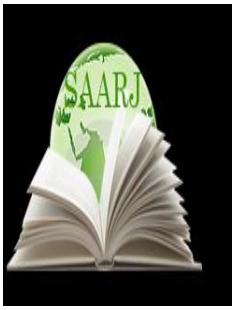

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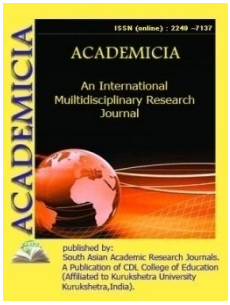

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A SYSTEMATIC REVIEW OF INTERNET OF THINGS APPLICATIONS

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ABSTRACT

The Internet of Things (IoT) is a network of smart devices containing sensors, networking, and computing technologies that integrate and operate together to create an environment where smart services may be delivered to end users. The Internet of Things is bringing a slew of advantages to people's lives by creating an environment where smart services are available to use for any activity, anywhere and at any time. All of these features and services are delivered via a variety of IoT-based apps. Monitoring and, as a result, rapid decision making for effective management are the most essential services provided by IoT applications. In this article, we use the Systematic Literature Review (SLR) technique to survey several IoT application areas in order to understand the various methods in IoT applications that have recently been presented. The goal of this article is to classify and evaluate current research methods on IoT application approaches published between 2011 and 2018, both analytically and quantitatively. A technological taxonomy for IoT application methods is provided based on the content of current research chosen using the SLR process in this study, which include health care, environmental monitoring, smart cities, commercial, industrial, and general features in IoT applications. IoT applications are compared based on technical characteristics such as Quality of Service (QoS), suggested case studies, and assessment settings. Each study's accomplishments and drawbacks are addressed, as well as some suggestions for resolving their flaws and identifying future research difficulties and unresolved problems in IoT applications.

KEYWORDS: *Internet of Things, Quality of Service, Sensors, Systematic Literature Review, Smart Objects.*

1. INTRODUCTION

The Internet of Things (IoT) has pervaded most aspects of human life in recent years, including cities, homes, universities, industrial factories, organizations, agriculture environments, hospitals, and health-care centers. Through the IoT context, numerous capabilities such as produce/consume data and online services improve daily life and activities all over the world. The different applications that are conducted in the IoT environment carry out the facilities and smart services. Innovative apps for monitoring, controlling, and automating human activities are being developed as consumers' demands increase [1]. In addition, IoT applications use cloud service computing to create appropriate composite services for service-based applications in the IoT environment by composing existing atomic services. IoT scenarios are applied to smart device apps that consumers utilize in their everyday activities in a variety of areas. IoT applications also provide some advantages for users, such as the ability to choose the best option in any situation, as well as decision-making, management, and monitoring of environmental cloud resources. Regardless of the motives of the many application areas, they all have a similar goal: providing smart services to improve the quality of human life[2].

The satisfaction of Quality of Service (QoS) criteria is the primary focus of IoT applications. Smart services in IoT applications should support user requirements by covering QoS metrics such as security, cost, service time, energy consumption, reliability, and availability.There are several technical surveys and review articles that do not systematically focus on IoT applications. The primary goal of this study is to conduct a survey of various IoT applications in order to better understand the variety of methods that have recently been offered in IoT applications. Health-care, environmental monitoring, smart city, commercial, industrial, and general methods are among the main approaches of IoT applications that have been emphasized in chosen research[3]. We propose a technique for doing a Systematic Literature Review (SLR) and provide an overview of IoT application possibilities. This section provides a quick overview of the relevant work studies in IoT applications[4]. Existing networking standards in the IoT context should explain how they may meet the QoS requirements of objects to create a smarter IoT ecosystem.

In addition, a study of various applications and the danger of a lack of cross-domain integration in the IoT environment was given in order to achieve the interoperability and QoS criteria for delivering IoT services, such as availability, dependability, scalability, and security. The study's strength is in presenting a categorization of different current standards in the network layer and application layer in various sectors such as construction, transportation, smart city, business, and grid systems. The study's main flaws are the lack of statistical information about the discussed standards' application in various stated domains, as well as the lack of a statistic chart for the risk analysis of lack of interoperability between IoT objects and transport protocols to illustrate the judgments briefly[5]. Environmental and industrial agricultural uses of the Internet of Things Four areas are addressed in this review paper: prediction, monitoring, control, and logistics. Fig. 1, illustrates the taxonomy of internet of things, which present the proper working and implementation.

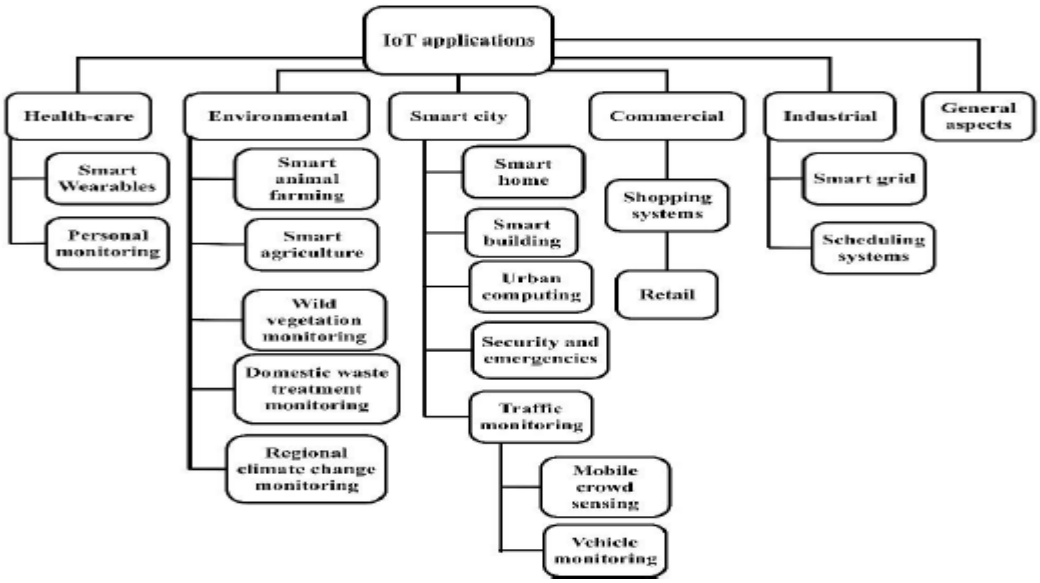

Fig. 1: Illustrates the taxonomy of internet of things, which present the proper working and implementation[6].

In this research, two significant topics are discussed and answered. The first is about the foundational technical efforts in IoT-based applications for agricultural, industrial, and environmental problems, and the second is about the infrastructures and technologies utilized in the solutions stated[7]. The majority of the articles were focused on monitoring (62 percent), followed by control (25 percent), logistics (7 percent), and prediction (7 percent) (6 percent).

In addition, according to the survey's second question, the majority of technologies and infrastructures used in IoT agroindustrial and environmental applications are divided into seven categories: visualization approaches, storage approaches, edge computing technologies, communication techniques, power sources, actuators, and sensing variables. The following problems are highlighted as outstanding issues in this review: robust standards, reduced power consumption, security, reusability of software and hardware components, cost reduction, suitable interoperability with current infrastructures, and scaling difficulties[8].

The authors proposed an architecture for IoT applications in agriculture, industry, and the environment. There are four layers in the model: application, service, communication, and physical layer. The benefit of this research is that it provides useful and complete data on studies and efforts in agroindustrial and environmental applications in the context of the Internet of Things. The paper's flaw is that it doesn't go into enough detail on the linked studies[9]. A look at the issue of service composition in smart Internet of Things (IoT) devices using the Internet Protocol (IP). The authors conducted a thorough study of smart IoT object systems, service modeling, target applications, target platforms, and service composition methods for IPs in the IoT. The survey's major flaw is that the assessment elements of availability, response time, cost, and scalability, all of which are significant quality criteria, were not examined. A survey on the Internet of Things was provided[10].

2. DISCUSSION

This research looks at issues including Service Oriented Architecture (SOA), Wireless Sensor Networks (WSN), health-care systems, and social computing. The study's major flaw is that it doesn't analyze assessment criteria like availability, energy consumption, cost, reaction time, and dependability as quality elements in this field. This part provides a thorough taxonomy on IoT applications that includes health-care, environmental, smart city, commercial, industrial, and general elements, as well as a technical evaluation of the chosen IoT applications for current research according to the applicable SLR procedure. We review papers that attempt to address some issues to support IoT applications in a specific domain, because in each type of IoT application, some problems may arise that should be focused on finding effective solutions to make IoT applications more efficient and applicable in real IoT environments. For example, important topics in smart city IoT applications include semantic-aware mobile crowd-sensing, vehicular monitoring, location finding, context-aware or QoS-aware service composition, scalable IoT platforms, handling scaled heterogeneous data streams, and many more.

As a result, the taxonomy provided in this article is based on several kinds of IoT applications in which certain subjunctives were explored and addressed in the research papers chosen. In terms of difficulties and concerns in various categories of IoT applications, we first focus on the kind of IoT applications, and then attempt to analyze the primary context highlighted in the chosen articles. Because certain issues in IoT applications are universal, we add a category called "generic aspects" to our taxonomy to categorize articles that offer a solution to a particular difficulty for supporting any kind of IoT application. Of course, the suggested taxonomy's general features apply to all IoT application areas, such as applied and systematical software, assessment procedures, and IoT application performance prediction. To put it another way, the illustrated studies of the general features provided a new conceptual framework that could be used to build any kind of IoT application. A roadmap for IoT health-care service providers that was based on the consumers' perspective. Some key provided characteristics have additional effects on consumers' confirmation of such services, according to this research.

To qualify the services, a study was conducted to assess recommended criteria such as trust and risk sensitivity. The findings of this research, which focused on lifestyle illness, show that individuals in South Korea choose trustworthy and safe health-care services. The benefit of this study is that it provides a straightforward and innovative guidance for IoT health-care service providers, as well as increasing the dependability. The study's flaw is that the retrieved data is based on a fictional service description rather than a commercial service used by a health-care customer. The reaction time is also not assessed, which is another flaw a platform for developing a monitoring system in a residential setting to identify and prevent chronic medical problems such as diabetes, obesity, and depression. The problem of energy constraints is addressed in this study as a consequence of the associated expenses of recharging or replacing the batteries of wearable devices. Only solutions that are battery driven are considered in this article. The energy efficiency of wearable devices is enhanced as a result of implementing asymmetry of network resources. The suggested system is based on Bluetooth low power and is also a part of a home platform that is equipped with video cameras on the body and environmental sensors for detecting and making decisions using machine learning methods.

A prototype wearable gear and three prototype receiver units were used to test the proposed framework. The benefits of this article are that it improves the energy feeding of wearable

devices while also increasing the system's dependability. In addition, the RSSI accuracy and transmission power are assessed. The reaction time is not measured in this study, which is a flaw. In today's living in a home setting, a platform to build a monitoring system to identify and prevent chronic medical problems such as diabetes, obesity, and depression. The problem of energy constraints is addressed in this study as a consequence of the associated expenses of recharging or replacing the batteries of wearable devices. Only methods that concentrate on battery-powered devices are considered in this article. The energy efficiency of wearable devices is enhanced as a result of implementing asymmetry of network resources. The suggested system is based on Bluetooth low power and is also a component of a home platform that is equipped with video cameras on the body and environmental sensors for detecting and making decisions using machine learning methods.

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The benefit of this study is that it makes use of low-cost sensors and low-energy-consumption devices that are often found in houses. The system's flaw is that it only provides the bare minimum of service in accordance with the gathered business needs an Internet-of-Things (IoT) system for remote mobile medical monitoring Using intelligent nodes, the authors proposed a model of human interaction and physiological characteristics. The provided solution is used to create effective emergency alert systems by storing important emergency data in a hospital database. The benefits of this study include increased speed and accuracy in physiological factor measurement, as well as the use of low-power devices. The work's flaw is that the expense was not taken into account a high-level adaptive security management method in terms of security metrics. The security objectives of E-health IoT applications, especially for the health of the elderly and the treatment of chronic illnesses, are examined in order to illustrate this concept.

In addition, the requirements of adaptive security management and decision-making are addressed in this article, which are required to establish security demands and implement adequate security controls in the face of changing security threats in such systems. Several security variables, such as security accuracy, effectiveness, efficiency, privacy level, and secrecy, are taken into account by the proposed method for adaptive security management. The major benefit of this research is that it will help to improve the security intents of E-health IoT apps. The lack of a thorough study of security metrics and adaptive decision-making algorithms in such E-health IoT applications is a flaw in this work. For IoT health-care applications, a

layered context-aware data combination method is used. Context attainment, condition structure, and implication are all part of the suggested method.Body Sensor Networks (BSN) or Wireless Body Area Networks (WBAN) that are usually positioned to the patient's body to collect physiological data for IoT health-care applications are described in this article. Because the data is gathered from various heterogeneous sources, a method known as "data fusion" is required to combine these datasets. In this article, a new method for displaying gathered data in a manner that aids in making timely precise decisions is given.

This research has the benefit of resolving issues such as sensor inadequacy, limited coverage, irregularity, and ambiguity. The paper's shortcoming is that it does not provide any particular method for evaluating the proposed solution for least error adjusted IEEE 802.15.4 transceiver for health-care applications in the Internet of Things. In this work, an improved frequency offset evaluator for IEEE 802.15.4 is proposed, with superior error modification performance than existing assessors. In comparison to the conventional design, the benefit of this research is a significant improvement in bit error amount and packet error frequency of the provided transceiver. Another accomplishment of this study is lower power consumption as a consequence of fewer retransmissions in each packet for successful packet broadcast an energy-efficient routing method for WSNs based on congestion and interference awareness Because multiple IoT devices send their data to the same target, which is a common scenario in IoT monitoring applications, the suggested method was designed to function in networks with high traffic and interference on the connection between nodes.

The proposed algorithm employs a function for selecting the next party node that takes into account three factors: (1) the connection's signal to interference and noise ratio (SNIR), (2) the route's survivability parameter from the next party node to the endpoint, and (3) the congestion degree at the next party node. The simulation results indicate an increase in network throughput, packet broadcasting ratio, node energy consumption, and a decrease in the number of lost packets. a wireless sensor network-based online IoT monitoring system for henhouses to manage environmental variables such as temperature, humidity, CO_2, and NH3. In this article, it is stated that in previous studies, the majority of the focus has been on building systems without considering the dependability of wireless data transfer. To address this problem, a wireless transport protocol based on the loss recovery method is proposed in this article. In order to estimate node data and increase the integrity of the proposed system, online lost data filling and duplicated data auto filtering are conducted. Furthermore, in order to meet the remote monitoring requirement, a web-based remote monitoring system was created to enable users to access the acquired information through smart phones or personal computers in order to manage the henhouse environment via an efficient interactive user interface. The primary benefit of this study is the novelty in providing an IoT-henhouse monitoring system that focuses on increasing wireless data transmission dependability. Other enhancements made as a result of this effort include increased data collecting accuracy and system integrity, as well as lower maintenance costs and upgrading. The major flaw in this study is that it does not assess energy usage.

3. CONCLUSION AND IMPLICATION

An SLR-based technique for IoT application is described in this study. This research provided a thorough knowledge of IoT applications as well as thoughts on outstanding problems. We demonstrated the SLR-based method in this literature by utilizing the exploration query on 185

articles published between 2011 and 2018. Finally, we looked at 72 articles that focused on Internet of Things applications. By 29 percent of quotas in the literature, the smart city strategy has the greatest proportion of application methods. Of course, health-care applications account for 20%, commercial applications for 14%, environmental applications for 12%, general features of IoT applications for 12%, and industrial applications for 10% of all IoT applications, according to AQ1. According to AQ2, QoS-aware methods have the highest proportion of research (21), followed by intelligent monitoring (17). In addition, we discovered that 24 percent of the research projects using the AQ3 have used the suggested method to build an IoT application. To compare the assessment factors, the reaction time factor has the highest percentage in the evaluation of the composition methods at 27%, followed by cost (18%), energy (18%), availability (14%), reliability (14%), throughput (5%), and security (4%). We may not have looked at all of the papers that are available for the SLR-based approach.Non-English, non-peer reviewed, and editorial papers, book chapters, and survey pieces were thus excluded. We conducted a thorough investigation of IoT application methods in this study, based on the results of more than 100 writers and various studies.

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