

My Physio: A Design of Speech to Text Telehealth Application to Facilitate Home Based Physiotherapy Session for Patients with Physical Limitation

Raja Rina Raja Ikram , Lee Pik Yun , Lizawati Salahuddin, Nadiah Ishak , Nor Syafinaz Yaakob, Fatimah Dzaharudin

Raja Rina Raja Ikram, Lee Pik Yun, Lizawati Salahuddin, Centre for Advanced Computing Technology (C-ACT), Fakulti Teknologi Maklumat dan Komunikasi, Universiti Teknikal Malaysia Melaka.

Nadiah Ishak, Department of Science and Technology, Faculty of Business Innovation and Technology, Batu 28, Kuala Sungai Baru, Melaka, Malaysia.

Nor Syafinaz Yaakob, Drug and Herbal Research Centre, Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300, Kuala Lumpur, Malaysia

Nur Hazlin Hazrin Chong, School of Biosciences and Biotechnology, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300, Kuala Lumpur, Malaysia

Fatimah Dzaharudin, Faculty of Mechanical and Manufacturing Engineering, University Malaysia Pahang, 26600 Pekan, Pahang

Article Info

Volume 83

Page Number: 1025 - 1031

Publication Issue:

March - April 2020

Abstract:

Patient adherence towards home physiotherapy sessions are perceived to be low due to the challenges physical disability patients face. A study done in Australia shows that out of 352 physiotherapists, the mean perceived rate of patient adherence towards home physiotherapy sessions was only 67%. A majority of physiotherapists believed that patient self-management strategies were important in improving patient outcomes. Amongst the barriers towards adherence include low levels of physical activity at baseline or in previous weeks, low in-treatment adherence with exercise, low self-efficacy, depression, anxiety, helplessness, poor social support/activity, greater perceived number of barriers to exercise and increased pain levels during exercise. This paper proposes MyPhysio, a design of a telehealth mobile based application to facilitate home based physiotherapy session for patients with physical limitation. This system enables physiotherapy sessions to be conducted via teleconferencing and enables activation of certain functions via speech, particularly starting and ending a teleconsultation or telephysio session.

Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 14 March 2020

Keywords: telemedicine, mobile health, physiotherapy.

I. INTRODUCTION

Telehealth is defined as “the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies, for the exchange of valid information for diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, in all the interests of advancing the health of individuals and their communities.” [1] [2]

Telehealth includes several modes of delivery, such as videoconferencing, mobile health and secure texting [3]. The

increased use of technology in healthcare has caused a great emphasis on telehealth because it can deliver the services of providers to remote locations and capitalise on the availability of subject matter experts and overcome the barrier of proximity [5]. Amongst the increasing forms of telemedicine include telephysiotherapy.

Telephysiotherapy can take many different forms, with the components driven by the goals of treatment. Telephysiotherapy programs may include remote monitoring of physiological signals, such as pulse rate, oxygen saturation, electrocardiograms (ECG), and joint range of movement, in specific populations such as cardiorespiratory or orthopaedic disease [6]. Whilst some telephysiotherapy

models require specially designed equipment, others have achieved similarly successful outcomes with off-the-shelf consumer devices and software [3]. The ubiquitous nature of the smartphone provides new opportunities for telephysiotherapy, including: physical activity monitoring; sound and light cues to set exercise intensity and duration; real-time feedback on exercise performance; and text messaging to provide exercise advice or progression. Simple web-based diaries can be used to record exercise and provide feedback.

II. RELATED WORK

In this section, a review of similar physiotherapy applications developed are discussed.

Features System	Platform	E- Commerce	Telemedicine	Appointment	Electronic Medical Record	Speech to Text Command
MyPhysio	Web Based + Android		✓	✓	✓	✓
Door2Door	Web Based			✓		
TELEME	Web-based		✓			
Doctor2U	Web Based+Android + IOS	✓	✓		✓	

Table 1 Related works in Telemedicine Physiotherapy field

Table 1 shows the related works in tele physiotherapy that are available. Physiotherapy applications that are available in the market are Door2Door [7], TELEME[8] and Doctor2U [9]. The features that will be compared in this section are e-commerce, telemedicine, appointment module, electronic medical record and speech to text command. E-commerce features are features that allow an sale or purchase transaction to be done online [10]. Telemedicine is the remote diagnosis and treatment of patients by means of telecommunications technology [11] [12]. Appointment module is a module where appointments can be made by the patients online. Electronic medical is a digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users [13]. Speech to text command is a module that allows patient speech to be converted to text to provide commands to the application.

Based on Table 1, only Doctor2u provides an e commerce platform together with their application. However, the e commerce platform is deemed not necessary to be included in telephysiotherapy application as there are many platforms out there such as shoppee and Lazada. Door2door and TELEME system both also have limited features such as appointment scheduling and limited telemedicine using a web based system. MyPhysio, our proposed application contains major functions that are required by patients and can be accessed via mobile devices. MyPhysio is one of the only applications that have access to web based and mobile devices including speech to text commands. Speech to text command module is embedded with the start and stop recording of video during physiotherapy sessions. Commands for emergency can also be used if the patient

faces difficulties or unwanted accidents and need to request for help.

III. METHODOLOGY

A survey was conducted to patients and physiotherapists using convenience sampling approach to gauge the acceptance of telemedicine in physiotherapy field and recommended features. Convenience sampling is a non probability sampling technique where subjects are selected based on their convenient accessibility. This technique was chosen because of the limited time of research period and focused sampling availability. A separate questionnaire was sent to patients and physiotherapists to gauge their acceptance towards telemedicine and their expectations requirements of a telemedicine system in the field of physiotherapy. The questions sent to the patients revolve around the following issues of acceptance of usage of telemedicine during doctor patient consultation, improving services quality and patient experience, concerns of using telemedicine, preferred teleconsulting method and preferable functions in telemedicine application.

Subject matter experts that consists of experienced physiotherapists also were included in this survey to ensure multiple viewpoints were obtained to maintain study comprehensiveness. The questions in the survey revolved around the issues of previous experience using telemedicine platform, perceptions on telemedicine will improve patient access and experience, concerns in telemedicine practice and features for implementation. The results of the survey from both patient and physiotherapists was taken into consideration during the final design and implementation of MyPhysio. A design of MyPhysio proposed was then used to facilitate implementation.

Results for Patients

A total of thirty patients and twelve physiotherapists participated in this study. All participants in this study were patients between 21 to 30 years old and seventy five percent (75%) or them are female. These patients were selected based on their previous experience with physiotherapy or planning to visit physiotherapist in the future. Thus, there may be a bias in the acceptance of telemedicine due to the young age and younger generations have higher acceptance towards technology. Ninety percent of the highest education of the respondents have a bachelor degree as a highest education level. Thus, the sample used are mostly educated patients as majority of them have at least a degree.

Age	Degree	Diploma	STPM
21-30	28	1	-
Less than 21	-	-	1

Table 1: Background of patients

Based on the feedback, 57% of these participants have visited government clinics whereas the other 43% visit private hospitals. Twelve participants or 40% have rated the waiting time as "Very Long" where as fifteen has rated

“Neutral” or a selected a scale of 3 out of 5. This is based on the assumption that only half have visited government clinics, thus it is safe to assume that the waiting time with a rating of three is meant majority for private clinics.

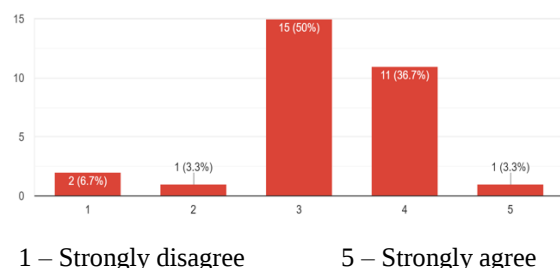


Figure 1. Patients feedback on the waiting time in government and private hospitals.

Patients were also surveyed whether they would accept telemedicine as a means of communication for follow up physiotherapy sessions. Based on Figure 2, a total of twenty out of thirty participants (66.7%) agreed and eight participants were neutral about it. Only two participants of 6.7% did not agree using telemedicine during doctor patient consultations, particularly during follow up sessions.

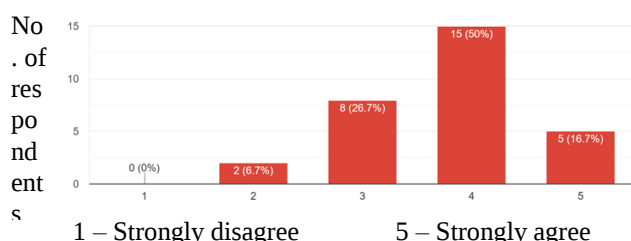


Figure 2: Patient response on the acceptance of use of telemedicine technology during doctor patient consultation

In addition, respondents expressed their concerns in using telemedicine during consultation as showed in Figure 3. Most of the patients (60%) prefer physical contact rather than telemedicine and 26.7% were concerned about incorrect diagnosis. Lack of trust in technology or medical approaches received a minor 10% of feedback and response.

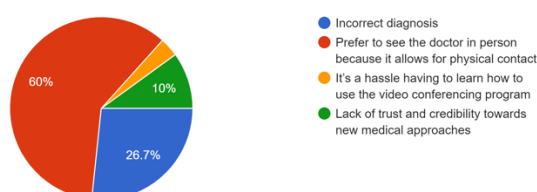


Figure 3: Patients concern when engaging video conferencing during consultation

This is an interesting finding since patients are young and shows there is a high trust in telemedicine applications being used during physiotherapy. This may also be due to the education background of the respondents as 90% have at

least a bachelor degree and all participants are less than 30 years old.

Result for Physiotherapists

A total of twelve physiotherapists took part in this study. No. out of twelve participants (33.3%) have experience in private hospitals whereas eight participants have experience in government hospitals. Eleven physiotherapists have been one to five years of experience in physiotherapy and one therapist has more than ten years of experience. None of these respondents (0%) have ever used any telemedicine platform when providing consultation to their patients. Thus, it is worth to note that the response shared are based on perceptions on telemedicine and not experience.

Work Experience	Government Hospital	Private hospital
1-5 years	4	7
5-10 years	-	-
>10 years	-	1

Table 2: Background of physiotherapists involved in the study

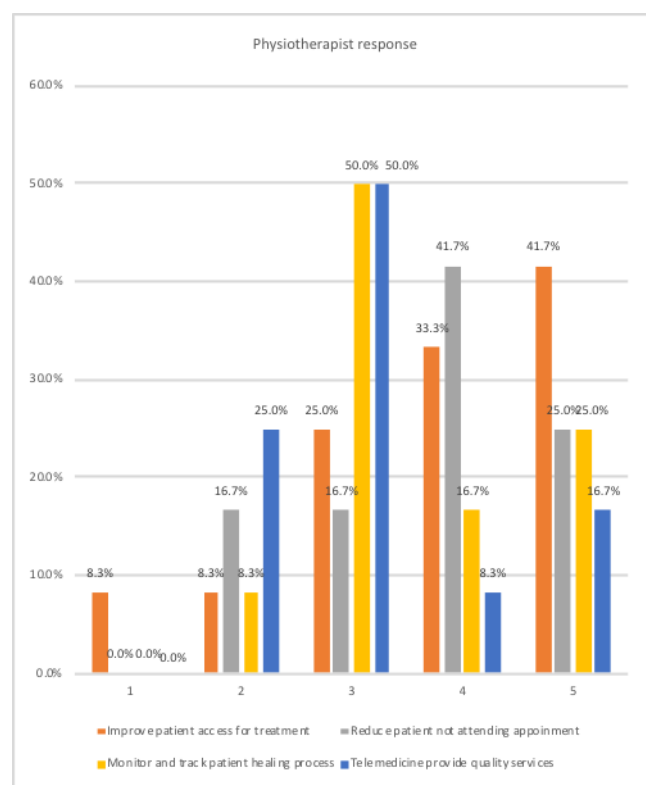


Figure 4: Physiotherapist response on improve patient treatment access, reducing patient not attending appointments, monitoring of patient progress and the use of telemedicine to provide quality services.

Based on Figure 4, eight out of twelve patients (66.67%) agreed (Rated 4 or 5) that telemedicine can improve patient access, patient experience and reduce patients from not attending scheduled physiotherapy appointments. Thus it is worth to note that the use of telehealth application during

physiotherapy can continue to provide quality services for patients.

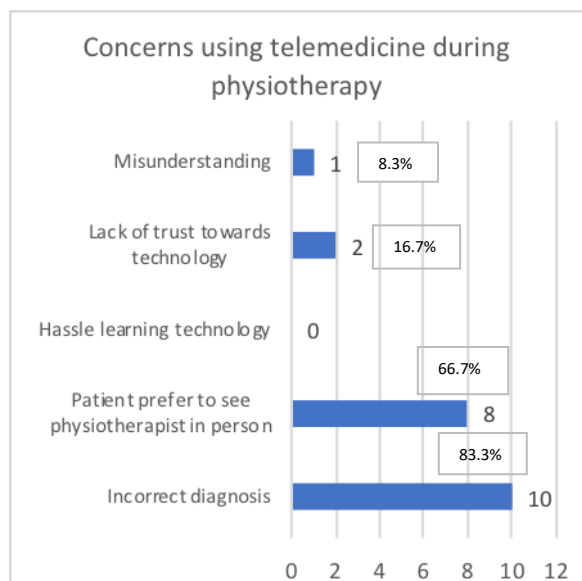


Figure 5 shows the main concerns of physiotherapists when engaging in telemedicine practices.

Incorrect diagnosis is one of the main concerns followed by patient preference for hands on treatment. It is also interesting to note that lack of trust and credibility towards usage of telemedicine is only a concern of 16.7% of physiotherapists, concluding that there is a high trust towards telemedicine technology during doctor patient consultation.

IV. PROPOSED FEATURES

Amongst the main features mentioned by patients are the ability for patients to upload regular exercises and the ability of physiotherapist to provide feedback on the regular exercises (75%). It is also worth to note that 92% prefer patients to upload videos instead of images and also provide feedback through video. Other features highlighted by patients and physiotherapists include automatic call to the hospital in case of emergency (75%). A majority of 58% participants agreed that speech to text features are useful and suggest to be used during recording physiotherapy sessions and emergency calls. Other features mentioned by patients are virtual nurse or physician watches the treatment live over so patients can be guided well instead of seeing videos and images, like a live camera. In addition, appointment features including finding nearest consultants were also highlighted.

V. PROPOSED DESIGN

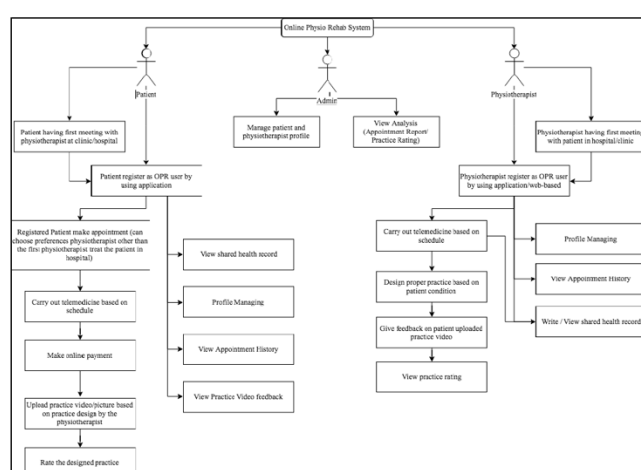


Figure 6 shows the process flow of MyPhysio

Figure 6 shows the process flow of MyPhysio, an online physiotherapy rehabilitation system. There are three main users of the system – patient, admin and physiotherapist. The patient is required to have a first meeting with the physiotherapist before registering to use MyPhysio. Registered patients can make appointments and carry out telemedicine consultations according to schedule. They are also able to make online payments for consultations, rate the physiotherapist chosen, make appointments and access personalised health record. In addition, they are able to manage their own profile. After the first meeting with physiotherapist, the physiotherapist can design proper practise based on patient condition and provide feedback for every session.

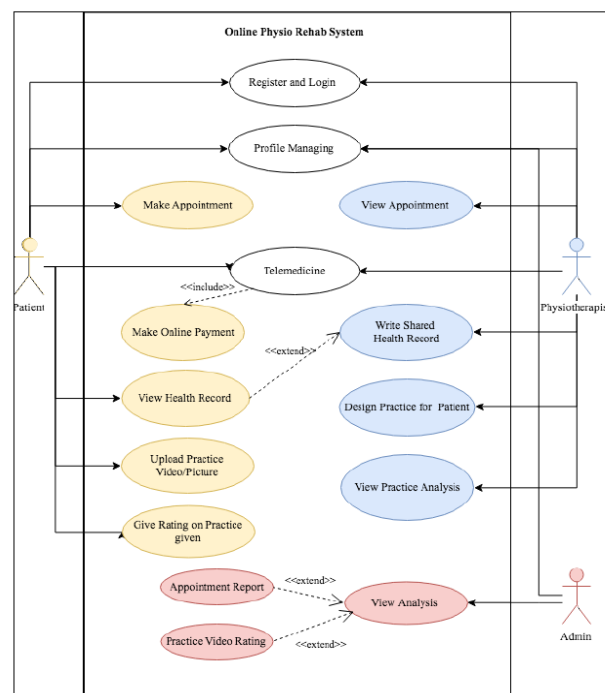


Figure 7 shows the use case for MyPhysio

Based on Figure 7, patients and physiotherapist able to register as user before access to the system. Registered

patient can arrange appointment on video consultation. Physiotherapist able to view the appointment schedule. Registered physiotherapist able to record patients' case notes and view record through webpage while registered patients view through the mobile. Registered patients can update their profile through mobile. Physiotherapy can update physiotherapist profile through webpage. Registered patients can upload their practice video and physiotherapist to give feedback. Patients able to view the price charged before book for the telemedicine.

VI. IMPLEMENTATION

A. Speech to Text Patient login page

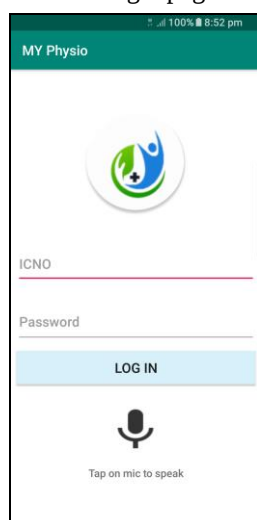


Figure 8 shows the patient login page

When the patient tap on each text field, the mic button will be triggered out as shown in figure 8. This speech-to-text function eliminate hassle typing for those with serious musculoskeletal based injury patients.

B. Patient's page

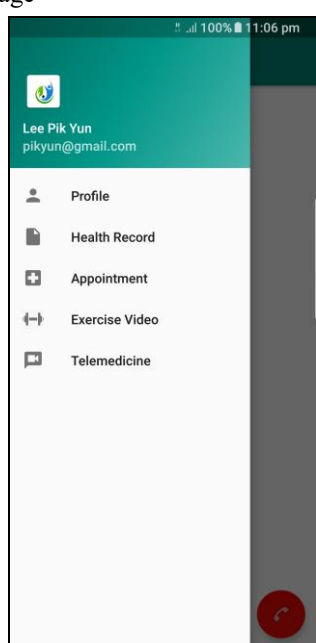


Figure 9 shows the navigation menu for patient

Figure 9 showed that patient can manage his/her profile, read health record, book for an appointment, upload exercise video based on the rehab plan given by the physiotherapist and lastly carry out telemedicine session.

C. Emergency call

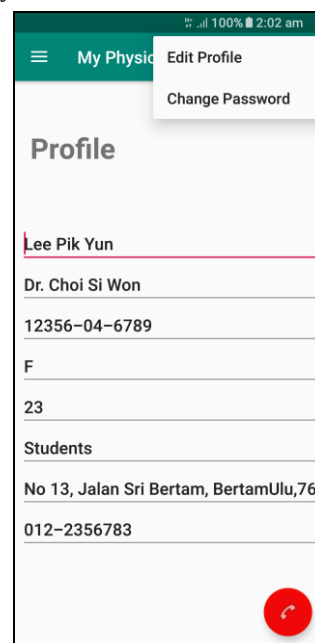


Figure 10 shows the patient profile page

Patient is able to edit his/her profile details and change user password. Besides, the red call button at right bottom corner that appear in every layout functioned as an emergency call. This allowed patients make a direct call to emergency line.

D. Patient physiotherapy session

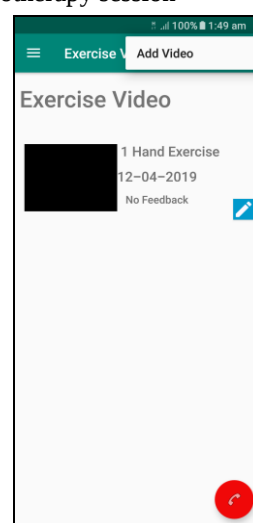


Figure 11 shows the patients' recorded physiotherapy session

After carry out a face-to-face appointment or telemedicine session, the physiotherapist will plan a specific physiotherapy exercise for the patient. By click on the add

video button, patient able to read the plan description and upload their physiotherapy session in the form of video. Furthermore, patient able to read the feedback from physiotherapist.

E. Patient rate the physiotherapy session

Figure 12 shows the rating layout of physiotherapy session by the patient

After the patient uploads the exercise video, they are allowed to rate the session based on level of pain, mood, services and physiotherapist. This is to allow physiotherapist to analyse the effect of the sessions and suggest treatments.

F. Physiotherapist dashboard

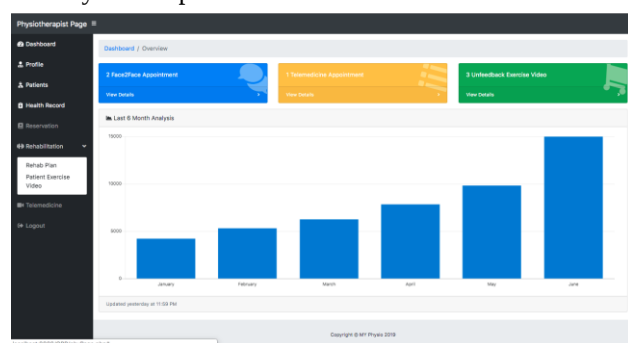


Figure 13 shows the dashboard for physiotherapist

Physiotherapist able to manage his/her profile, view patient list, write health record, view appointment list, plan a rehab, view patient exercise video, and lastly carry out telemedicine session.

G. Physiotherapist telemedicine session

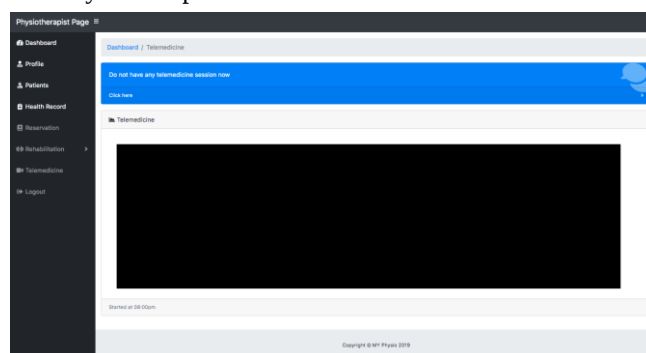


Figure 14 shows telemedicine session for physiotherapist

When there is no booked telemedicine session at that moment, the notice will shown as in figure 14. Besides, it will also display the next telemedicine session start time.

VII. CONCLUSION AND FUTURE WORKS

This paper has successfully presented MyPhysio, a telemedicine system with speech to text capability for patients with physical limitations. Telephysiotherapy has emerged as an evolutionary field of tele-medicine to overcome barriers that people with disabilities face in accessing the health and rehabilitation services. MyPhysio is capable to solve accessibility problem by providing a tool for physicians to communicate to patients a wide range of consultative, preventative, diagnostic, and therapeutic services in the comfort of their home.

ACKNOWLEDGEMENTS

This paper was funded by Universiti Teknikal Malaysia Melaka. PJP/2019/FTMK(7B)/S01681

REFERENCES

1. Hambaran O.M., Abd Ghani M.K., Raja Ikram R.R., Mohd Aboobaidar B., "Implementation Of Hybrid Software Architecture Framework In Clinical Information System: A Case Study Of A Malaysian Clinic". *ARNP Journal of Engineering and Applied Sciences*, 2015, 10(20), pp. 9891–9895.
2. Ikram R.R.R., Ghani M.K.A., Abdullah N., "An analysis of application of health informatics in Traditional Medicine: A review of four Traditional Medicine Systems, " *International Journal of Medical Informatics*, 2015, vol 84(11), pp. 988–996. doi:10.1016/j.ijmedinf.2015.05.007
3. Raja Ikram R.R., Abd Ghani M.K., "An Overview of Traditional Malay Medicine in the Malaysian Healthcare System", *Journal of Applied Sciences*, 2015, vol 15(5), pp. 723–727. doi: 10.3923/jas.2015.723.727
4. Ikram R.R.R., Ghani M.K.A., Abdullah N., "An analysis of application of health informatics in Traditional Medicine: A review of four Traditional Medicine Systems", *International Journal of Medical Informatics*, 2015, vol 84(11), pp. 988–996.
5. Raja Ikram R.R., Abd Ghani M.K., Hambaran U.,

- Integrated Modern And Traditional Malay Medicine Healthcare Services In Postnatal Care – An Evaluation Of Mypostnatalsys". *ARPN Journal of Engineering and Applied Sciences*, 2015, vol 10(19), pp. 9002–9008.
6. Salahuddin L., Ismail Z., Raja Ikram R.R. et al. "Safe use of hospital information systems: an evaluation model based on a sociotechnical perspective". *Behaviour & Information Technology*, 2019, pp. 1–25. doi: 10.1080/0144929X.2019.1597164
 7. Door2Door Doctor Malaysia - Healthcare at Your Doorstep. [<http://www.door2doordoor.my/>].
 8. Teleme - Talk To Doctors Online & Get Your Medication. [<https://teleme.co/>].
 9. Doctor2U. [<https://doctor2u.my/>].
 10. Ecommerce Definition - What is Ecommerce. [<https://www.shopify.com/encyclopedia/what-is-ecommerce>].
 11. Corstorphane J, Corstorphane D." Can EHR Be Implemented in Remote, Traditional Aboriginal Communities - How Kinship Impacts on Record Systems". *HIC 2005 and HINZ 2005: Proceedings* 2005:60.
 12. Van Egmond M.A., van der Schaaf M., Vredevelde T. et al." Effectiveness of physiotherapy with telerehabilitation in surgical patients: a systematic review and meta-analysis". *Physiotherapy*, 2018, vol 104(3), pp. 277–298.
 13. Ikram R.R.R., Abd Ghani M.K., Ab Hamid N.R., Salahuddin L., "Enabling Ehealth In Traditional Medicine: A Systematic Review Of Information Systems Integration Requirements", *Journal of Engineering Science and Technology*, 2018, No 13(12), pp. 4193–4205.

Foundation level (CTFL) by International Software Testing Qualifications Board (ISTQB).



Lizawati Salahuddin received her PhD from Universiti Teknologi Malaysia. She is a senior lecturer in Universiti Teknikal Malaysia Melaka. Her research interest includes healthcare informatics and biomedical computing



Nadiah Ishak received her PhD from Universiti Tun Hussein Onn Malaysia. She is a lecturer in Kolej Universiti Islam Malaysia Melaka.



Nor Syafinaz Yaakob received her PhD from Monash University Australia. She is a senior lecturer in Universiti Kebangsaan Malaysia.



Fatimah Dzaharudin received her PhD from University of Melbourne, Australia. She is a senior lecturer in Universiti Malaysia Pahang.

AUTHORS PROFILE



Raja Rina Raja Ikram received her undergraduate degree in Software Engineering from University of Melbourne and PhD from Universiti Teknikal Malaysia Melaka. She is a senior lecturer at Universiti Teknikal Malaysia Melaka. Her research interest include biomedical computing, health informatics, and healthcare analytics.



Lee Pik Yun is a final year student of Bachelor of Software Engineering at Universiti Teknikal Malaysia Melaka (UTeM) and is expected to graduate in December 2020. Her graduation education has prepared her well for challenges she wish to pursue. She has a wide breadth of skills and knowledge of the type that gives potential employers the flexibility to place her in a broad range of demanding situations, with the confidence that will undertake her duties professionally and effectively. She was awarded with Dean's list for five semester throughout the three years of study in UTeM. She is also a certified tester under Certified Testers