A CRITICAL STUDY TO UNDERSTAND THE POTENTIAL BENEFITS OF USING INTERNET OF THINGS (IoT) FOR WIRELESS COMMUNICATIONS

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ABSTRACT

Over the past decade, the Internet of Things (IoT) has revolutionized the collective world by introducing a wide range of sensor-based applications. It is safe to say that Internet-based product models are very popular, and there are many reasons to expect this trend to continue. By 2020, there are expected to be billions of devices, and the average person has about 6-7 of these devices. The Internet of Things (IoT) is an important technological advancement as it connects many smart systems, frameworks, smart devices and sensors in a single network. In addition, quantum and nanotechnologies have improved its security, optical power and structure. Many studies have been conducted to emphasize the effectiveness and implementation of IoT development. These studies can be found in academic journals, articles, and online resources, as well as in print. It is possible that this could be a process of creating the first business idea that takes into account security, trust and relationships. Primary data were collected using a questionnaire and approximately 153 participants were selected using a purposive sampling strategy. In addition, the study used different types of secondary data. In addition, researchers collect data from secondary sources to better understand the appropriate methodology used in the study area. Secondary sources include, but are not limited to, EBSCO, etc. From the overall analysis, it is observed that all the changes have a positive impact on the advantages of IoT in wireless networks.

Keywords: *Internet of Things , Wireless Communication, Regression Analysis, Structural Equation Model (SEM)*

1. INTRODUCTION

In the last ten years, the Internet of Things (IoT) has completely transformed ubiquitous computing by introducing a number of applications that are dependent on sensors. It's safe to say that Internet of Things–based product categories are already highly popular, and there's every reason to anticipate that this trend will continue. By the year 2020, it is anticipated that there will be billions of devices, and the average person would possess around 6-7 of these gadgets. The last decade have seen a growth in device-to-device (D2D) communications as well as the integration of sensors and sensor-based systems as a result of advancements made at the device and protocol levels. Through innovations such as machine-to-machine communication and cognitive data analytics, it is anticipated that the Internet of Things will bring about a profound shift in the competitive landscape of a great number of business sectors. It is anticipated that cloud computing and its application to the fog paradigm would encourage more innovation in the Internet of Things (Khan, 2020). This development in "smart" electrical gadgets is driving this expectation. According to Cisco's projections, more than five hundred billion gadgets would be connected to the internet by the year 2030. These gadgets will have an IoT module installed within to allow for device-to-device (D2D) communication, which will make them the fundamental constituents of Internet of Things network. Applications of the Internet of Things will be used in almost every aspect of human endeavour, including "smart" homes, "smart" cities, "smart" agriculture, and "smart" transportation (Sinche, 2020).

The beginning of the 1980s saw the birth of mobile communication networks. Mobile radio communication systems have a predisposition, all during their development, to include all other systems that are already in use. End-user devices are becoming capable of processing an increasing variety of data kinds, such as music, video, and real-time multimedia applications. At the same time, these devices are getting more intelligent, smaller, and more power-efficient. Increases in bandwidth and data rate are seen in tandem with cost reductions. According to the findings of our study, the 1G-3G network generations have already been considerably implemented and standardised; hence, we will not be concentrating on these difficulties in favour of the 4G network generation (Cirillo, 2020). Within the next several years and decades, machine-to-machine communication will play a crucial part in the expansion of the paradigm known as the internet of things. The Internet of Things (IoT) is a paradigm change that allows numerous electronic gadgets and sensors to communicate to one another over the internet, which in turn streamlines our day-to-day life. The Internet of Things (IoT) takes use of the internet and other smart gadgets to devise innovative solutions that can be implemented by businesses, governments, and organisations in both the public and private sectors all over the globe. The Internet of Things is having a fast increasing influence, and it can already be found in every facet of our everyday lives (Zhu, 2020). The Internet of Things (IoT) is a significant step forward in terms of technology since it integrates several smart systems, frameworks, intelligent devices, and sensors into a single network. In addition, its powers of storage, sensing, and processing are significantly improved thanks to quantum and nanotechnology. Extensive research studies have been carried out to highlight the prospective efficacy and application of IoT advancements. These studies are accessible in the form of academic papers, news pieces, and materials that can be found online as well as in printed form. It is possible that this might serve as the framework for coming up with very original business concepts that take safety, dependability, and interoperability into consideration (Farooq, 2019).

Academics and business experts working in the area of the Internet of Things are making great efforts to improve the quality of life for people of all ages who have physical disabilities or limitations. The Internet of Things has achieved significant advancements in this field and has created a new focal point for the day-to-day lives of people who are able to profit from it. (Uddin, 2019). They are able to continue living their lives normally thanks to the Internet of Things. The method through which we go about from day to day is another factor that has a significant impact on our lives. The Internet of Things has sparked a number of innovative inventions that have the potential to improve the dependability, convenience, and efficacy of the network. Additionally, contemporary cars are being manufactured with sensors that are pre-installed. These sensors are able to anticipate large traffic jams on a map and give an alternate route that has less congestion. As a result, the Internet of Things (IoT) has the capability of bringing about advancements in a variety of industries (Kirimtat, 2020).

2. PROBLEM STATEMENT

The Internet of Things will assist contemporary civilizations in realising their ideal of building completely intelligent settings, as shown by the indications of a major surge in its use. Several research projects have investigated the possibility of combining the Internet of Things with "smart" surroundings. It is very necessary for the Internet of Things (IoT) to be included into the infrastructure of the smart home in order for a user to be able to monitor their smart home from another state or even another country (Joris, 2019). The Internet of Things (IoT) may be integrated with many different kinds of smart environments, depending on the needs of the application. Academics have identified a number of issues that still need to be resolved in relation to the Internet of Things. These issues include the inherent complexity of the network, its design that is still undergoing development, a variety of connection options, information flow security within the IoT, and user privacy. Because there is not a single, well-understood business model that can generate finance for broad adoption of the IoT paradigm, it is difficult to put this paradigm into practise.

The high availability of an Internet of Things network is dependent on the high availability of both the physical devices and the IoT apps that run on those devices. One method that may be utilised to provide dependable load balancing is the use of redundant hardware and software that can be maintained to be used in conjunction with one another in the event of a breakdown. At other instances, simplicity is absolutely necessary in order to guarantee availability, while redundancy just helps to enhance the complexity of the former. Consequently, having redundant hardware components is a viable strategy to assuring availability. This is due to the fact that (Leonardi, 2019).

3. RESEARCH OBJECTIVE

The basic objectives of the study are stated as follows:

To analyse the impact of IoT in sharing real time information for seamless and effective wireless communication.

To evaluate whether the implementation of IoT support in savings cost in wireless communication domain

To critically evaluate the smart operations offered by IoT in wireless communications, thereby creating more benefits for users.

4. REVIEW OF LITERATURE

The Internet of Things (IoT) network is rapidly growing and expanding, which is contributing to an exponential rise in the number of sensors and devices that are now in use. Each of these devices has the capability of connecting to the internet and either receiving or transmitting data, which creates an enormous pool of information that can be shared and sent. Because of the vast amount of material and the consistent flow rate, this information is referred to as "big data." The ever-expanding nature of IoT-based networks presents significant issues in a variety of domains, including administration, data collecting and storage, data processing and analytics, and data processing and analysis (Ahmed, 2018). The Internet of Things big data framework for smart buildings may be used to efficiently address a wide variety of challenges, including, but not limited to, the monitoring of oxygen levels, the detection of smoke and hazardous substances, and the determination of lighting levels (Guo, 2019). A system similar to this one may use data analytics to compile information gleaned from sensors set up inside of buildings and then base decisions on that compiled information. In addition, the production of manufactured goods may be improved by a cyber-physical system that is constructed on the Internet of Things and is fitted with data analysis and information-gathering capabilities (Ali, 2019).

The Internet of Things (IoT) continues to develop as new ideas and pieces of technology are integrated into it. As a result, it encourages the creation of apps that are more innovative, useful, and forward-thinking that are based on the Internet of Things. Iteration in the creation of customised Internet of Things apps is driven by demand from end users. There are a number of organisations that are prepared to standardise technology connected to the internet of things in order to deliver applications that are more efficient and secure.

Unmanned aerial vehicles (UAVs) need to replace a significant number of Internet of Things (IoT) devices, particularly in the fields of agriculture, traffic, and monitoring, in order to bring down the amount of electricity that is used and the amount of pollution that is produced. Unmanned aerial vehicles, also known as UAVs, are an exciting new technology that has the potential to make green Internet of Things (IoT) more accessible, both in terms of price and performance. New developments related to the Internet of Things are of interest to academics and developers all around the world. Academics and developers of Internet of Things technologies are collaborating to advance the technology and broaden the positive influence it has on society.

The authors suggested a number of changes that might be made in order to improve the functioning of time division duplex (TDD) as well as the performance of 5G New Radio. Although recent developments in lessening interference from further away are also covered, the primary focus is on eliminating interference brought on by cells that are located in close proximity to one another through the use of cochannel cross link interference (CLI). The groundwork for a game-changing methodology is put down here, one in which user devices act as sensors to identify CLI issues. The authors demonstrate that reinforcement learning is a useful strategy that, in comparison to more conventional strategies for TDD adaptation, results in a considerable improvement in overall performance (Wang, 2018).

5. METHODOLOGY AND MATERIALS

Scalability, modularity, interoperability, and openness are essential aspects to consider while designing an effective Internet of Things architecture for a context that is diverse. The architecture of the Internet of Things has to be developed with the requirements of cross-domain interactions, multi-system integration with the possibility of easy and scalable administrative features, user-friendly apps, and storage and analysis of large amounts of data in mind. The automation and intelligence of IoT devices are also key elements, and they should be scalable within the broader architecture of the system.

Businesses may be able to gather data in real time about their goods and operations in a smart environment that is built on the IoT, analyse the data, and then offer the findings to their stakeholders so that their stakeholders may make choices based on accurate information. The quick response time of the intelligent environment contributes to the enhancement of both operational efficacy and the level of pleasure experienced by customers.

By collecting data from the environment and delivering it to the cloud through the Internet of Things, cloud-based applications that are affordable, flexible, and secure have the potential to turn a smart environment into a platform for decision-making. This is accomplished by collecting data from the environment. The analysis of gathered data, the formation of decisions, and the forecasting of parameter values are the primary responsibilities of cloud servers. It will also be necessary to develop intelligent cloud operation management solutions in order to guarantee that a cloud infrastructure is performing at its highest possible level.

The primary data was collected through the use of a questionnaire, and approximately 153 participants were selected through the use of a purposive sampling strategy. In addition, the research made use of a variety of secondary sources. In addition to this, the researchers gather data from secondary sources in order to acquire a deeper comprehension of the applicable framework that has been utilised in the region of the study.

6. CRITICAL ANALYSIS

This part enables in presenting the critical data analysis and findings of the study, based on the data collected. The major analysis used are Demographic data analysis, Regression and Structural Equation Model (SEM) analysis

Table 1: Demographic variables

Gender	Frequency	Percent
Male	81	52.9
Female	72	47.1
Age	Frequency	Percent
Less than 30 years	58	37.9
31 - 40 years	44	28.8
41 - 50 years	20	13.1
Above 50 years	31	20.3
Living in	Frequency	Percent
Metro City	73	47.7
Non-Metro City	80	52.3
Level of Management	Frequency	Percent
Lower Level Management	71	46.4
Middle Level Management	35	22.9
Top Level Management	26	17
Others	21	13.7
Experience	Frequency	Percent
Less than 5 years	52	34
5 - 10 years	49	32.1
10 - 15 years	25	16.3
Above 15 years	27	17.6

Based on the table 1, it is noted that 52.9% were male and remaining were female respondents, 37.9% of the respondents were in the age group of less than 30 years, 28.8% were in the age group between 31 - 40 years, 20.3% were above 50 years and remaining 13.1% were in 41 - 50 years age group. Furthermore, 47.7% were living in metro cities and remaining were living in non-metro cities, 46.4% were in lower level management, 22.9% were in middle level management, 17% were in top level management. 34% possess less than 5 years of experience, 32.1% possess 5 - 10 years, 16.3% possess 10 - 15 years of experience and 17.6% possess experience of above 15 years.

Regression analysis

In order to understand the nature of association between the variables, regression analysis is applied.

Table 2: Regression Analysis

Regression	B val	Std. Error	t	Sig.
(Constant)	0.301	0.157	1.919	0.06
Real time Information	0.343	0.084	4.076	0.00
Savings in cost	0.336	0.085	3.937	0.00
Smart operations	0.22	0.073	3.033	0.00
Coeff. Of deter	0.807	F Val	207.51	0.00

From table 2, the coefficient of determination is 0.807, which shows the model is good fit, also the F value is at 207.51 with significance value of 0.00, hence it is noted all independent variables (Real time information; Savings in cost and Smart operations) possess significant difference towards potential benefits of using IoT in wireless communications. Also, the regression equation can be framed as

Potential Benefits = 0.343 x Real time information + 0.336 x Savings in cost + 0.22 x Smart operations.

Structural Equation Model analysis

The structural equation model sis one of the extensive analyses which is considered as combination of multiple linear regression and factor analysis, the SEM model provides the path output which shows the degree of association between the variables. The data is then analysed to understand the causal measure and provide in detail the extent of relationship among the variables effectively.

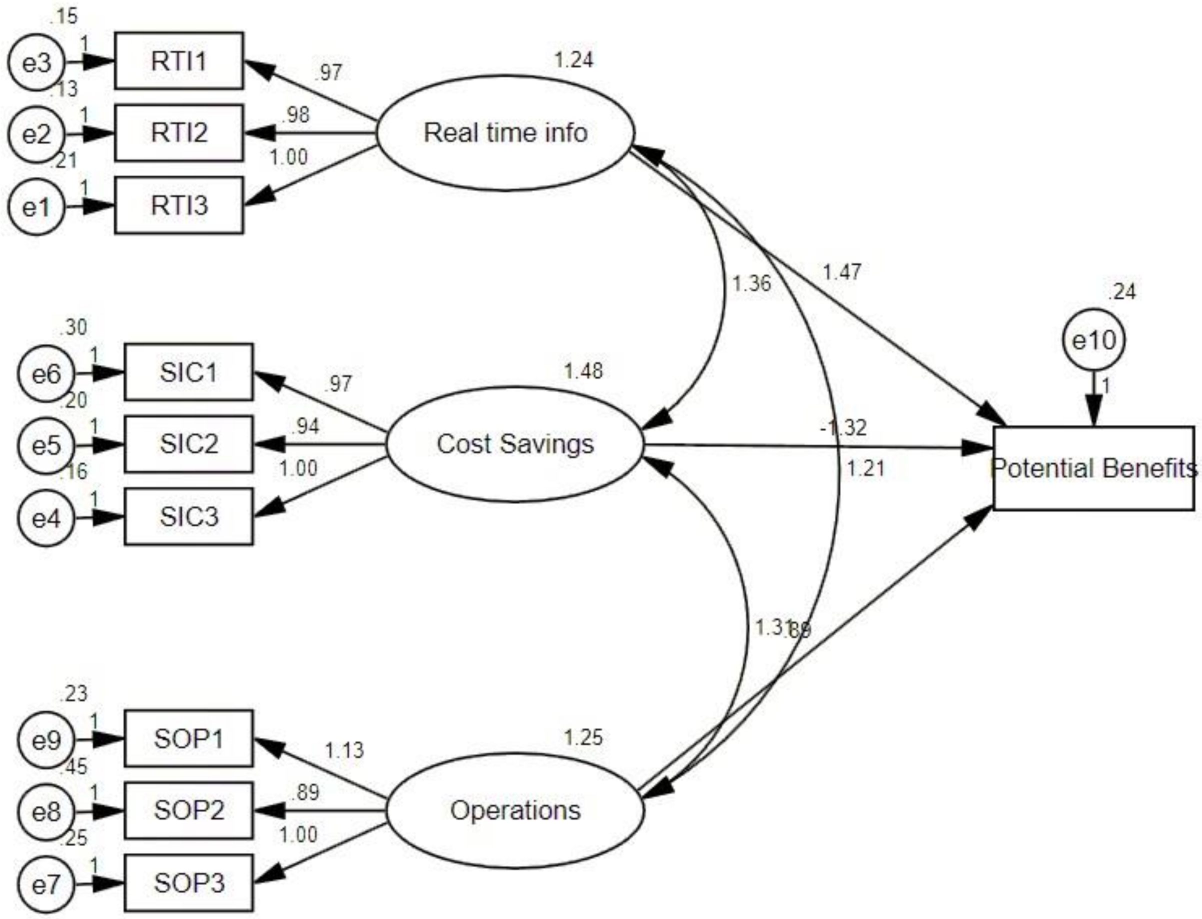

Fig 1: Path Diagram

The diagram shows that extent of relationship between the key variables, this is represented through path analysis

Table 3: SEM Analysis

Dependent Variable	Independent Variable	Estimates	Std. Err.	P Coef
Potential Benefits	Real time information	1.465	3.625	0.006
Potential Benefits	Cost savings	1.318	2.983	0.002
Potential Benefits	Smart operations	0.888	0.527	0.001
Model Fit	GFI	RFI	CFI	PCFI
Default	0.811	0.932	0.931	0.621

From table 4 it is noted that the p value is less than 0.05 and hence all variables possess significant association towards the dependent variable.

The goodness of fit index (GFI) is noted to be at 0.811, the threshold level of the GFI is 0.600, hence can be stated that the model is a good fit, also it is noted that the comparative fit index (CFI) is at 0.932, the threshold level is more than 0.90, hence it can be stated that the model is stated as good fit.

Also the analysis reveals that the p coefficient is less than 0.05, hence it can be stated that all the variables possess effective influence towards the potential benefits of using IoT in wireless communication.

7. DISCUSSION

Analysts predict that by the year 2025, there will be more than sixty billion linked devices, which may result in the production of enormous amounts of data. The majority of applications for the Internet of Things are dependent, for their most efficient functioning, on data management services. For the purpose of processing, gaining access to, and storing vast amounts of IoT data, highly scalable computing platforms are required. These platforms must ensure that the performance of the application is not negatively impacted by the massive amounts of data that are produced by smart IoT environment devices.

In a smart environment based on the Internet of Things, where a wide variety of items are linked to one another, compatibility is an extra difficulty. The vast majority of goods, as a result of the absence of a universal language, are unable to interact with one another, which results in compatibility problems. Device connectivity necessitates the collaboration of many businesses, such as LG, Philips, and Samsung. People will be frustrated if these businesses do not collaborate with one another and are limited to using a single brand in this scenario. Therefore, in order for engineers to build a universal coding language that takes into consideration the architecture of each product, it is necessary for these firms to collaborate with one another. It is necessary to find a solution to the compatibility problem before the Internet of Things can be successful.

The choice to implement an industrial internet of things ecosystem will need a significant investment in internet of things technology. It is challenging for enterprises to use IoT when the hardware and software of the objects being connected are not open and compatible. It is necessary to develop Internet of Things solutions for industrial use that are both open and integrated in their underlying hardware and software. In addition, the solutions should have enough adaptability to make it possible for industries to change and advance, as opposed to just replacing the installations that are already in place with brand new ones. In order to innovate within the frameworks of already existing technology and software, one needs both the necessary skills and financial resources.

8. CONCLUSION

Security and privacy issues are among the most significant and difficult challenges posed by the Internet of Things (IoT) because of the proliferation of threats, hacks, hazards, and vulnerabilities. Device-level privacy may be compromised due to a number of problems, including insufficient permission and authentication, insecure software, firmware, and web interfaces, and inadequate transport layer encryption. Creating trust in Internet of Things (IoT) systems requires addressing several issues, including those related to data security and privacy. Each layer of the architecture of the Internet of Things has to have security mechanisms built into it in order to reduce the likelihood of security breaches and attacks. Interoperability refers to the capability of several Internet of Things (IoT) systems and devices to communicate with one another and share information. The information that is being transferred is not reliant in any way on the software or hardware that has previously been installed. The problem of interoperability is due to the varied character of the technologies and solutions that are employed in the development of the Internet of Things (IoT). The technological, semantic, syntactic, and organisational layers of interoperability all need to be considered.

Even if there aren't many drawbacks, one might make the case that the use of the Internet of Things is only focused on bringing about brand new financial and social benefits for society as a whole and the people who live in it. This involves a wide variety of public conveniences, such as industrialisation, the regulation of water quality, the advancement of the economy, and the maintenance of one's health. The Internet of Thingsis making significant contributions toward achieving the social, health, and economic objectives set out by the United Nations. The preservation of the natural environment is an additional important priority. IoT developers have a responsibility to be aware of how their systems and devices affect the surrounding environment in order to mitigate any adverse effects. The old civic framework of society is being replaced with a high-tech structure thanks to the Internet of Things and its concepts of "smart cities," "smart homes," "smart cars and transportation," and "smart transit." Taking into account the aspects of the natural environment that make up the smart city is an additional crucial consideration. Therefore, technology that is both energy efficient and kind to the environment ought to be taken into consideration during the planning and construction of the infrastructure for smart cities. In addition, cutting-edge technology is being built into brand-new automobiles so that they can recognise when there is a traffic jam ahead and direct the driver to the most efficient detour possible.

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