

## A Survey: Systems and Applications Based on Cloud Computing

### دراسة استقصائية: الأنظمة والتطبيقات التي تعتمد على الحوسبة السحابية

Taher Qabaha<sup>1\*</sup>, Derar Eleyan<sup>2</sup>

طاهر قباها<sup>1\*</sup>، ضرار عليان<sup>2</sup>

<sup>1,2</sup>Computer Science, Palestine Technical University Kadoorie, Tulkarm, Palestine

قسم علم الحاسوب، جامعة فلسطين التقنية خضوري، طولكرم، فلسطين<sup>1,2</sup>

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**Abstract:** mobile cloud computing is an emerging technology that combines the power of cloud computing with the ubiquity of smartphones. This technology enables smart devices to access cloud computing resources. It offers various advantages, such as increased storage capacity, improved processing power, extended battery life, higher storage spaces, and faster response times. Mobile cloud computing has the potential to revolutionize mobile computing by providing users with anytime, anywhere access to cloud-based services and applications. However, mobile cloud computing faces many challenges, such as security, privacy, and network issues. This paper presents an overview of mobile cloud computing, its benefits, and challenges. We employed a descriptive approach to collect data on various programs and systems that rely on cloud computing, including automated video surveillance systems, health applications, MISSION SWACHHTA, car sharing for delivery and parcel customers, banking applications and systems, e-commerce platforms, big data systems, e-learning systems, and logistic systems.

**Keywords:** Mobile cloud computing, cloud computing applications, smart devices, mobile applications, cloud computing.

**المستخلص:** تعد الحوسبة السحابية للأجهزة من التقنيات الناشئة التي تجمع بين قوة الحوسبة السحابية والانتشار الواسع في الهواتف الذكية في كل مكان، تمكن هذه التقنية الأجهزة الذكية الوصول إلى موارد الحوسبة السحابية؛ حيث تتيح هذه التقنية مزايا متنوعة مثل زيادة سعة التخزين، قوة المعالجة المحسنة، إطالة عمر البطارية، المساحات التخزينية العالية وسرعة الاستجابة. لدى الحوسبة السحابية للأجهزة القدرة على إحداث ثورة في الحوسبة المتنقلة من خلال تزويد المستخدمين بإمكانية الوصول في أي وقت وفي أي مكان إلى الخدمات والتطبيقات المستندة إلى السحابة. تواجه الحوسبة السحابية للأجهزة العديد من التحديات كالأمن، الخصوصية ومشاكل الشبكة. تقدم هذه الورقة البحثية لمحة عامة عن الحوسبة السحابية للأجهزة، وفوائدها وتحدياتها، كما أنه تم اتباع المنهج الوصفي في جمع البيانات حول بعض البرامج والأنظمة التي تعتمد على الحوسبة السحابية مثل نظام المراقبة بالفيديو الآلي، التطبيق الصحي، MISSION SWACHHTA، مشاركة السيارة لعملاء التوصيل والطرد، التطبيقات والأنظمة المصرفية، التجارة الإلكترونية، أنظمة البيانات الضخمة نظام التعلم الإلكتروني والنظام اللوجستي.

**الكلمات المفتاحية:** الحوسبة السحابية المتنقلة، تطبيقات الحوسبة السحابية، الأجهزة الذكية، تطبيقات الموبايل، الحوسبة السحابية.

\* Corresponding Author E-mail: [taher.qabha@ptuk.edu.ps](mailto:taher.qabha@ptuk.edu.ps)

## INTRODUCTION

Cloud computing, with its transformative capabilities, has fundamentally altered the landscape of data management and access. This technological paradigm shift offers unprecedented opportunities for organizations to leverage vast amounts of data efficiently and securely. The advent of big data and the Internet of Things (IoT) has underscored the importance of cloud computing as an indispensable tool for managing and analyzing data at scale. Its role in preserving data integrity and confidentiality has become increasingly critical in safeguarding against theft or loss, thereby streamlining operations and mitigating risks (Yousaf et al., 2020).

One of the key advantages of cloud computing is its on-demand self-service capability, empowering users to autonomously store, process, and retrieve data without manual intervention. (Arun & Prabu, 2017) This feature not only enhances operational efficiency but also facilitates seamless scalability to accommodate fluctuating workloads. Moreover, ubiquitous network access ensures that users can tap into cloud resources from any location with internet connectivity, facilitating collaboration and productivity across diverse environments. Cloud computing's ability to pool resources irrespective of location further optimizes resource allocation and utilization, thereby maximizing efficiency and reducing overhead costs.

In parallel with the proliferation of smartphones and mobile devices, the convergence of cloud computing and mobile technology has given rise to Mobile Cloud Computing (MCC), a dynamic ecosystem that extends the benefits of cloud computing to mobile platforms (Aliyu et al., 2020). MCC provides a versatile framework for delivering computing services and resources to mobile users, enabling them to access data, applications, and processing power on the go. This symbiotic relationship between cloud computing and mobility not only enhances accessibility but also addresses the resource constraints inherent in mobile devices, thereby unlocking new possibilities for innovation and service delivery.

As the demand for cloud-dependent applications continues to soar, understanding the challenges and opportunities inherent in Mobile Cloud Computing is paramount. Through a comprehensive analysis of cloud-based systems and applications, this research endeavors to unravel the intricacies of Mobile Cloud Computing and its implications for software management. By examining the performance, scalability, security, and efficiency of various cloud-based systems, this study aims to provide insights that will inform decision-making processes surrounding the adoption and implementation of cloud solutions. Ultimately, this comparative exploration seeks to illuminate the unique attributes of cloud-based systems, empowering organizations to make informed choices that align with their strategic objectives and operational requirements.

Furthermore, as organizations navigate the complexities of digital transformation, the comparative analysis of cloud-based systems offers a roadmap for optimizing technological investments and maximizing returns on investment (Noor et al., 2018). By dissecting the nuances of different cloud architectures, deployment models, and service offerings, stakeholders can gain a deeper understanding of the trade-offs involved in selecting the most suitable solution for their specific use cases. This granular examination not only facilitates benchmarking against industry standards but also fosters innovation by identifying areas for improvement and optimization. Moreover, by elucidating the interplay between performance metrics, security protocols, and scalability options, this research empowers decision-makers to devise robust strategies for leveraging cloud computing as a catalyst for organizational growth and resilience in an increasingly dynamic digital landscape. Through meticulous analysis

and synthesis of empirical evidence, this study seeks to elevate the discourse surrounding cloud-based solutions, catalyzing informed decision-making and driving sustainable business outcomes in an era defined by rapid technological change.

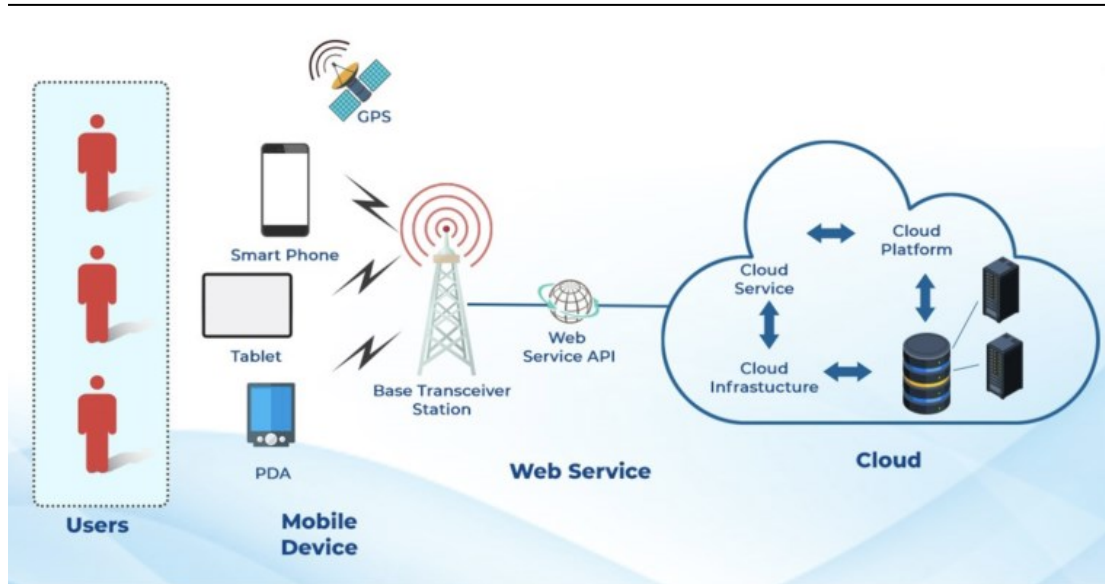


Figure (1). Mobile cloud computing

## Background

Mobile cloud computing connects users to resources and offers a range of cloud-based services, including ample storage, software management, and data analysis. To comprehend the challenges encountered in mobile cloud computing, we conducted a study on various cloud-based software. In this section, we present the program details:

### 1. Automated Video Surveillance System

System working principle: This system monitors things and then analyzes situations and makes decisions for appropriate actions in real time, taking into account no delay to avoid errors.

The system monitors objects, whether it is a human, animal, vehicle or any other moving object, and records a complete video of the object's movement and sends it to the cloud to be able to refer to it at any time it has access to the cloud.

Then the system analyzes the event monitored by this object by performing analyzes on the recorded video, gives the full result of the action of this object, and stores this result directly on the cloud for you to refer to it at any time.

In the last steps, the system makes the appropriate decisions based on the data obtained from the analysis of the video recorded in the observing phase of the work of the object, in this phase, the system has difficulty in the

decision-making process because it cannot know with absolute certainty the intent of the object in the event. (Jang et al., 2017).

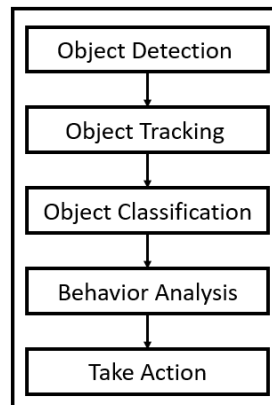


Figure (1). AVSS tasks

This monitoring system needs complex algorithms that require huge amount of resources in order to execute these algorithms at high speed without any errors.

Robotic technology made it simple to use the device and deploy it anywhere. Numerous sensors, including audio and video, can identify objects, record an event instantly, transfer it to the cloud at a rapid speed, assess the situation, and determine the appropriate course of action in real time to carry it out right away.

However, a person can view the complete details of the incident through the data on the cloud, and the system cannot function in situations where there is insufficient connectivity infrastructure. The system runs entirely on its own and does not require any human participation (Cheong et al., 2019).

Challenges faced by the application (Valentín et al. 2017):

- Limited processing power and storage capacity of mobile devices
- Dependence on wireless communication for network formation and video transmission
- Network disruptions and connection failures in mobile ad hoc clouds
- Security and privacy concerns due to reliance on wireless networks and mobile devices

Appropriate solutions to the challenges faced by the application:

- Efficient video compression techniques can reduce the amount of data transmitted over the network, thereby reducing the processing and storage requirements of mobile devices.
- Development of robust wireless communication protocols and mechanisms for network formation and maintenance can help reduce network disruptions and improve network reliability.
- Implementation of security mechanisms such as encryption and authentication can help mitigate security and privacy concerns.

- Integration of cloud computing technologies can offload some processing and storage tasks to remote servers with higher processing power and storage capacity.

Advantages of Automated Video Surveillance System (Elharrouss et al. 2020):

- Quick and easy deployment without the need for fixed infrastructure.
- Distributed video processing through mobile ad hoc cloud network.
- Can perform automated video surveillance tasks effectively.
- Lower cost compared to traditional video surveillance systems.

Disadvantages of Automated Video Surveillance System:

- Dependence on mobile devices for network formation and processing.
- Limited processing power and storage capacity of mobile devices.
- Susceptibility to network disruptions and connection failures.
- Possible security concerns due to reliance on wireless networks and mobile devices.

## 2. Health Application

The system connects all physicians and pharmacists working within the same hospital or medical facility with their patients through a unified program, facilitating the online exchange of information for the benefit of patient health. Patient systems are interconnected via electronic devices and sensors that capture vital measurements, including weight, blood pressure, and blood sugar levels for each patient. Specialized physicians receive the patient's health information, along with instructions generated by the instruments and sensors. They use this data to diagnose the patient's condition comprehensively and then relay the information to pharmacists for prescription purposes. The measurement results are securely stored in the cloud.

Every individual using the system, whether a doctor, patient, or pharmacist, has specific access restrictions in place to ensure that unauthorized users cannot access or utilize the data not meant for them.

Program advantages (Dang et al., 2019):

- The program provides a detailed diagnosis of the patient's condition so that the system links all doctors together, so that each doctor can present his opinion for the same case, so the patient gets a very accurate and safer diagnosis of his condition.
- By connecting a network between pharmacists, the system gives patient has several suggestions, such as alternative medicine, and explain how to give it in detail through the online application.
- Doctors are able to follow up and monitor patients' cases at any time because the system is active throughout the day.
- The system manages records properly as it displays critical cases first before less severe cases with doctors and others.

- The system is separate, so if any defect occurs in one part of the system, the rest of the program does not stop.

System problems (Kulkarni et al., 2014):

- Not integrated, a glitch can occur that is difficult for the program to deal with, such as a glitch that occurs in the database for chronic patients that can affect the database for all patients and make it difficult for the system to solve.
- This system cannot be provided to different clinics or pharmacies, because the system is for medical centers that have their own doctors and pharmacists.
- The operations are slow, which leads to some errors such as delaying the entry of patients' data or delaying showing patients' cases to the doctors, and this thing causes a problem because it may affect the lives of patients.

Challenges faced by the application (Minh et al., 2019, Damodharan & Ravichandran, 2019):

- Limited battery life of mobile devices
- Limited processing power and storage capacity of mobile devices
- Network latency and bandwidth limitations in mobile networks
- Security and privacy concerns related to sensitive health data
- Quality of service (QoS) requirements for healthcare applications

Appropriate solutions to the challenges faced by the application (MarketsandMarkets, 2017):

- Development of energy-efficient algorithms for mobile devices can help extend battery life.
- Use of cloud computing technologies can offload processing and storage tasks from mobile devices to remote servers with higher processing power and storage capacity.
- Optimization techniques can be used to reduce network latency and improve bandwidth utilization in mobile networks.
- Implementation of security mechanisms such as encryption and authentication can help protect sensitive health data.
- QoS-aware resource management techniques can be used to ensure that healthcare applications meet their QoS requirements.

### 3. MISSION SWACHHTA

This valuable program aims to serve and develop the country by soliciting opinions, suggestions, and complaints from all citizens who aspire to bring about positive change. The primary method employed by the program involves ordinary citizens submitting complaints to the municipality by uploading them to the cloud. These complaints are then organized by priority, with the most critical issues addressed first, followed by less urgent matters. This approach allows the municipality to prioritize and begin working on resolving the issues identified by responsible citizens.

The program offers a convenient online service to the public, eliminating the need to physically visit the municipality's office to file a complaint. This online submission process is not only faster but also more cost-effective, enabling citizens to capture and report issues such as roadside garbage directly to the municipality. Notifications are promptly sent to the municipality's staff, alerting them to address the citizen's complaint as soon as possible.

To submit a complaint with the municipality, every citizen must create an account within the program and then proceed to submit their complaint. Once the municipality resolves the issue, it is archived within the cloud, under the citizen's name and within the program's database. Additionally, citizens receive tokens that can be used to purchase items through programs associated with this system. This serves as an incentive for citizens to actively engage in monitoring their country and suggesting ideas that support national development.

It's worth noting that this application relies on Firebase as its cloud platform. While Firebase offers numerous advantages, it may occasionally result in data delivery delays and provides less storage capacity compared to other cloud solutions. The application is designed for use on the Android operating system and is integrated with the Firebase database."

Application Challenges (Sharma, 2020):

- Integration of cloud computing technologies into a mobile application
- Limited processing power and storage capacity of mobile devices
- Dependence on network connectivity for accessing cloud resources
- Security and privacy concerns related to user data and cloud resources

Solutions to the problems of this application (MarketsandMarkets, 2021):

- Development of cloud-based architectures and algorithms optimized for mobile devices can improve the performance of mobile applications.
- Use of cloud storage can help reduce the storage requirements of mobile devices.
- Offline functionality can be implemented in the mobile application to allow for limited use without network connectivity.
- Implementation of security mechanisms such as encryption and authentication can help protect user data and cloud resources.

Advantages of application:

- The use of cloud computing technologies can improve the performance and functionality of the mobile application.
- Reduced storage requirements on the mobile device can free up space for other applications and data.
- The ability to access cloud resources allows for greater flexibility and scalability of the mobile application.

Disadvantages of application:

- Dependence on network connectivity can cause the application to become slow or unusable if network connectivity is lost.
- The use of cloud resources may add additional cost or complexity to the development and maintenance of the application.
- Security and privacy concerns related to cloud resources may need to be carefully addressed to avoid data breaches or unauthorized access.

#### **4. Car Sharing For Delivery Customers and Parcels**

This program facilitates the sharing of private cars among passengers and car owners, either for reaching specific destinations or delivering packages. Car owners post trip details, including time and location, on the program, which are then uploaded to Firebase. All users can view trip details and the available vehicles, allowing customers to select the trip that suits their needs at the specified times set by the vehicle owner.

To access the application's services, every user must create an account and specify their role as either a car owner or a customer in need of transportation.

One of the application's notable benefits is that it is the first of its kind in the country. It provides a solution for individuals without private cars to travel to areas lacking public transportation. Additionally, it allows car owners to share the cost of fuel among all passengers, making trips more cost-effective.

The application operates on the Android operating system and is integrated with the Firebase database. Occasionally, we encounter challenges related to handling large volumes of data. In general, we experience software slowdowns during periods of high demand or when there is heavy user traffic. If the number of users continues to grow significantly, we may consider the possibility of migrating to another cloud solution".( Kabaha, 2020)

Advantages of the application:

- easy to use
- There are not many annoying restrictions for users
- Provides services that make it easier for users to navigate
- Complimentary

Application problems:

- The application targets a small spatial area.
- The app does not accommodate high data.
- The application does not have a high security system.



## 5. Banking and e commerce

With the advancement of technologies and reliance on them in organizing financial matters, many financial applications that depend on cloud computing have appeared in storing, organizing and processing financial data for users, of which (Vinoth et al .2022):

- Open-Access Commercial Online Banking Portals: By enabling commercial customers to access an integrated package of services, products, and information, some of which may be provided by the bank but many of which may be provided by third parties.
- Widget-Based Internet Banking Applications: These applications give the user the authority to manage his online banking account, and are largely intended to deal with buying and selling services.
- Mobile Retail Stock Trading: This type of application provides digital trading and stock services, making it easier for investors to access and monitor their data periodically.
- Self-Service Applications for Commercial Customers: These applications give the user the authority to fully manage their online banking account.

Advantages of using cloud computing in banks (Saggi et al., 2015):

- Saving on commercial and banking companies' money instead of buying high-cost storage and processing devices that are replaced by cloud services.
- Ensuring business continuity, regardless of any breakdowns or disasters in the banking company, the system will remain running in the cloud and customer's funds will remain preserved.
- Fast and accurate customer management that enhances the progress and prosperity of banking companies so that it increases the customer's confidence in the bank, and also provides opportunities for the customer to use the many advantages that benefit the customers and the bank.

Disadvantages of using cloud computing in banks (Tsai et al., 2018):

- The cloud allows all users to access the same bank's resources, and this poses a risk of privacy breach.
- Analyzing the use of this private information is equally as risky as its acquisition. When operating in a cloud environment, security can be compromised in order to get alerts for important activities like new execution processes or file creation.
- Control Loss, Any customer who stores data on the cloud forfeits physical ownership of that data. This suggests that cloud providers have access to their customers' sensitive information and might mine it, potentially leading to a security breach.

Challenges of Banking and e commerce systems (Xue et al .2021):

- Security and privacy concerns related to sensitive financial data
- Dependence on network connectivity for accessing cloud resources
- Integration of legacy systems with cloud-based systems
- Compliance with regulatory requirements

- Cost and scalability considerations

Solutions to the problems of Banking and e commerce systems (Tesema, 2020):

- Implementation of robust security mechanisms such as encryption and authentication can help protect sensitive financial data.
- Use of hybrid cloud models can help ensure that critical data is kept on-premises, while non-critical data is moved to the cloud.
- Integration of legacy systems with cloud-based systems can be achieved through the use of APIs and microservices.
- Compliance with regulatory requirements can be achieved through careful planning and adherence to relevant standards and guidelines.
- Cost and scalability considerations can be addressed through the use of pay-as-you-go cloud services and automation tools.

## 6. Big data application

- A. Immune Cloning Algorithm: The immune system in living things is a sophisticated adaptive system. Since the human immune system can identify viruses and react to them, it possesses some learning, memory, and pattern recognition skills. The human immune system is stimulated in a manner comparable to an external stimulating antigen in order to make antibodies that are suited to it. That is, each output function has a specific input variable. Computer algorithms can solve scientific and engineering problems in this way by describing the principle and mechanism of its information processing. Algorithmic immunity introduces some features of the biological immune system while retaining others in order to address optimization issues. (Tabrizchi et al., 2020).
- B. Education Development Systems: With the advancement of science and technology and the diversity of student abilities, it has become imperative to evolve the teaching and learning process beyond traditional methods. Modern technologies are required to challenge students according to their individual levels and provide customized learning models based on the analysis of their performance. Dealing with these technologies, which handle substantial amounts of data for each student, cannot rely solely on simple resources. Hence, the utilization of cloud technology becomes essential to facilitate accurate data processing and analysis. (Tang, 2022).

## 7. E-commerce systems

In e-commerce, the cloud provides many and very important services, as it stores and properly processes large amounts of sensitive data, provides programs that connect customers with the company directly, provides the company's services to customers appropriately, and the cloud provides facilities for company members to manage business matters and Implement complex accounts automatically And quickly.

The tasks that the cloud provides for companies in e-commerce (Gao, 2019):

- Store too much data and manage it automatically and quickly.

- The cloud provides the necessary software for every company and is complete with all the services that employees and customers need.
- The cloud saves businesses the cost of purchasing resources, and it provides the service all the time without stopping, which makes the company focus only on its main goal of providing appropriate services to customers without having to think about the things that the cloud solves.

Benefits of using cloud computing in e-commerce (Wang, 2022, Shah et al., 2016):

- High storage and large and huge data absorption.
- Save money on the company instead of buying the necessary resources.
- Facilitate the work of the joint companies together, so that all the joint companies can access all the data with certain powers and communicate together with ease.
- Not to worry about storing and protecting large data, from the cloud provides high storage space and high data protection.

## **8. E-learning system**

With the continued development of technologies and the availability of Internet service, many technologies have appeared in the educational process that aims to develop science and facilitate learning.

Universities and educational institutions have become dependent on technology in the educational process and the dissemination of many services for students, including the emergence of platforms that connect the professor to the student, the publication of lessons and explanations all the time, online e-learning platforms, and the emergence of the name of Learning Management Systems (LMS).

Cloud computing offers a comprehensive set of services that create an optimal learning environment. It provides ample storage capacity for data, ensuring accessibility for students at all times. Additionally, cloud computing saves users valuable time due to its high-performance specifications. Moreover, educational institutions do not need specialized programmers to manage their programs, as the cloud handles all programming-related aspects.

The advantage of E-learning system (Wu, 2021):

- **Accessibility:** Students and instructors can access course materials and resources from anywhere and anytime as long as they have an internet connection.
- **Scalability:** Cloud computing allows for the flexible allocation of resources, enabling universities to scale their e-learning platforms to accommodate large numbers of students without compromising performance.
- **Collaboration:** Cloud-based e-learning platforms support collaborative learning and communication between instructors and students, facilitating group projects and discussions.
- **Cost savings:** Cloud computing eliminates the need for universities to invest in expensive hardware and software infrastructure for e-learning platforms.

The disadvantages of E-learning system (Hussein & Hilmi, 2020):

- Dependence on internet connectivity: A reliable internet connection is required for both instructors and students to access e-learning materials and resources.
- Security: Cloud computing raises concerns about the security and privacy of student data, and universities need to implement adequate security measures to protect sensitive information.
- Technical issues: Technical glitches or downtime of cloud-based e-learning platforms can disrupt the learning process.
- Training and support: Faculty and students may require additional training and support to effectively use cloud-based e-learning platforms.

### 9. Logistic Management System

Fresh food is transported on the spot, but the cost of cold chain logistics is still significant. Because of the expensive cold chain. The continued emergence of products such as “pig feet whitening” and “zombie chicken feet”, which have a negative impact on society as a whole, is the result of businesses choosing to add preservatives, food additives and other low-cost ways to extend the preservation period in order to reduce logistics costs. Other companies choose some small or even informal cold chain logistics enterprises to transport fresh products the cold storage majority of refrigerated trucks do not meet the requirements for crossing the cold chain.

The cloud stores all merchandise data, and a range of data from a variety of sources including traffic data, weather data, route information, and geographic information. The data is used to create a logistics distribution for the cold chain (Zhao et al., 2020).

Advantages of Logistic Management System (He & Yin, 2021):

- Improved efficiency: A logistic management system can streamline the entire logistics process, from planning to execution, leading to improved efficiency and productivity.
- Real-time tracking: With a logistic management system, businesses can track shipments in real-time, enabling them to quickly address any issues that may arise.
- Cost savings: By optimizing logistics operations, businesses can reduce transportation costs, minimize inventory holding costs, and avoid stock outs, leading to significant cost savings.
- Enhanced customer service: A logistic management system can provide accurate delivery estimates and improve delivery speed, leading to higher customer satisfaction.

Disadvantages of Logistic Management System (Zhang, 2022):

- Implementation costs: The initial implementation cost of a logistic management system can be high, including software licenses, hardware, and training costs.
- Technical issues: Technical issues such as system downtime or connectivity problems can disrupt the logistics process and lead to delays.

- Data security risks: Logistic management systems involve the processing and storage of sensitive information, such as shipment details and customer information. Therefore, there is a risk of data breaches and cyber-attacks.
- Dependence on technology: A logistic management system relies heavily on technology, which means that any issues with the software or hardware can bring the entire logistics process to a halt.

Overall, a logistic management system can provide significant benefits to businesses in terms of efficiency, cost savings, and customer service. However, businesses should also be aware of the potential challenges and risks associated with implementing such systems.

### Comparative analysis

By following the descriptive approach in comparing applications and systems, we have reached the following comparison results:

	High storage space	The battery of device strong	infrastructure (network)	Application speed	Program delay	Security
AVSS	√	×	×	√	×	√
HEALTH APP	√	√	×	√	√	×
MISSION SWACHHTA	×	√	×	×	√	√
Car Sharing App	×	√	×	×	√	×
banking and e commerce	√	√	×	√	×	√
Big data application	√	×	×	×	√	×
e-commerce systems	×	√	×	×	√	√
E-learning system	×	√	×	×	√	×
Logistic Management System	√	√	×	×	√	√

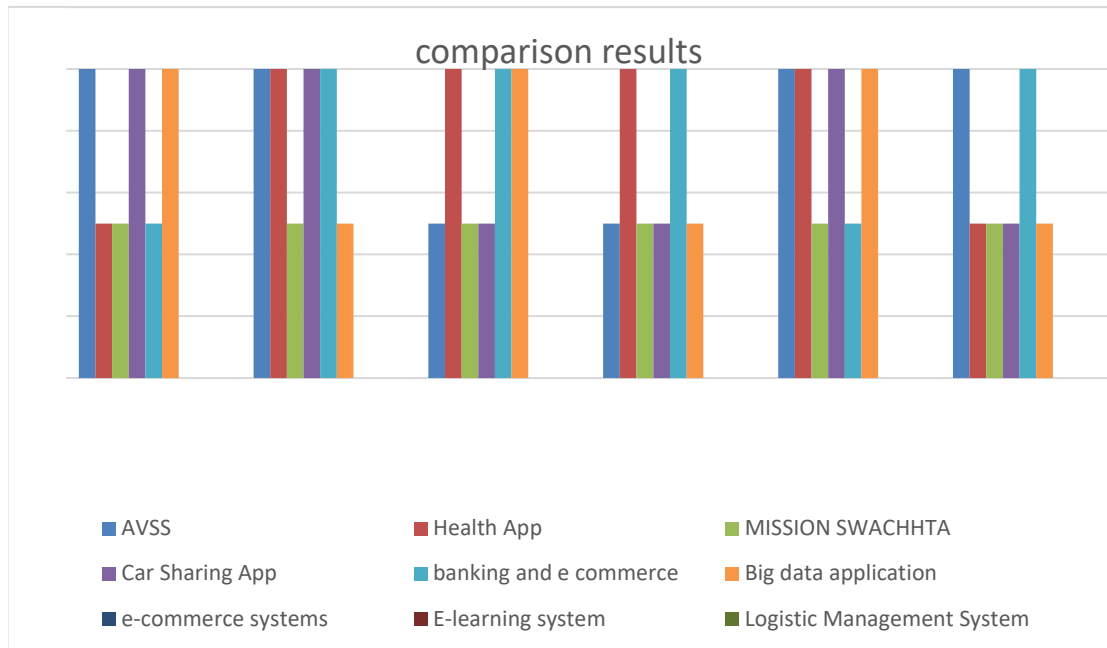


Figure (1). Comparison table

AVSS collects data from sensors and stores it in the cloud, then conducts sophisticated analytics on this data. This system employs complex algorithms to analyze videos of various sizes, necessitating a substantial storage capacity to accommodate all of this data.

The AVSS system suffers from the issue of the battery of the device used, as the sensors have a very low battery due to the small size of the sensor. Therefore, it is necessary to have a constant power source connected to the sensor.

The AVSS system relies on an external network and the associated cloud infrastructure. It depends on a continuous Internet connection to transmit recordings to the cloud. In the event of an interruption in the Internet connection, sensitive records may be lost and fail to reach the cloud.

Operations of these companies are on a modest scale and the temperature detection and incubator technology is rather outdated. Then terms of speed, the AVSS system is very fast because it uses clouds dedicated to big data, complex processes and algorithms, so this system will not cause any delay or loss of data. Also, this system cares highly about the issue of security and data security, so that this data is considered private, and no one will be allowed to access or control it except for the owners and employees of the system within special restrictions.

The health application facilitates communication between patients, doctors, and pharmacists. It includes sensors for measuring various medical parameters, such as blood pressure, and provides a range of healthcare services. As a result, the system necessitates a robust cloud infrastructure capable of handling the extensive activities within

the application. Data is collected and exchanged between patients and doctors via mobile phones, which requires significant device battery consumption. Therefore, it is crucial for the device to have a long-lasting battery, enabling it to operate for two or three days without the need for recharging.

The health application depends on the internet on the phone device to exchange data between users, there is no private network between application users.

The health application is considered a fast application, as if it slows down, it can cause the death of a patient, because the application is a matter of life or death. Although it is a sensitive application, it can cause delays in the arrival of data, and this is a very worrying thing.

Users' data in the health application is handled securely so that each user has certain powers that he cannot override so that the patient only sees his data and is limited to the doctors' data that he needs, and also doctors can access the necessary data for him only from patients. , etc. between all users of the application.

The MISSION SWACHHTA program receives complaints from ordinary citizens and delivers them to the responsible authorities. Therefore, it does not require large storage spaces. The owners of the application use simple cloud storage.

Of course, as long as the users of the MISSION SWACHHTA application submit complaints through their phone, then the battery of the device used is strong. There is no private network in this application, as the advantages of the application are taken advantage of via the Internet only. Unfortunately, this application is considered one of the relatively slow applications and there is also a delay in the data, but this application has a high security system so that it does not use user data in a bad way or disclose it It is treated with high confidentiality.

The car sharing application is used a firebase to save data only, as there is not a large number of data for each user in the program, but it is considered a somewhat small storage space.

The car sharing application was programmed only for devices running on the Android operating system, so users' devices enjoy a high device battery because they are mobile devices. There is no private network for the users of the application, communication takes place between users only with the presence of the Internet.

This car sharing application was designed by students who are beginners in programming, as it is not fast and has data delay problems, and also it does not have a high security system, although there are restrictions for each user. The responsibility lies with the weakness of Firebase and the lack of experience of programmers using code with less complexity time.

In the banking and e-commerce program, the storage space is very high so that no data containing people's money is lost. In addition, the batteries of the devices used are very powerful or connected to a constant electrical source.

Sometimes, specialized networks are used for communication among users of banking and e-commerce programs, but the majority primarily rely on the internet. Those involved in these programs prioritize quick access to data and

speedy responses. However, occasional delays in data transmission and data loss can result in significant losses. Despite this, security remains of utmost importance in these programs, and stringent restrictions are in place to prevent unauthorized access, even for those working within these programs.

In systems that handle large volumes of data, there is a focus on securing substantial storage capacity to accommodate the vast amount of data securely. Handling extensive data can be challenging, as ensuring both speed and minimal delays can be costly. Acquiring devices with powerful batteries and high data processing capacity may also pose difficulties.

In the e-learning system, programmers are interested in making it easy to use because not all users of the system are programmers or computer science students. Therefore, some e-learning systems suffer from a weakness in storage space, which requires the user to use only a certain amount of cloud storage, the batteries used to operate this system they are large because they are mobile phones or laptops. The e-learning system relies on the Internet in communication between students and teachers. These systems are not very fast and some data delays occur in it, and it is sometimes exposed to weaknesses in security despite the presence of certain powers per user.

In the logistics management system, the cloud storage is high and the batteries of the devices used are high, but there is no private network in this system. Sometimes data delays, slowness, and lack of security occur.

## Methodology

### A. Primary Study Selection:

In our research, we adopted a descriptive approach to gather comprehensive data concerning applications and systems reliant on cloud computing for data storage and processing. To ensure the reliability and completeness of the information, we employed multiple sources, including previous research studies and application repositories. Additionally, we collected data pertaining to an application previously developed by the researcher, which heavily relies on cloud storage for data management. Subsequently, a comparative analysis was conducted to evaluate the performance and functionalities of these various applications and systems within the cloud computing paradigm.

### B. Selection result:

To compile relevant literature, we conducted extensive searches on Google Scholar, targeting studies that discuss applications utilizing cloud computing infrastructure. Subsequently, the search results underwent rigorous filtering, focusing on the most recent and pertinent research articles pertaining to our research topic. By applying stringent selection criteria, we ensured that only the most relevant and up-to-date studies were included in our analysis. This meticulous selection process enabled us to gather a diverse range of insights and perspectives on the subject matter, thereby enriching the depth and breadth of our research findings.

## Recommendations

- Based on the analyzes that we carried out during our research, we recommend companies that provide cloud services to add network service to users, as this is a distinctive aspect in improving the performance of applications that depend on cloud computing.



- In order to improve efficiency in cloud-based applications, we recommend that application designers choose the appropriate cloud for the application environment, amount of data, and application users.

### **Future work**

- There is a need for research in developing network performance applications that rely on applied computing.
- While our study focuses on researching applications that depend on cloud computing, we can work on creating a new application that depends on cloud computing in storing and processing data, and it is within appropriate criteria that achieve the proposed solutions in order to be an ideal system based on cloud computing.

### **Conclusion**

cloud computing emerges as a cornerstone technology in the realm of computer science, offering unparalleled benefits in terms of data storage efficiency, cost reduction, and accessibility across a myriad of applications. From Automated Video Surveillance to Health Applications and Car Sharing platforms, the versatility of cloud computing is evident in its widespread adoption across various domains. However, the realization of its full potential hinges on addressing critical challenges such as infrastructure requirements and security vulnerabilities.

Looking ahead, future research endeavors could focus on enhancing the resilience and scalability of cloud infrastructures to accommodate evolving demands and mitigate potential risks. This could involve exploring novel approaches to network optimization, cybersecurity protocols, and data encryption techniques to fortify the security posture of cloud-based systems. Additionally, there is scope for investigating innovative use cases and applications that leverage emerging technologies such as artificial intelligence, edge computing, and blockchain to augment the capabilities of cloud computing.

In light of these considerations, it is imperative for organizations to adopt a proactive stance towards cloud governance and risk management, investing in robust infrastructure and implementing stringent security measures to safeguard sensitive data assets. Furthermore, fostering collaboration between academia, industry, and policymakers can foster knowledge exchange and drive innovation in the realm of cloud computing, ultimately paving the way for a more secure, resilient, and efficient digital ecosystem. By embracing these recommendations and charting a course towards continuous improvement, stakeholders can harness the transformative potential of cloud computing to drive sustainable growth and innovation in the digital age.

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