerous advantages at an early stage and successfully digitize a company's application scenarios using an appropriate IoT platform (Bhatt& Chakraborty, 2023).
- Digital Transformation is becoming the order of the day and is an unavoidable theme for any company that intends to remain competitive in the coming years. The use of digital platforms is essential to ensure maximum business efficiency at various levels. Digitalization has thus been changing companies and their processes, from sales to customer support, research and development to administration, including the financial area and, of course, marketing (Al-Hussain, 2021).
- Digital transformation is a transversal process within an organization, through which it transforms and improves its management methods in order, in the end, to add value to its products and services known as "Industry 4.0" or the 4th industrial revolution. This kind of transformation translates into the digitalization of all (or almost all) business activities, to improve customer satisfaction. The digital transformation impacts services and products, internal processes (sales, human resources, production, financial) and, in the end, everything that can be optimized through the introduction of technology (Nicolescu, et al., 2018).
- It is a disruptive process, based on new technologies, and therefore requires changes in a company's business models and organizational culture.
- This silent revolution optimizes an organization's entire value chain, reducing costs and/or increasing process productivity. Through the digitization and automation of traditional processes from design to production, through customer service and after-sales, these become more transparent and

interconnected. The result is visible: greater customer satisfaction and sustainability for the company (Birkel, 2022).

- Despite the digitization of processes that started about 30 years ago, the reality is that we have never been more dependent on technological modernization as we are today. If in 2015 the digital transformation was a trend in the business world, today it is unavoidable. The projections for 2019 point to a further improvement of technologies existing and greater investment by the organizations in the promotion of digital transformation in business (Al-Safwa, 2022).
- In addition, the importance of IoT in Digital Transformation can be summarized as follows: (Bhatt& Chakraborty, 2023)

### **3. The Internet of Things (IoT) in healthcare:**

- Research has revealed that Traditional IT systems are not effective in digital transformations as compared to IoT since they are not flexible enough. In addition, traditional strategies are not responsive enough and are expensive to maintain. Technology vendors in contemporary society are moving away from supporting their on-premises applications.
- The Internet of Things (IoT) is currently transforming all industries in modern society. In the past few years, professionals have come up with strategies to link devices in unique ways. The efforts in the IT industry to enable connectivity to permeate the world have increased. There has been an increased focus to link the big data from machines and sensors. The emerging and traditional data sources can produce new insights when they are correctly interlinked. Digitalization is a great technique which provides a chance for new business opportunities in the modern environment (Al-Ayed& Al-Tit, 2023).
- Healthcare systems are important to improve the healthcare and medical services for elderly patients and also for kids; therefore, improving the quality of lives. Many researchers are interested to make new innovations in this field.
- (Elaydi, 2019) designed a healthcare system to track and control the medical doses for elderly people using arduino. The device was designed to deliver the medicine doses according to a prescribed medicine schedule by alerting patients to take the medicine through GSM module. Using GSM network to alert the patient by sending SMS is not suitable for emergency situations due to delay.
- (Parra, et. al., 2017) designed a healthcare system to monitor the medical doses schedule using arduino. In this system the patient may confuse what pill will be taken because the complete pillbox will be opened.
- (AlMotiri, et. al., 2016) proposed a system of m-health that uses mobile devices to monitor the patient parameters in real time by using a number of wearable devices to collect data from patients and store it on network servers then a certain specific clients can access this data for monitoring purpose.
- (Hayes, et. al., 2018), proposed an electronic pillbox called MedTracker. This device records the time at which each lid was opened or closed and transmitted to PC via a Bluetooth. However, the device does not provide any reminder or confirm functions.
- (Shinde, et. al., 2017), designed a smart pillbox for old people to avoid confusion in taking pills by alerting sound to the user at a particular time and real-time clock gives continuous time as an output.
- (Huang, et. al., 2020) proposed a smart pillbox to provide full medication safety for elderly by reminding the patient about the time to take medicine.
- (Jassas, et. al., 2015) proposed a monitoring system to monitor the body temperature of patient using Raspberry pi board in cloud-based system. The data were sent to cloud and could be monitored on a web site.
- (Gupta, et al., 2016) designed a healthcare monitoring system using IoT. Various sensors were used to collect data of patients, including patient's heartbeat, blood pressure and ECG then these data were sent to the doctor for monitoring purpose. This system provides a fast and reliable health care service.

- (Gelogo, et al., 2015) designed smart healthcare monitoring system using IoT. temprure and pulse rate sensors were be used to collect data of patients. Then the data was be sent and stored in cloud. The doctors can monitor the heath conditions of patient from any place and anytime.
- (Divya, et al., 2017) proposed patient health monitoring system using IoT. Various sensors were used to collect data of patients. These sensors were used to measure the patient parameter such heartbeats, blood pressure, and body temperature. This data was sent to the internet through wifi and was updated every 60 seconds.
- (Devi.S, et al., 2016) designed a healthcare monitoring system using IoT technology. ATMEGA8 microcontroller collected the data from the sensors and sent it to a server. Doctors can access this data by typing the website URL.
- (Santos, et al., 2018) shared the data which collected by sensors with smart phones and cloud databases.
- (Jimenez& Torres, 2015) considered only on monitoring the patient's health condition and sending the necessary information and notification to doctors, family members. Moreover, it does not contain the appliance control, it only focused on Monitoring and provide notification to the respective people on time.

#### **4. Artificial Intelligence (AI) and internet of things (IoT):**

- In recent years, due to the rapid advancements in technologies, healthcare industry has witnessed lot of innovation to improve quality of patient care. With evolving technologies such as cloud computing, blockchain multiple use-cases have opened up new avenues for improving standards in health care sector. This document specifically works around improvement in Patient Experience with use of Artificial Intelligence techniques (Birkel, 2022).
- Today's business world is changing with the adoption of IoT (Internet of Things). IoT is helping in prominently capturing a tremendous amount of data from multiple sources. However, wrapping around the multitude of data coming from countless of IoT devices, makes it complex to collect, process, and analyse the data (Al-Nahar, et al., 2019).
- Realizing the future and full potential of IoT devices will require an investment in new technologies. The convergence of AI (Artificial Intelligence) and IoT can redefine the way industries, business, and economies functions. AI enabled IoT creates intelligent machines that simulate smart behaviour and supports in decision making with little or no human interference (Al-Muzayen, 2021).
- Combining these two streams benefits the common person and specialists alike. While IoT deals with devices interacting using the internet, AI makes the devices learn from their data and experience. This blog highlights why we need IoT and AI to work together. IoT and AI are two of the hottest topics in tech, which is a good reason why enterprise technologists must understand them. The two technologies are very symbiotic, so it's critical to plan for how they can support each other to benefit enterprise users (Birkel, 2022).

#### **5. How can IoT and AI support each other**

In IoT, real-world events are signalled and processed to create an appropriate response. In a simple sense, then, any IoT application that uses software to generate a response to a trigger event is at least a basic form of AI, and AI is then essential to IoT. The question for IoT users and developers isn't whether to use AI, but how far AI can be taken. That depends on the complexity and variability of the real-world system IoT



supports (De Lacalle& Posada, 2019).

Simple rule-based AI would say "If trigger-switch is pressed, turn on light A," and a more sophisticated evolution might say "If trigger-switch is pressed, and it's dark, turn on light A." This represents not just event (trigger-switch) recognition, but also state (it's dark) recognition. Programmers use state/event tables to describe how a series of events are interpreted in multiple states, but this only works if there are a limited number of states that can be easily recognized (Gupta, 2018).

Referencing the example of a truck arriving at a warehouse with goods to store, simple AI could provide a means for the driver to enter a code to pass through a security gate. This would eliminate the cost of hiring a worker attend the gate. It's also possible to read a barcode or RFID tag on the vehicle itself and allow entry without the entry of a code. This would allow the truck to keep moving as its right to enter was validated, further speeding the process (Al-Fuqaha, et al., 2015).

if more conditions must be analysed to determine a response to an IoT event, the process falls outside the capabilities of the simple AI application. If the it's dark state was substituted with one called, I need more light, and the IoT system was to respond not to a specific trigger switch but to the task a person was trying to perform, simple AI wouldn't be enough (Nicolescu, et al., 2018).

In that situation, the ML form of AI might monitor the arrival of a truckload of goods at the warehouse. Over time, it could learn when the drivers and workers needed lighter and activate the switch without the person needing to act. Alternatively, an expert might perform expected tasks and "teach" the software when more light would be appropriate. AI/ML software would then eliminate the need for a programmer to build each IoT application (Schmidt, et al., 2019).

In the inference form of AI, the IoT application attempts to gather as much information as possible, mimicking what a person senses. It then applies inference rules, such as people can't work where light levels are below x, and from the conditions sensed and the application of those rules, decides to turn on a light (Nicolescu, et al., 2018).

Inference-based AI requires more complicated software to gather conditions and define inference rules, but it can respond to a wider range of conditions without being programmed. The same level of inference processing could determine whether additional workers should be assigned to unloading, because the goods are critically needed, the work is getting behind schedule or simply because workers are available. All this could improve the movement of goods and the overall efficiency of truckers and warehouse personnel (Shirey, 2017).

## **6. Conclusion**

A reliable digital information system is a primary challenge in the medical field for ICU patients, which is quickly undertaken by IoT. There are challenges to studying the technologies being used, their benefits and associated critical applications to fulfil higher efficiency requirements. It can solve various issues due to its extended capability by providing innovative information for ICU patients. The impact of IoT technologies on healthcare sector and examining to what extent the IoT play a role in enhancing the user satisfaction and how it can increase business profit. we presented a literature review related to the application of AI in IOT. To do so, two stages were applied. The first stage focused on the presentation of theories and methods related to patient satisfaction. In addition, it addressed the empirical studies carried out on the application in IOT. Second part we presented studies showed the reflect of AI with IOT in healthcare sector.

To fill this gap we must draw attention to the importance of adopting IoT, Building a framework to

preliminarily explore the implementation of IoT in healthcare and how IoT can be effective in health monitoring system and finally, Discussing how the successful adoption of IoT in healthcare will increase business profit.

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