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Clarity of Knowledge Gap between IoT and AoT

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ABSTRACT
In this era, we have the basic idea of "Internet of Things". We know that IoT refers to the vast network of interconnected physical devices or "things" that are embedded with sensors, software, and other technologies to collect and exchange data over the internet. These "things" can be anything from household appliances and industrial machines to wearable devices and vehicles. But what will be the outcome if the word "Analytics" added in the place of the word "Internet" and will be attached with the word "things" and will be termed as "Analytics of Things"? Will it be as similar as Internet of Things or it will be completely different from Internet of Things? Shall there be any other functionalities related to "things" associated with the word "Analytics"? Will it require Internet? This research paper will answer all the questions.

KEYWORDS IoT, AoT, Artificial Intelligence, Analytics

INTRODUCTION

In recent years, the rapid proliferation of technology has transformed the way we perceive and interact with the world around us. The rise of the Internet of Things (IoT) and the Analytics of Things (AoT) has been at the forefront of this technological revolution [1]. IoT, with its interconnected physical devices and data exchange capabilities, has reshaped industries, homes, and daily life. Simultaneously, AoT, leveraging advanced analytics and data processing techniques, has become instrumental in deriving valuable insights from the vast ocean of data generated by IoT devices [2].

The convergence of IoT and AoT offers unprecedented opportunities and challenges, demanding a diverse set of skills and expertise from professionals in these fields [3]. However, as these domains continue to evolve, it becomes increasingly important to understand the knowledge gap that exists between IoT and AoT professionals' perspectives. Bridging this gap is essential for harnessing the full potential of these transformative technologies [4].

The purpose of this research paper is to examine the clarity of the knowledge gap from the viewpoints of professionals working in both the IoT and AoT domains [5]. By delving into their perceptions, experiences, and areas of expertise, we aim to identify the specific areas where the gap is most pronounced and to uncover potential strategies for closing this gap.

This study will not only shed light on the challenges faced by professionals in understanding the intricacies of both IoT and AoT but also contribute valuable insights to different industries [6].

In the following sections, we will outline the research objectives, provide a comprehensive review of relevant literature, describe the methodology employed for data collection and analysis, and present the expected contributions and implications of this study. Through this research, we endeavor to illuminate

the path towards a more integrated and knowledgeable community of professionals in the intersecting domains of IoT and AoT [7].

Internet of Things (IoT)

IoT refers to the vast network of interconnected physical devices or "things" that are embedded with sensors, software, and other technologies to collect and exchange data over the internet [8]. These "things" can be anything from household appliances and industrial machines to wearable devices and vehicles [9]. The primary objective of IoT is to enable these devices to communicate with each other and with centralized systems, creating a smart and interconnected environment [10]. IoT allows for real-time data collection, remote monitoring, and automation of various processes, leading to increased efficiency, productivity, and convenience. In essence, IoT is the foundation that enables the connectivity and data exchange between devices, creating a vast network of interconnected "things" that can be monitored and controlled remotely [11].

Analytics of Things (AoT)

Analytics of Things (AoT) is the process of collecting, processing, analyzing, and deriving insights from the massive volumes of data generated by IoT devices [12]. As IoT generates a tremendous amount of data, AoT focuses on extracting meaningful information from this data to make data-driven decisions and gain actionable insights. The data analytics process involves using various techniques, such as data mining, machine learning, and predictive modeling, to identify patterns, trends, and anomalies within the IoT data [13].

AoT plays a crucial role in leveraging the data collected by IoT devices to optimize processes, improve performance, detect issues proactively, and enhance overall decision-making [14]. It helps organizations understand and respond to the data generated by IoT, transforming raw data into valuable knowledge and actionable insights [15].

LITERATURE REVIEW

The Internet of Things (IoT) has been hailed as one of the most significant technological revolutions since the invention of the internet. With a projected estimate of over 50 billion connected devices by 2020, the volume of data generated is set to increase exponentially [16]. As storage costs decrease and hardware advancements in sensors, storage, connectivity, and data transfer accelerate, the adoption of IoT is expected to expedite across industries [17].

One of the most prominent applications of IoT is self-driving cars, which have garnered the attention of major tech companies like Google, Apple, Tesla, and Uber [18]. Equipped with an array of complex sensors such as laser range finders, GPS, cameras, lighting, and weather sensors, self-driving cars are quintessential IoT systems [19]. The aviation industry is another sector making significant IoT investments, with aircraft featuring tens of thousands of sensors generating terabytes of data in each flight [20]. Close monitoring of these components is critical for avoiding fatal crashes and optimizing fuel consumption [21].

Beyond transportation, IoT finds applications in manufacturing, smart homes, smart cities, oil & gas, healthcare, and energy management at the enterprise level [22]. However, simply collecting data is not

enough; the true value lies in its analysis [23]. Data that goes untouched and unanalyzed is a lost opportunity. For instance, a self-driving car gathering data from various sensors must analyze it in real-time to make decisions on navigation, direction, and safety [24].

With the rise of Artificial Intelligence (AI), real-time decision-making is becoming a crucial aspect of IoT [25]. Algorithms play a pivotal role in analyzing the vast volumes of data generated by IoT devices. The need to develop innovative algorithms or enhance existing ones to analyze IoT-generated data has led to the emergence of a new term called "Analytics of Things" (AOT) [2]. AOT focuses on the processing and analysis of raw data produced by IoT devices, empowering organizations to make data-driven decisions and derive valuable insights [26].

As IoT continues to permeate every industry, it is essential to give due importance to the development of sophisticated algorithms that enable efficient analysis of IoT data. The combination of IoT and AOT represents a powerful duo, revolutionizing industries, optimizing processes, and enhancing overall efficiency [27]. By harnessing the potential of IoT data through AOT, businesses can stay ahead in this technology-driven era [28].

SURVEY METHODOLOGY

This project aims to investigate and enhance the awareness of professionals by examining the factors related to their knowledge that may uniquely influence the awareness about IoT and AoT applications. The research process involves four main steps to achieve this goal.

Step 1: Primary Research

The primary research phase is the foundation of the project. It involves conducting a comprehensive study on the subject matter, focusing on the current scenario. The researchers will design surveys to gather relevant data from the young professionals who have just started their career working in the domain of IoT and AoT. These surveys will delve into various aspects of their experiences, and factors that impacted their knowledge regarding IoT and AoT. The primary research will provide valuable insights into the key determinants to check whether the respondents are aware of the basic terminologies related to IoT and AoT.

Step 2: Descriptive Analysis

Once the primary research data is collected, the next step is to analyze and illustrate the findings in a more objective manner. The researchers will carefully examine the survey results to identify patterns, trends, and correlations. Through descriptive analysis, the research team will examine different industries e.g. IT or software engineering, business administration, healthcare studies where the professionals are working in IoT and AoT in their daily purposes and here the researchers will present the data in a vivid and analytical manner, providing a concise overview about the information that checks the knowledge of the respondents whether they are aware of the applications of AoT in real life or not.

Step 3: Exploratory Investigation

The exploratory phase involves delving deeper into the identified factors related to the awareness of the comparison between AoT and IoT. The research team will investigate various studies and literature to gain

a deeper understanding of these factors. They will explore existing research and theories that address the technological involvement in young professionals. This process will help establish a comprehensive framework for understanding the complexities of differentiation among AoT and IoT.

Step 4: Interviews

To add a qualitative dimension to the research, the project includes interviews with participants who have less experience in their professional life. These interviews will provide firsthand perspectives and insights into their knowledge regarding AoT and IoT. By engaging in structured interviews with participants who are well-informed about the topic, the researchers can gather rich and detailed information that complements the qualitative data obtained through surveys.

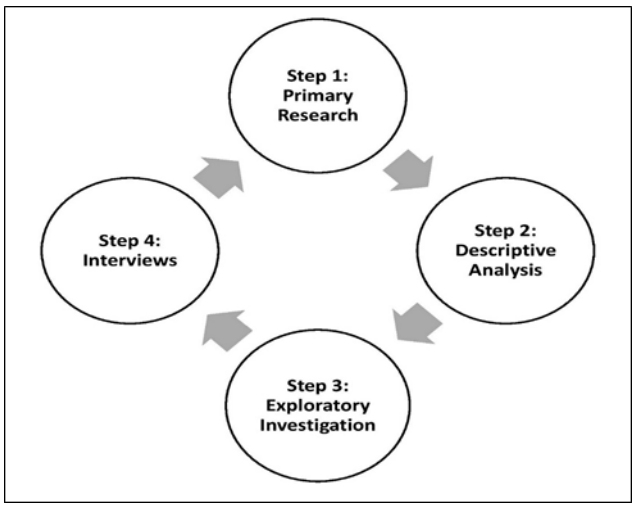

Figure1: Survey Methodology

The Figure 1 shows the steps of survey methodology by which the researchers will examine the awareness of the knowledge about IoT and AoT who has just started their career and works on the said technologies in their day to day life.

RESULTS

The researchers have gone through the survey in which they have asked questions to the young professionals who have just started their career. The questions were related to the knowledge of internet of things and analytics of things. The researchers have taken 57 respondents and the following tabulated data refers the questions asked to the respondents during the interviews.

SL No	Question	Results		
		Yes (%)	No (%)	Maybe (%)
1	Have you heard about the term “Internet of Things (IoT)”?	84	16	N/A
2	Have you heard about the term “Analytics of Things (AoT)”?	69	31	N/A
3	Is AoT applicable for business purpose?	79	6	15

4	Is AoT applicable for health care purpose?	67	12	21
5	Is AoT applicable for software engineering purpose?	76	15	9
6	Is there any difference between AoT and IoT?	67	33	N/A

It has been observed from the above data that question no. 6 where the researchers have asked the respondents that whether they know any differences between AOT and IOT and among 57 respondents, 22 opted for "Yes" and 11 don't have any idea about the said question.

Step 1: Primary Research

In this step, the researchers have chosen two questions to gather information regarding the knowledge of AOT and IOT among young professionals. The questions are -

1) Have you heard about the term "Internet of Things (IoT)"?
2) Have you heard about the term "Analytics of Things (AoT)"?

Therefore, the intention to ask the above questions is to gain insights about the awareness of these terms among the respondents.

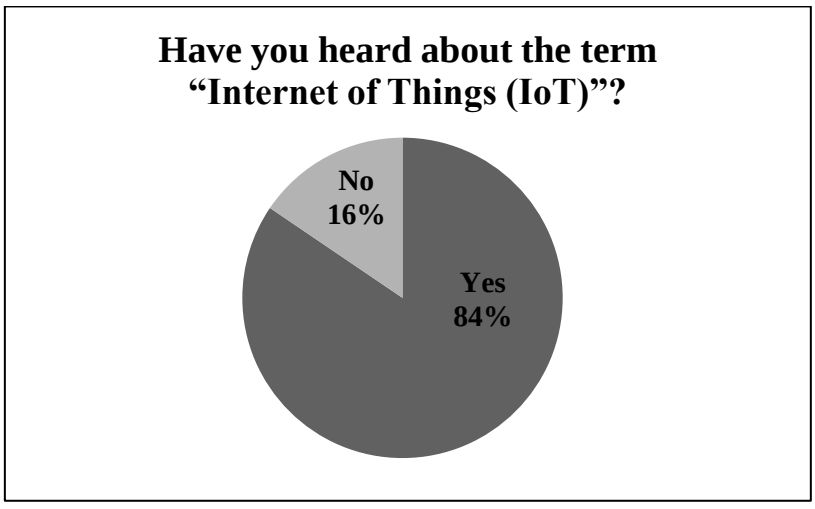

Figure 2: Awareness of the IoT Terminology

It has been observed from Figure 2, where the researchers have asked the respondents that whether they are aware about the terms IoT or not. The researchers have taken 58 responses and out of the submitted data, 49 (84 %) opted for "Yes" and 9 (16%) opted for "No" for the term "IoT".

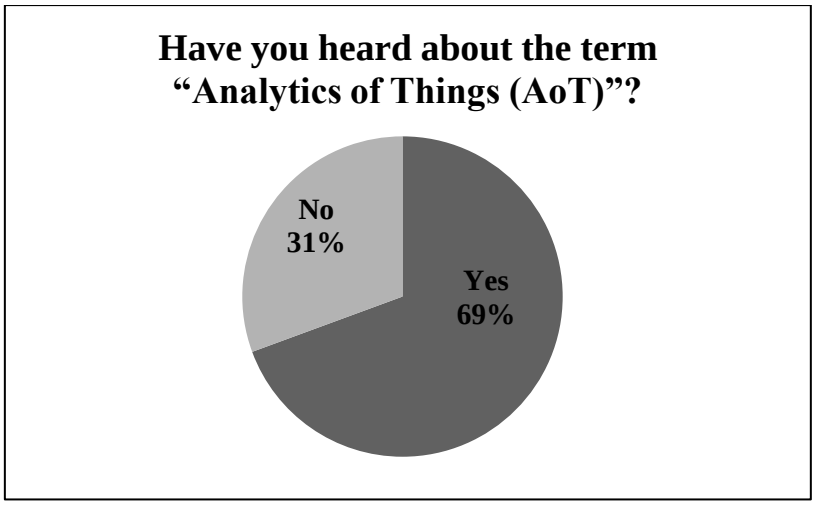

Figure 3: Awareness of the AoT Terminology

It has been observed from *Figure 3*, where the researchers have asked the respondents that whether they are aware about the terms AoT or not. As depicted from *Figure 2*that 49 responses aware of the term "IoT", and out of 49 responses it has been observed from *Figure 3* that 33 (69%) opted for "Yes" and 15 (31%) opted for "No" for the term "AoT".

Step 2: Descriptive Analysis

In descriptive analysis, the researchers have chosen three questions to the young professionals to gather information about the effectiveness of AoT in business context, software development context and in healthcare context. The questions are listed below –

1) Is AoT applicable for business purpose?
2) Is AoT applicable for healthcare purpose?
3) Is AoT applicable for software engineering purpose?

The objective is to examine the professionals employed at different industries for instance IT or software engineering, business administration, healthcare studies uses AoT in their daily purposes and here the researchers observe the knowledge of the respondents whether they are aware of the applications of AoT in real life or not.

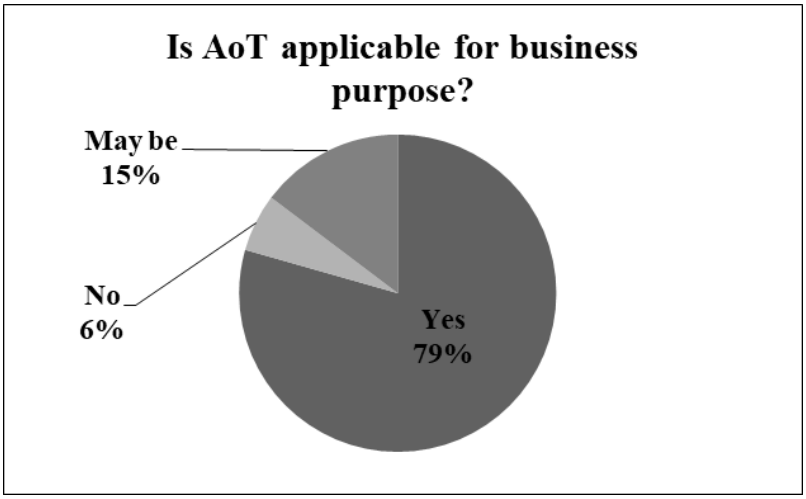

Figure 4: Awareness of the AoT applicability for business purpose

It has been depicted from Figure 4, where the researchers have asked the respondents whether they are aware about the applicability of AoT in business context or not. The researchers have taken 33 responses and out of the submitted data, 26 (79%) opted for "Yes", 2 (6%) opted for "No" and 5 (15%) opted for "Maybe".

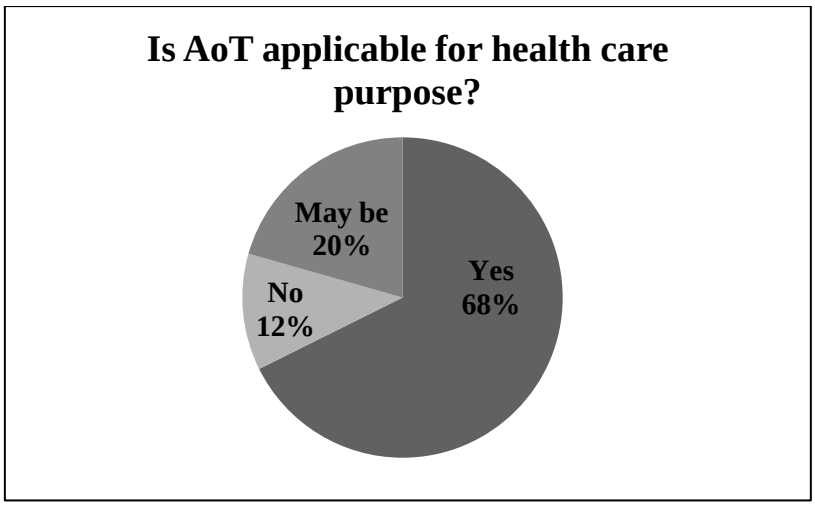

Figure 5: Awareness of the AoT applicability for healthcare purpose

It has been observed from Figure 5, where the researchers have asked the respondents whether they are aware about the applicability of AoT in healthcare context or not. The researchers have taken 33 responses and out of the submitted data, 22 (68%) opted for "Yes", 4 (12%) opted for "No" and 7 (20%) opted for "Maybe".

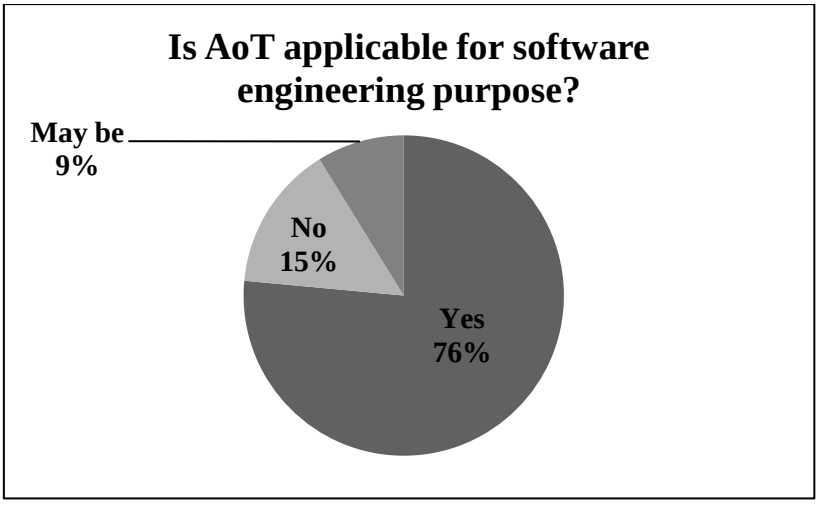

Figure 6: Awareness of the AoT applicability for software engineering purpose

The researchers have asked the respondents, who works in IT industry, to check whether they are aware about the applicability of AoT in software engineering context or not. After the survey, the researchers have taken 33 responses and out of the submitted data, 25 (76%) opted for "Yes", 5(15%) opted for "No" and 3(9%) opted for "Maybe" which is clearly understand from *Figure 6*.

Step 3: Exploratory Investigation

For exploratory investigation, the researchers have chosen one simple question to check the knowledge of the interested respondents whether they know the difference between IoT and AoT or not. The question is written below:

1) Is there any difference between AoT and IoT?

Since the researchers have the idea that, though most of the young professionals working indifferent kinds of AoT and IoT enabled projects, but are they aware of the existing differences between AoT and IoT? Is there any difference between AoT and IoT at all? Here in this step, the researchers have clear intention to find out the answers of the said question for their exploratory investigation.

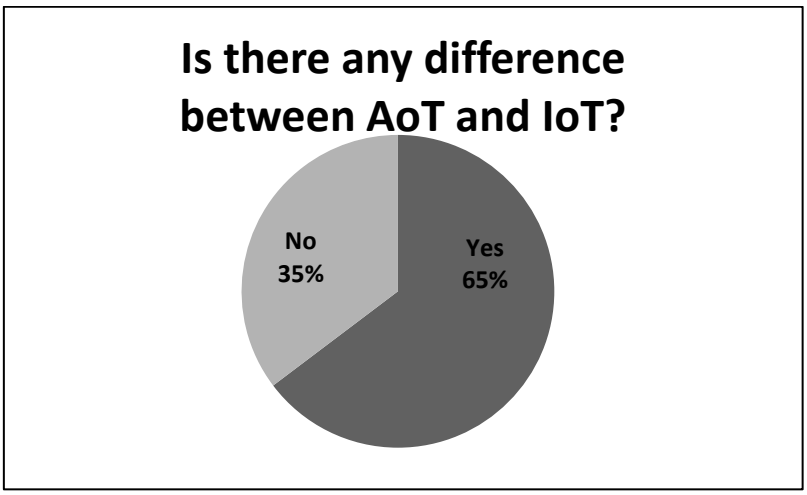

Figure 7: Awareness of the comparison between AoT and IoT

The researchers have asked the respondents, who works in different industries, to check whether they know the difference between IoT and AoT or not. After the survey, the researchers have taken 33 responses and out of the submitted data, 22 (65%) opted for "Yes" and11 (35%) opted for "No" which is clearly understand from *Figure 7*.

Step 4: Interviews

At this final step, the researchers have taken 22 interviews those have admitted that they have the knowledge of comparison between AoT and IoT. Here the researchers have counted the responses of the participants for the final scrutiny.

DISCUSSION

In this survey, the researchers have observed that most of the working professionals, who have started their career, they know the basic idea of the term Internet of Things (IoT). We can see from the survey that few of them does not have idea regarding the term Internet of Things (IoT) and have not heard about the term Internet of Things (IoT). The researchers have also found from the survey that those are aware of the term IoT, among them an average number of people heard about the term AoT and very less amount of people does not know the term AoT but they are working in the field of AoT in their daily life.

The researchers have also seen after the survey that a good number of management professionals knows the applications of AoT. On the other side, a few don't have any knowledge regarding the usefulness of it and some of them are dubious about its utilization in business context.

Moreover, it is also noted that those are working in healthcare industries and are presently assigned in projects related to AoT, among them a moderate number of people have the knowledge of the applications of AoT whereas a very small number of participants doesn't have any knowledge of its usefulness. And also, some of the participants are confused regarding the applicability of AoT in healthcare context.

Furthermore, the researchers also examined that a very good number of young software professionals are aware of the applications of AoT whereas a few respondents does not have any idea of the usefulness of AoT and a very small number are indecisive about the exertion of AoT in software engineering context.

In addition to this, the researchers have also gone through the survey where they tried to find out the knowledge gap between AoT and IoT and it has been observed that more than average number of respondents told that "yes" there is difference between AoT and IoT. On the contrary, few of them told that there is no difference between AoT and IoT. Lastly, the researchers have taken the interviews who have submitted "yes" to the question and most of them told that Internet of things (IoT) means that devices are connected to the Internet and are transmitting data to a central repository, analytics of things conducts analytics on things and in this case 'things' are nothing but IoT devices.

CONCLUSION

Initially, the primary goal of this survey report is to find out the basic knowledge of the young professionals engaged in different industries about Analytics of Things (AoT) and Internet of Things (IoT) [29]. The researchers had also the intention to clarify the comparative study between AoT and IoT and for that they have taken the interviews those have a fair knowledge about AoT and IoT. After the interviews and the survey, it is found that most of the respondents voted for the existing of differences between AoT and IoT, however, the real fact is something else. Basically, IoT is the device and AoT is the manipulative analysis of the IoT device [30]. Here the researchers can conclude that there are no direct differences between AoT and IoT, they are correlated with each other.

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