# SaaS Cloud Solution for Healthcare

Hamidreza Malekioskouei
*School of Technology*
*Asia Pacific University of Technology and Innovation (APU)*
Kuala Lumpur, Malaysia
TP063095@mail.apu.edu.my

Dr. Intan Farahana Binti Kamsin
*School of Computing*
*Asia Pacific University of Technology and Innovation (APU)*
Kuala Lumpur, Malaysia
intan.farahana@staffemail.apu.edu.my

***Abstract* – Dr. Alexander Fleming discovered the existence of the world's first antibiotic substance in 1928, which later became known as Penicillin. Fleming's discovery saved thousands of lives and revolutionized the health industry. Almost a century later, the world we know today is much different from what it was in 1928. We are now living in a cyber and digital era, yet the issue of health remains one of the primary concerns of our modern society. The recent pandemic has shown that even places like hospitals and clinics can be overwhelmed with high infection rates. Advancement of technology over the past two decades has made it possible to find a new, modern solution to problems like these. Therefore, hospitals and clinics need to adapt to a new system that allows patients to access doctors and medications online through the Internet. For that reason, the focus of this research study will be on efforts to develop a solution designed as Software-as-a-Service (SaaS) cloud and explicitly for healthcare purposes.**

***Keywords— cloud, healthcare, saas, pandemic***

## I. INTRODUCTION

In recent decades, technology has advanced quickly, leading to a massive effect on civilization. More and more businesses are deciding to switch from their conventional approach to a digital one; they rely on cloud computing to make this transition possible. SaaS (Software-as-a-Service), IaaS (Infrastructure-as-a- Service), and PaaS (Platform-as-a-Service) are the three cloud service models, but SaaS has the largest market share of the three. SaaS allows software providers to distribute their web applications through the internet, and it liberates organizations from the burden of managing and maintaining their service models (Bokhari et al., 2016). Further, SaaS uses the software licensing approach known as pay-as-use, meaning a company has to pay the subscription fee every time they use software (Kanner, 2022).

SaaS can provide benefits to software-dependent industries, including the health sector. In recent years, hospitals have begun employing SaaS applications to help them manage their revenue cycling, electronic health records, telepath, and PAACS (Peranzo, 2022). Therefore, it shouldn't come as a surprise that the cloud market share in the healthcare industry is expected to reach 128.19 billion by 2025, with a projected growth of 18.56% yearly (Vantage Market Research, 2022) as shown in Fig 1. The above supportive data shows that the design and implementation of SaaS applications in healthcare have a bright feature and can help the industry to tackle some of the issues that have come to light by the recent pandemic.

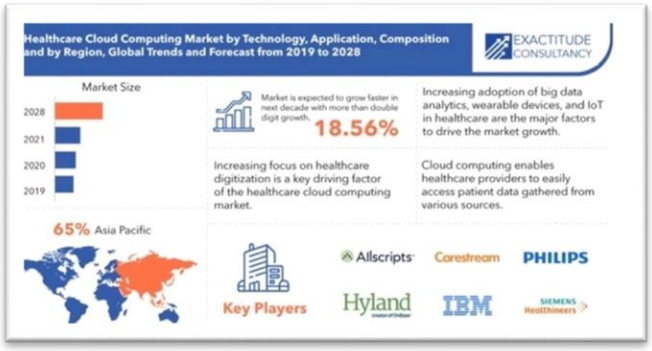


Fig. 1. Cloud computing market share in healthcare

## II. LITERATURE REVIEW

### A. *Cloud Computing*

Cloud computing is Internet-based computing where users access hardware and software resources as needed. In other terms, cloud computing is a technique to deliver hosted- based services via the Internet to users (Chai & Bigelow, 2021). Because of cloud computing, it's possible to access applications over the Internet, build remote databases and even run software through a browser without needing to install it on a local device (Peterson, 2022). The three service models of Infrastructure-as-a-Service, Platform-as-a-Service, and Software-as-a-Service are used to deliver cloud applications. Network architects employ Infrastructure-as-a-Service to access IT infrastructure (Sowmya et al., 2018). Software-as-a-Service provides access to front-end software that users can interact with. In contrast, Platform-as-a-Service acts as an interface between the underlying hardware and running applications.

### *B. Software as a Service (SaaS)*

The National Institute of Standards and Technology (NIST) defines SaaS as a cloud computing deployment type that enables users to access an application hosted in a cloud environment (Gamage, 2020). Users can access the hosted application through programmable interfaces or via their browsers. Software-as-a-Service is implemented very differently than other conventional on-premises software solutions. On-premises software is owned, hosted, and maintained by businesses, whereas a SaaS solution is managed, hosted, and distributed to end users through the Internet. The fundamental advantage of SaaS is that users do not have to worry about controlling the shared application's underlying infrastructure, such as network, storage, and CPU usage (Gamage, 2020).

Therefore, developing a SaaS solution will be essential to ensure that the public has quick access to healthcare services, especially at the time of pandemic.

### C. *Similar Systems*

#### *DoctorOnCall*

Considering the topic of this research study, let's take a look at two internet- based healthcare solutions which are operating in Malaysia. One of the first healthcare providers to go online in Malaysia is DoctorOnCall, which launched its platform in 2016 (Hawkins, 2022). Users can use this platform to seek medical practitioners through audio calls or chat (DoctorOnCall, 2022). Along with providing an online pharmacy and vaccination programs, the DoctorsOnCall portal allows its users to book consultations with specialists (Hawkins, 2021). Fig 2. Shows the DoctorsOnCall user interface.

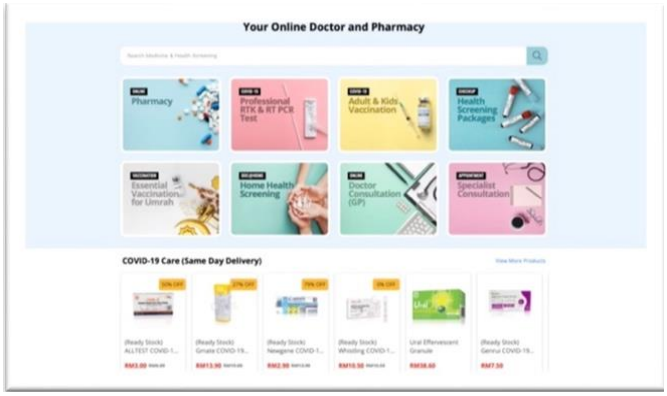


Fig. 2. DoctorsOnCall user interface

#### *REMEDi*

REMEDi is another online platform in Malaysia that offers its users health-related services over the Internet. REMEDi reduces the amount of paperwork that needs to be exchanged between patients and doctors, giving them more time to concentrate on the treatment. Medical professionals are also given secure access to patient records through REMEDi, enabling them to use the data to combat illness and health-related problems effectively (Remedi, 2022). Given the recent developments in the healthcare industry, medical records have risen exponentially. Therefore, migrating to platforms such as REMEDi would be a suitable solution as they provide their users with an agile cloud database with a vast amount of space to store millions of records (Chai, 2020). Fig 3. Shows the REMEDi user interface.


Fig. 3. REMEDi user interface

### D. *Comparison*

TABLE I. COMPARISON BETWEEN EXISTING SYSTEMS

| Feature | DoctorsOnCall | REMEDi |
|---|---|---|
| Pharmacy | ✓ | ✓ |
| Home Screening | ✓ | |
| Doctor Consultation | ✓ | ✓ |
| Vaccination | ✓ | |
| Specialist Consultation | ✓ | ✓ |
| Medication Management | | |

### E. *Summarization*

Users of both platforms can access a range of medical services, as the Table I indicates. DoctorsOnCall provides a broader range of services like home screening, vaccination, and online pharmacy. But neither one of them provides their users with reliable means to schedule and manage their medications, which is one of the primary objectives of this research paper. Some progress has been made in using cloud technology and online platforms as means of delivering health services to the public, but Malaysia still has a long road ahead regarding this matter. Therefore, developing a new SaaS solution will help fill in some of the gaps not addressed by current solutions and will be a big step forward in allowing the public access to health services through the Internet.

## III. PROBLEM STATEMENT, AIMS AND OBJECTIVES

A SaaS (Software-as-a-Service) healthcare solution intends to shield patients with compromised immune systems from catching infectious diseases in medical facilities like clinics and hospitals. Contrary to common belief, hospital-acquired illnesses are not simply random occurrences (Monegro et al., 2022). The World Health Organization estimates that out of every 100 hospitalized patients, seven in high-income countries and fifteen in low-income countries will have at least one health issue due to HAI (WHO, 2022). Sadly, occurrences like this might occasionally result in patient deaths. A study by the Centers for Disease Control (CDC) found that HIA infects over 2.0 million people worldwide and causes 100,000 deaths per year (Stubblefield, 2018). According to an analysis of two early case series from China, 44% of 179 severe respiratory infections were contracted in hospitals (Richterman et al., 2020). Therefore, there should be no question that a SaaS solution will benefit patients because it gives them easy flexibility and considerably lowers the risk of contracting an infection by physically visiting health institutions.

The main aim of designing and developing a SaaS solution for the healthcare sector is to give the public simple access to healthcare services, especially at a time when hospital workloads have risen significantly because of pandemic and virus-related difficulties. To ensure that the goal of this research is achieved, a list of objectives has been carefully planned out:

- To reserve a time slot with a doctor online and through the SaaS solution.

- To provide public with a platform where they can treat their health problems remotely.
- To offer a timetable which helps patients to keep their medications on schedule.

## IV. RESEARCH QUESTIONS

- How will a SaaS solution help patients to reserve a time slot with a doctor online?
- How does a SaaS solution provide a platform for patients to treat their conditions online?
- How does a SaaS solution offer a timetable to help patients to keep their medication on schedule?

## V. RESEARCH SIGNIFICANCE

The findings of this research are crucial as it discovers the impact a SaaS solution can have on the healthcare industry. There hasn't been much research carried out to examine the connection between developing a SaaS solution and the implications it would have on the healthcare sector. This research will be carried out to see if it is possible to develop a SaaS solution that enables the public to access health-related services online and over the Internet. This will decrease the number of people who go to hospitals, which lowers the risk of patients contracting viral and other infectious diseases there.

## VI. METHODOLOGY

### A. *Sampling*

The topic of this research paper is to develop a Software-as-a-Service solution that addresses some of the issues caused by the recent pandemic by lowering the number of people who visit hospitals, putting themselves at risk of getting viral diseases. Developing such a solution requires a comprehensive view of users, such as potential patients. Therefore, a quantitative approach will be applied to gain insight into potential patients' viewpoints. The acquired information will then be analysed to help develop a SaaS solution that satisfies user requirements (Peranzo, 2020).

### B. *Data Collection*

Questionnaires are one of the methods used in quantitative research to collect data. The ease of questionnaire distribution and the speedy data-gathering process are the key advantages of a quantitative research technique over a qualitative research approach. The survey contains open-ended questions, making it easier for respondents to express their true feelings while lowering the likelihood of researcher bias (Formplus, 2022). Furthermore, participants will not feel pressured or pushed to react as they would in interviews, giving them more time to consider their responses. This enables the collection of better data that is more precise and offers better insights into what future users may think about the system.

### C. *Respondents*

It is planned to collect 200 responses from the survey. Due to the high number of responses, snowball sampling will be used to collect the responses. Snowball sampling simplifies the overall feedback-gathering process, as it asks respondents to recruit additional participants for the survey. It also makes it simpler for the researcher to gather large amounts of data which can result in some unexpected results that serve to explore the limits of the suggested solution (Probability and statistics topic, 2021). Additionally, the responses will be loaded into RStudio and analysed using R programming language. The analysis is then added to a word document with a graphic visualization and a summary.

## VII. OVERVIEW OF THE PROPOSED SYSTEM

The proposed SaaS solution for healthcare will allow its users to have access to a variety of features. Once the user logs in, they will encounter different options which provide them easy and flexible access to health-related services. The proposed solution will run in the cloud, so users will not need to install software or patches to access it. Instead, they will use their browsers to access the system and have immediate access to healthcare services. The capabilities and features offered by the proposed SaaS Solution are illustrated in the navigational diagram below. Users can plan doctor appointments, make online drug purchases, monitor their meds, schedule home screenings, and reserve slots for vaccination using the proposed SaaS solution.

## VIII. CONCLUSION

The development of a SaaS solution for the healthcare sector opens a wide range of opportunities that can be used to address some of the challenges the industry is now facing. The SaaS solution will allow patients to save time as they no longer must wait in long lines, waiting to be called by doctors. Moreover, a SaaS solution will decrease the number of individuals who visit medical facilities, preventing many people from contracting HAI (Hospital Acquired Illness), particularly during the pandemic when hospitals and clinics can become a major source of viral transmission. Overall, this research paper looks at the possible uses of SaaS cloud technology in the healthcare industry and provides a summary of how a SaaS solution can be put into practice.

## ACKNOWLEDGMENT

The authors would like to thank to all school of computing members who involved in this study. this study was conducted for the purpose of healthcare solution project.

## REFERENCES

Bokhari, M. U., Shallal, Q. M., & Tamandani, Y. K. (2016, March 31). Cloud computing service models: A comparative study - researchgate. ResearchGate. Retrieved October 20, 2022, from https://www.researchgate.net/publication/333117926_CLOUD_COMPUTING_SERVICE_MODELS_A_COMPARATIVE_STUDY.

Chai, W., & Bigelow, S. (2021, December 16). What is cloud computing? everything you need to know. SearchCloudComputing. Retrieved October 21, 2022, from https://www.techtarget.com/searchcloudcomputing/definition/cloud-computing.

DoctorOnCall. (2022). How can we assist you? DoctorOnCall Help Centre. Retrieved October 21, 2022, fromhttps://www.help.doctoroncall.com.my/.

Gamage, C. C. (2020, October 10). Cloud Computing: Determinants Of Software As A Service (Saas) Model Adoption. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH. Retrieved October 21, 2022, fromhttps://www.ijstr.org/final-print/oct2020/Cloud-Computing- Determinants-Of-Software-As-A-Service- saas-Model-Adoption.pdf.

Hawkins, L. (2021, March 10). Doctoroncall deal to expand Malaysia's Digital Healthcare. Healthcare Digital. Retrieved October 21, 2022, from https://healthcare- digital.com/digital-healthcare/doctoroncall-deal-expand-malaysias-digital-healthcare.

Kanner, Q. (2022, August 9). SAAS vs. subscription vs. recurring revenue business models. New Breed. Retrieved October 20, 2022,

fromhttps://www.newbreedrevenue.com/blog/saas- vs-subscription-vs-recurring-revenue-models.

Peranzo, P. (2022, September 12). 10 healthcare SAAS trends that can transform medical industry. Imaginovation. Retrieved October 20, 2022, from https://imaginovation.net/blog/healthcare-https://imaginovation.net/blog/healthcare- saas-trends-that-revolutionize-medical- industry/.

Peterson, R. (2022, September 3). What is cloud computing? examples, types & benefits. Guru99. Retrieved October 21, 2022, fromhttps://www.guru99.com/what-is-cloud- computing-with-example.htm.

Vantage Market Research. (2022, October 25). Healthcare Cloud Computing Market Size Worth USD 128.19 bn by 2028: Vantage Market Research. GlobeNewswire News Room. Retrieved October 27, 2022, from https://www.globenewswire.com/en/news-release/2022/10/25/2540620/0/en/Healthcare- Cloud-Computing-Market-Size-Worth-USD- 128-19-Bn-by-2028-Vantage-Market-Research.html.

Chai, J. (2020, March 27). They really, really want you to stop having to register yourself at every clinic you go to. Vulcan Post. Retrieved October 21, 2022, from https://vulcanpost.com/693388/remedi-malaysia-cloud-based-healthcare-database- platform/.

Remedi. (2022). Remedi – Clinic Management System Malaysia. Remedi. Retrieved October 21, 2022, from https://remedi.my/.

Formplus. (2019, July 10). 15 reasons to choose quantitative over qualitative research. Formplus. Retrieved October 21, 2022, fromhttps://www.formpl.us/blog/quantitative- qualitative-research

Probability and statistics topic. Statistics How To. (2021, April 30). Retrieved October 22, 2022, fromhttps://www.statisticshowto.com/probability- and-statistics/.

Monegro, A., Muppidi, V., & Regunath, H. (2022, August 22). Hospital acquired infections - statpearls - NCBI bookshelf. National Library of Medicine. Retrieved October 22, 2022, from https://www.ncbi.nlm.nih.gov/books/NBK441 857/.

World Health Organization. (2022, May 6). Who launches the first ever global report on infection prevention and control. World Health Organization. Retrieved October 22, 2022, from https://www.who.int/news/item/06-05-2022- who-launches-first-ever-global-report-on- infection-prevention-and-control.

Richterman, A., Meyerowitz, E., & Cevik, M. (2022, October 25). Individuals with persistent fatigue, cognitive, and respiratory symptom clusters after COVID-19. JAMA. Retrieved October 27, 2022, from https://jamanetwork.com/journals/jama/fullarticle/2797443.