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The Implementation of the Internet of Things at the Theatre Foundation

Ndalo Ringani and Takalani Tshabalala
Department of Quality and Operations Management
University of Johannesburg
South Africa
ndalog2@gmail.com; tshabalalat@uj.ac.za

Abstract

This research was directed at investigating the viability and consequences of employing **Internet of Things (IoT**) solutions at a theatre in Johannesburg, South Africa – a widely visited theatre with significant obstacles in relationship to aging **infrastructures, ineffective resource utilization, and low audience ship**. The objective of this research was to assess the **applicability of IoT adoption to solve these operational challenges** and at the same time improve performance, security, and sustainability by making use of technology and infrastructure used in theatres The study outlines areas of the theatre's operation that can be redesigned and its benefits of using IoT which includes facility management, security, and audiences and evaluates the level of technological sophistication needed to apply IoT to those areas. This strategy recommends a gradual implementation process relevant to the course the theatre must operate considering the costs, maximum expansion capacity, and prospects for growth. Therefore, through IoT solutions, through this research, the theatre should manage to improve on the utilization of the resources to the audience, and the general productivity of the theatre, hence increasing its sustainability and its ability to adapt to change. This can be done using the Internet of Things Evolution. Even though the study is conducted directly with the Theatre, it elaborates on how IoT can be implemented to organizations with similar issues all over the world and the Usage of IoT in Theatres.

Key words
Technology and the Infrastructure Used in Theatres, Internet of Things – Evolution, Benefits of Using Internet of Things, Usage of IoT in Theatres.

1.Introduction

1.1 Background of the study

The implementation of the Internet of Things has emerged as a new strategy across various sectors and organizations that deal with different departments, which has completely changed the way we interact with technology and enhanced operational efficiencies. With its ability to interconnect physical devices and enable data exchange over a network, IoT has garnered significant attention due to its potential to optimize processes, improve decision-making, and enhance user experiences. As Johnson (2011) emphasizes, the implementation of IoT technologies offers immense opportunities for organizations to innovate and stay competitive in today's digital landscape.

The Theatre, renowned for its cultural significance and contribution to the arts, stands as a prominent institution in need of technological advancement to streamline its operations and enhance audience engagement. By leveraging IoT solutions, the Theatre can revolutionize various aspects of its functioning, ranging from facility management to audience experience enhancement. However, the successful implementation of IoT at the Theatre requires a comprehensive understanding of its unique requirements, challenges, and opportunities.

1.2 Problem Statement
The Theatre, despite its esteemed reputation and historical significance, grapples with a myriad of challenges in its operational landscape. Chief among these challenges is the outdated infrastructure and inefficient resource management practices, which impede the theatre's ability to deliver optimal experiences to its audience and stakeholders.

1.3 Primary Objectives
The implementation of Internet of Things at The Theatre Foundation.

1.4 Secondary Objectives
- To determine the assessment of the Theatre in terms of the current infrastructure and considerably evaluate the acting processes and technological needs.
- To determine which sectors in the Theatre can the IoT be applied.
- To assess different opportunities of IoT solutions and technologies for solving the defined problems and increasing organizational performance.
- To propose a strategy for the Theatre on the gradual adoption of the IoT in stages taking into consideration its feasibility, costs, and ability to grow.
- To evaluate the changes that will happen within or by means of the implementation of the IoT system to the Theatre’s operational performance, resource consumption and utilization, or even the experience of the audience.

1.5 Significance of the study
The significance of this research is that it will bring change towards the positive organizational culture within Theatre that has been for a long time and can be declared historically as well as socially important by exploring the feasibility and implications of integrating IoT technologies into the theatre's operations.

2. Literature Review

2.1. Technology And the Infrastructure Used Theatres.
According to a group of theatre professionals called the Illuminated Integration Team (2020), they mentioned how technology is increasing the functionality of theatres on a very large scale, starting with designs of sets, productions and all the way to the delivery of the actual performance. Technology is also being used to create the props in a much rapid way. Traditionally, the production managers and designers would draw multiple designs and make a lot of changes which would be time consuming, but thanks to technology, these designs can just be put up a program and automatically generated (Illuminated Intergration Team, 2020).

2.2. Internet of Things – Evolution.
Kramp (2013) mentioned that Internet of Things, abbreviated as IoT, was discovered back in 1999 by a British technology pioneer named Kevin Ashton (Kramp & Kranenburg, 2013). In that year, it is reported how this pioneer mentioned that IoT has been present ever since, and it is a combination of a lot of objects being connected all together, therefore it is not independent (Kramp & Kranenburg, 2013).Braun (2019), mentioned how the IoT has been in existence since 1969, and it include so many objects that are ‘smart’ and these are even found in our daily household objects , making our daily operations much easier (Braun, 2019)

Table 1. Application of IoT

Theatre Component	IoT Relation
Lighting System	There are electrical systems that are put in place and automated machinery used to program the lighting cues, all these need to be connected to specific internet and technologies.
Sound Systems	There are analogs and digitalized amplifiers and broadcasting channels that come to play, and these can be easily linked to online databases such an cloud systems.
Staging	Closing curtains, lighting bars are all controlled by a digitalized system which is not controlled manually.
Viewers Experiences	Theatre spaces can be easily changed to suit hybrid venues, or even 3D spaces such as virtual reality rooms.

2.3 The Internet of Things Defined.

According to Perwej and Haq (2019) IoT is an intertwined network of objects, which consist of software or sensors, technology related, which make it possible to connect to the internet, and also share big data with other devices or software systems (Perwej et al. 2019).

2.4 Benefits of using IoT in Theatre.

The internet can be easily applied in the world of theatre when it comes to managing the lighting designs and sound, the impressions, and the experience that the audience receives.

3. Research Methodology.

3.1 Research Methodology

The research method that will ensure the achievement of the secondary objectives are met in the Implementation of Internet of Things at The Theatre Foundation is by means of quantitative research. Quantitative research is a type of research that is, investigating the nature of something through use of numbers that is analyzed using quantitative technique (Creswell 2017). Restricted to Cohen (1980), it was social research that took empirical methods and empirical statements. Quantitative study is descriptive in its survey and exploration since it is based on theories that have already been developed (Leedy and Ormrod 2001).

3.2 Research Design

Creswell and Creswell (2017) defined that there are three methods in research, and they are, quantitative method, qualitative method and mixed method. In as much as this research project aims to evaluate the level of compliance with the Internet of Thing at the Theatre a quantitative technique was deemed applicable. The administered questionnaires were an effective way of assessing the participants' tendencies towards sects since quantitative research was more suitable for this study as prior research reveals that quantitative research is deemed more appropriate. A quantitative approach was adopted using a survey questionnaire method to collect data. A standardized set of questions was given to different people related to different sectors using the Internet of Thing, then data that can be stated and coded in numerical form was then generated. The questionnaires were distributed through a google survey link format and electronic mail.

3.3 Sample

A sample of a population is defined as that portion of the Worldwide population that is used to make an analysis. According to Mouton (1996), a sample is selected elements to establish information about the total population from which they were selected. Sampling is one way of making a definite sample that can be utilized in the establishment of data (Leedy 2003). Sampling designs are broadly classified into two categories: probable (by chance) and non-probable (by other than chance) samples. The target was established as 30 self-administered questionnaires completed by professionals from the Theatre based in Gauteng. Employees acting as Producers, Administrators, Operating officers, Actor/Actress, Project manager and Technician practitioners employed in different organizations in Gauteng province.

3.4 Procedure for Data Collection

The primary data of this study will be gathered by structured questionnaire which will provide in-depth information and general information that will be on research. The questionnaire used in this research will be designed to evaluate the implementation of Internet of Thing at the Theatre. The extent of the potential benefit on the six proposed areas and where the IoT is mostly used and how to improve the IoT for future use at the Theatre as discussed in the literature review. With all the respondents being qualified Theatre employees, the questionnaire was drawn up in English, the official language of South Africa; therefore, they can read and answer the questions. All respondents were assured anonymity in their responses. The questionnaire consisted of six sections: A, B, C and D. The focus of Section A was on the general background information of the respondents, it included their highest qualification, their genders, years of experience in the industry, etc. Section B was focused on the potential benefit of using the IoT at the Theatre, section C aimed to find areas where the IoT is mostly used at the Theatre and the section D focused on Areas of improvement for future use of the IoT at the Theatre.

3.5 Data Analysis and Interpretation.

According to Sharp, Peters & Howard (2002), analysis is the arrangement and categorization of data in a manner that results in data-information. Data analysis was done and therefore, interpreted using spread sheet; Microsoft and Statistical Package for Social Science (SPSS) computer software. The following two approaches are briefly outlined below:
The degree of Internet of Thing implementation at the Theatre was measured using a five-point Scale. Section A was the background information of the respondents; their highest qualification achieved, gender, years of experience in the industry. Section B was focused on the outcome that could be gained from the use of IoT at the Theatre. Section C endeavored to establish areas in which mostly use of the IoT at the Theatre is observed and section D focused on Areas of improvement if in the future IoT was to be employed in the Theatre.

Relative mean item score (MIS) was obtained from the summation of all weighted responses of an aspect in comparison to the total response of a particular aspect. This was premised on the percentage that the scores of the respondents on all the parameters adopted represent and constitute absolute measures of relative significance. The MIS index for a particular factor totals the actual scores that all the respondents gave and divide the sum by the total of all the possible maximum scores using the point scale. They all contain responses for each of them and each of them has a different point rating from one to five. The following equation was used to find the mean item score MIS as indicated below.

MIS= 1n1 + 2n2 + 3n3 +4n4+5n5 n1 = Number of people indicated extremely unlikely or strongly disagree.n2 = Number of respondent for unlikely of disagree;n3 = Sampling size for those that responded neutrally.n4 = Number of respondents for likely or agree;n5 = Number of respondents to extremely likely or strongly agree;N = Number of respondents ..Equation 1.0

$\sum N$
Where;
n1 = Number of respondents for extremely unlikely or strongly disagree;
n2 = Number of respondents for unlikely of disagree;
n3 = Number of respondents for neutral;
n4 = Number of respondents for likely or agree;
n5 = Number of respondents for extremely likely or strongly agree
N=Total number of respondents
These parameters would then be ordered in a descending order of their mean item score after going through some statistic computations.

4. Results and Discussion

4.1 Introduction

This section reflects on the results and findings previously addressed in chapter 3 on the research questions. Furthermore, in accordance with the literature examined, the results were discussed. The purpose of this chapter is to assess if the research questions presented were answered by the data analysis. The primary objective of this study was Assessing the Implementation of the Internet of Things (IoT) at the theatre.

4.2 Demographic Profile of Respondent

Figure 1 shows from the 26 respondents 29,2% were administrator,20,8% Technicians,16,7 % Operating officer,16,7 health and safety specialist ,12,5 % project manager and 3,16 actor and actress.

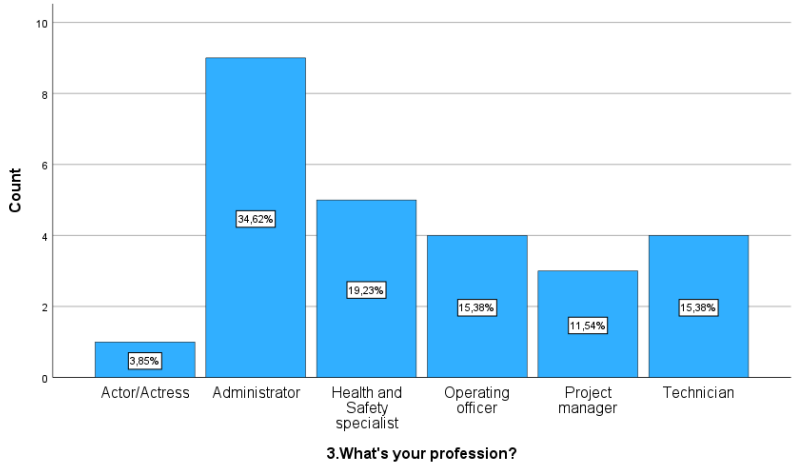

Figure1. Respondents professional occupation

Figure 2 shows different organization of respondents ,57.06% for private sector,19.29% public sector,16.7% consultant ,3,16% producer and 3.84 client.

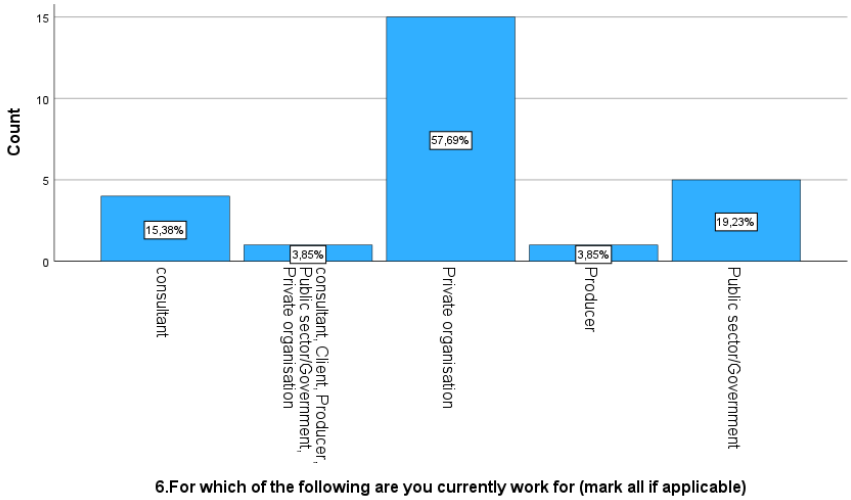

Figure 2. Sampled respondents' type of organisation

Figure 3 shows respondents' years of experiences,84.82% for 1 to 5 years,7.89% for 6 to 10 years,3.96% for 11 to 15 years and 3,06% for 21-25 years.

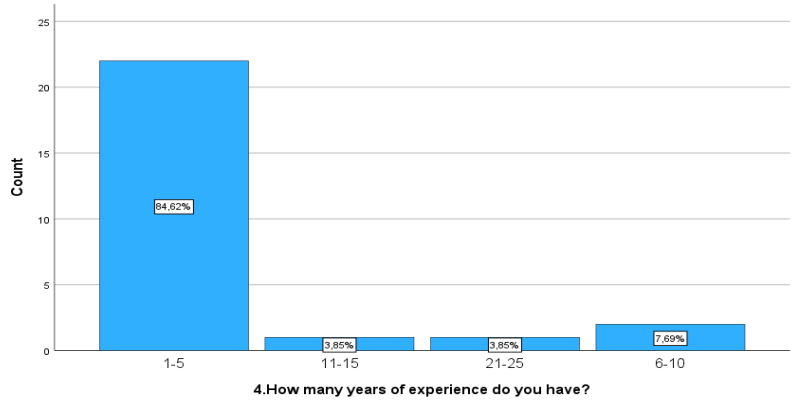

Figure 3. respondents' years of experience

Figure 4 shows respondents age group,76.9% are 20 to 30 years ,11.5% are 31 to 39 years old,3,9% are 40 to 49 years old and 7.69% are 50 to 59 years old.

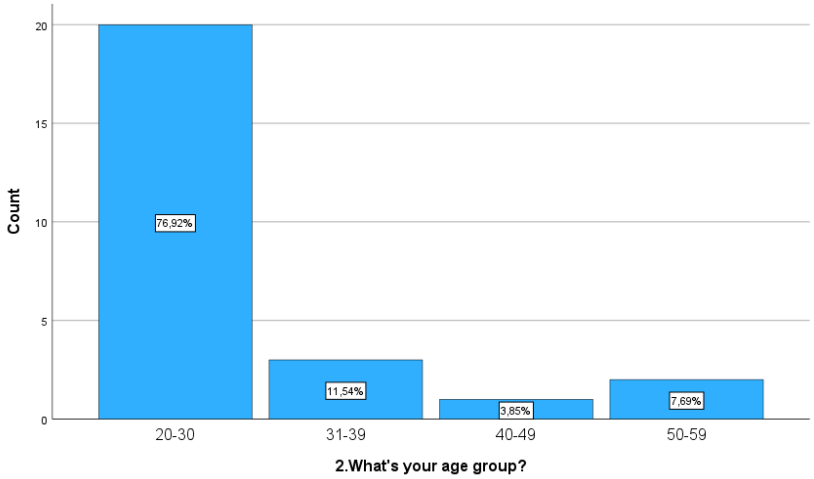

Figure 4. respondents age group

5. Conclusions and Recommendations

The findings have shown that on top of the list, the range of communication and the accuracy and precision remain, respectively the first and second concerns appear to be the most common area where the IoT should be improved at the theatre. From the findings, it can be further confirmed that the viewers' experiences are the most essential benefit of the implementation of the IoT at the theatre Walie (2024) stated that the viewer's experience remains one of the essential elements for immersive experience for the audience, customization and creativity.
The implementation of the Internet of Things at the theatre plays a big role in the operation management process in terms of data collection, security concerns, viewers' experience, and easy access at the theatre for any organiser, no matter where they could be on earth. Therefore, all participants at the theatre need to be aware of measures that can be used to enforce the use of the Internet of Things at the theatre for the operation management sector It is recommended that.

The top management team in the operation management organisations must contribute to the application of the IoT as well as new technologies by being innovative and supportive also by training the employees on the adoption of the Digitalization of the operation management sector also by training the workers on the adoption of the Digitalization of the operation management sector. Organisations with resistant employees must focus on establishing user acceptance by fostering a positive attitude toward the learning process of the labour force on the use of IoT in the operation management sector. This will help the organisation to face different challenges, the implementation of IoT at the theatre.

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