M-Healthcare to Facilitate Self-Management of Chronic Back Pain

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Abstract In this era of IT and mobility, mobile application becomes an essential software application in software industry. Medical and healthcare applications are widely used in human life. With the increasing capabilities of mobile phones, software industry finds it as an important paradigm to develop mobile-health which increased tremendously. Chronic diseases become one of the famous diseases nowadays. It affects many people around the world. This makes people start to miss their comfortable life and may be their ability to perform their job properly. Patients with chronic diseases suffers from providing updated information to the medical doctors, high cost of visiting doctors and treatments, and some of the medical applications are complicated in term of usage. To overcome such weaknesses, this paper offers a suitable solution that can figure out and control the chronic disease. Mobile healthcare application offers updated information for doctors about patients, low cost, user friendly and can be used by different ages and cultures to help them to manage their chronic disease effect or pain. This paper will focus on back pain chronic disease where many people suffer. A prototype is developed to help people controlling their pain by recording or analyzing their pain and sharing their pain records with doctor or physiotherapist. The prototype is allowing chronic people to be energetic by providing them the exercises' video which can reduce their pain. This will help people to reduce their pains and allowing them to self-manage themselves in order to have a better life.

Keywords Chronic disease; back pain; mobile healthcare

Introduction

Chronic disease is a non-communicable illness which cannot be cured by medication and vaccines and it is the major causes of death. This disease continuously affects many people year by year and become more serious when the time increases. Chronic disease usually affects many aspects of someone's life likes physical, social and psychological aspects [1]. Normally, the causes that lead to chronic disease are unhealthy diet, lack of exercises, high blood pressure, obesity and overweight, high blood glucose, high cholesterol, low fruit and vegetable intake, alcohol use and tobacco use [2]. Chronic back pain is one of the chronic diseases that affects many people. Back pain can be described as a pain at the back of the body which spreads in the region of neck, chest or abdomen [3]. Back pain is the second most causes that makes people absent from work and it is also the most common cause of disability. It is also recorded the second most common reason people seek physicians [4]. There are three type of chronic back pain which are chronic lower back pain, chronic middle back pain and chronic upper back pain.

Digital elements are emerging in healthcare. These digital elements can help to prevent human life [5, 6] and reduce the chronic disease. One of these emerging digital elements are mobile applications. Nowadays, almost everyone owns a smartphone and they will bring their smartphone where ever they go and this make it easier to use for various purposes [7]. Mobile healthcare application is one of the tools that allows a chronic disease patient to self-manage their condition [8]. The 21st century shows the growing of mobile health (m-health)

applications that help in facilitating life of patients and help them to manage their health and chronic diseases. However, there is a need to overcome some of current limitations in mobile healthcare applications. Such limitations include focusing on pain record of patients rather than integrated with suitable solution to reduce the patients' pain, several m-health are more general and not focused on specific type of diseases such chronic disease which needs an application that focus only on chronic pain. Lack of transferring updated patient's data to the doctors, besides the not low cost and not user friendly.

This paper will focus on one of chronic diseases which is the chronic back pain. It focuses on design and develops a prototype (My-Chronic-Pain) that tries to overcome some of the previous limitations. It helps patients to self-manage their back pain chronic disease. It helps in recording patient health data and email it to the doctor as well as providing video clips to advise patients to manage their chronic pain. It has a simple design which can be used by people of different ages and cultures, and to enable doctors and physiotherapists to be updated with their patients' health conditions.

Design of My-Chronic-Pain

This section explains briefly the design of My-Chronic-Pain prototype. It focuses mainly on two parts the pain diary and exercises as it has an important role for the back pain chronic patient. This prototype deals with the three main back pain chronic which are the upper back pain, the middle back pain and the lower back pain. Figure 1 shows the overall My-Chronic-Pain design flowchart.
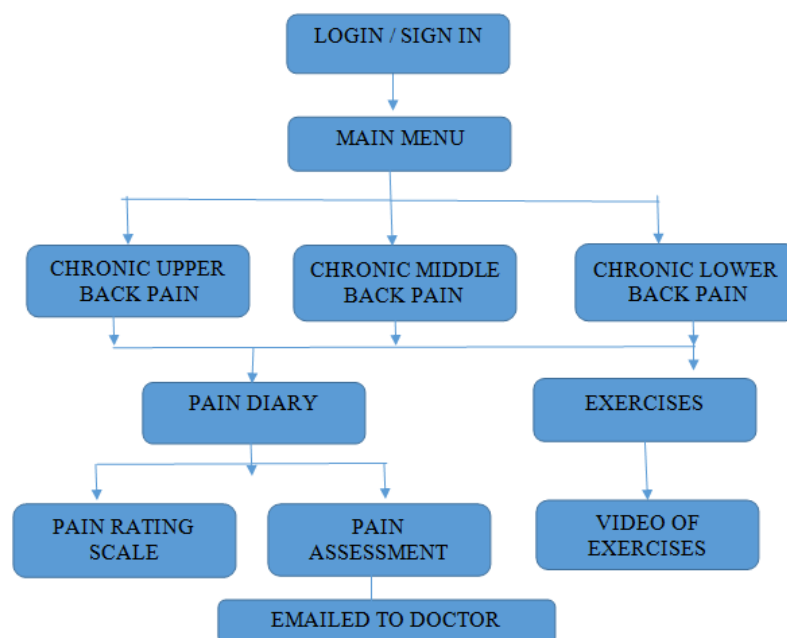

Figure 1: My-Chronic-Pain design flowcharte

The user start with sign in for the first time or login if he was registered then user will go to the main menu to choose which back pain chronic he suffer since we have three types. Design shows that every type of chronic back pain will have same activities which are pain diary, and exercises. However, each back pain type have different type of activities such as pain assessments questions and type of exercises. The pain diary is divided into two activities which are pain scale and pain assessments. Pain scale [9] is the scale for the users to evaluate their pain while pain assessment is where there will be a few questions for the users to answers. These questions are related to their type of pain. The Pain assessment questions for different back pain are designed based on theoretical knowledge in the physiotherapy book which is from the ministry of health in Malaysia. Pain assessment will email to the doctor.
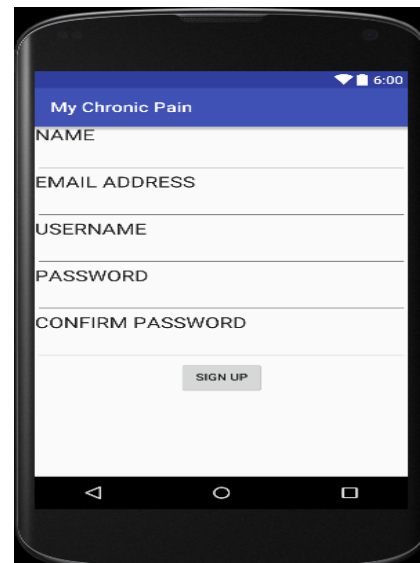
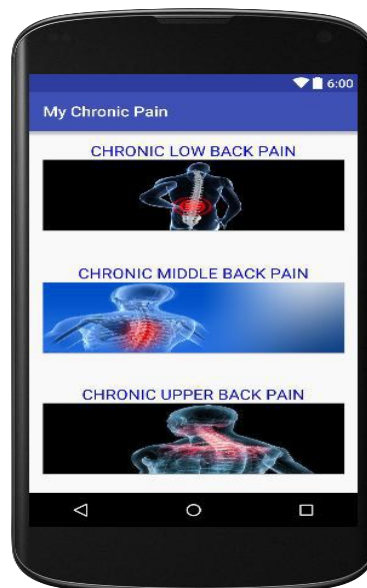*Figure 2: Welcome screen*

Figure 3: login screen

Figure 4: Types of Chronic Back Pain

Through this prototype people may record their pains using "Pain Diary". Pain Diary consists of pain scale and pain assessment questions as shown in Fig 5. Pain scale is a self- reported pain level. A pain scale will help the patients to rate their pain so it can be shared with the doctor. There are few types of pain scales. However, in this paper the face rating scale is used. Users may choose the scale to rate their pain where the scale begins with no pain, hurts little bit, hurts little more, hurts even more and hurts worst. In the pain assessments questions, users need to answer several provided questions related to their back pain. Those questions were taken from a physiotherapy book. There will be 5 to 6 answers available for each question as shown in Fig. 6. For example, in term of driving, user may choose how do they feel like 'drive car without pain', 'drive with slight neck pain', 'drive with moderate neck pain', 'cannot drive because of moderate neck pain', 'hardly drive at all because of severe neck pain' or 'I cannot drive at all because of neck pain'. Users may also have a chance to email their pain records to their doctor or physiotherapist. The email system is one of the tools that may encourage the users to self-manage their health and pain as the doctor or physiotherapist will know if they did not rate their pain because there is no pain record emailed to them. The pain rate also helps them to change their behavior as they may see the rating of their pain from day today.
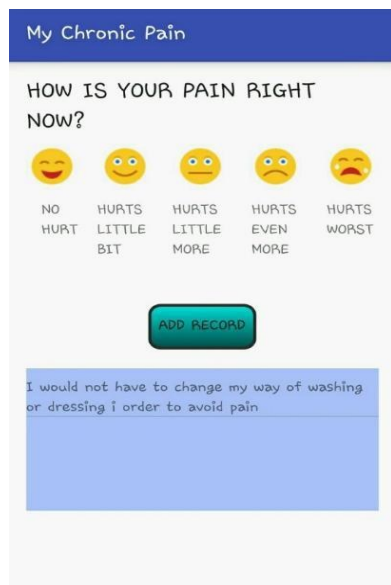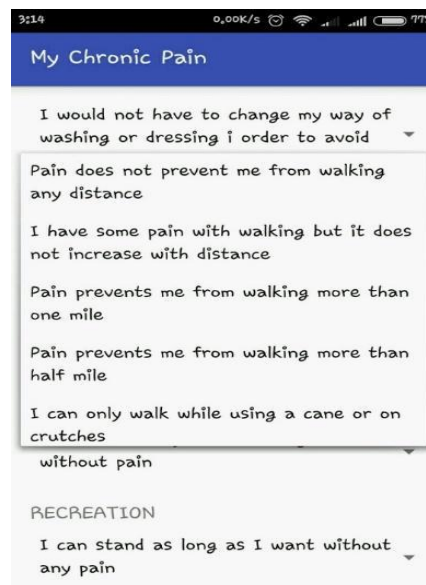
Figure 5: Pain Diary   *Figure 6: Pain Assessments Questions*

The other interactive features available in this prototype which may reduce the users pain is the exercises. In this prototype, each type of chronic back pain will have their own short video clip exercises. In chronic lower back pain, users may choose the short video exercises provided in this prototype such as 'Hip External Rotation Exercise', 'Backward Bending Exercise', 'Lying Prone in Extension', and 'Hip Extension Exercise' as shown in Fig.7. These exercises are simple exercises which the users or patients may practice by themselves at their home without any supervision. The exercises provided may reduce the patient's pain if they practice more often. Those exercises also may increase the flexibility of their lower back, strengthen the secondary muscles of the spine and help support the spine through various ranges of motion.
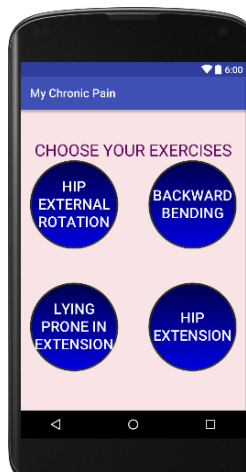

Figure 7: Chronic Low Back Pain Exercises   *Figure 8: Chronic Middle Back Pain Exercises*

The types of exercises that are available for chronic middle back pain are 'Rotation Stretch Exercise', 'Cat Cow Movement Exercise', 'Cobra Pose Exercise', and 'Passive Back Bend Exercise' as shown in Fig.8. These exercises help the users or patients to ease the pain in the joints, and reduce the middle pain without stressing the muscles. Performing those exercises regularly may reduce the middle back pain. In case of chronic upper back pain, the available exercises are 'Neck Flex or with Small Ball Exercise', 'Neck Retraction Exercise', 'Neck Stabilizing While Lying Exercise' and 'Strengthening Exercise with Their Band' as shown in Fig. 9.

The advantages of these exercises are to ease tension, prevent the body from hutching forward, improve the body posture and ensures strong bones and good health as well.

Fig. 10 shows one of the examples of the exercises videos. As can be seen from this figure, there will be a short description on how to do the exercise and there are also a buttons for the user to play, pause or stop the video. The exercises part is also one of the attractive tools as it helps the users or patients to reduce their pain wherever they are. Besides going to physiotherapy, they may also self-manage their health and pains at their home
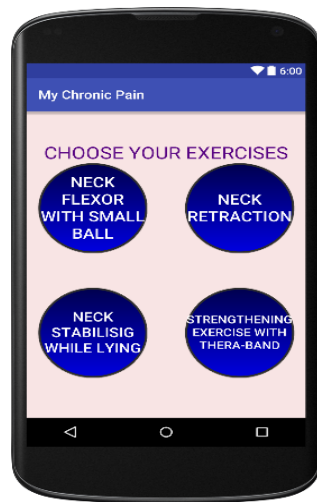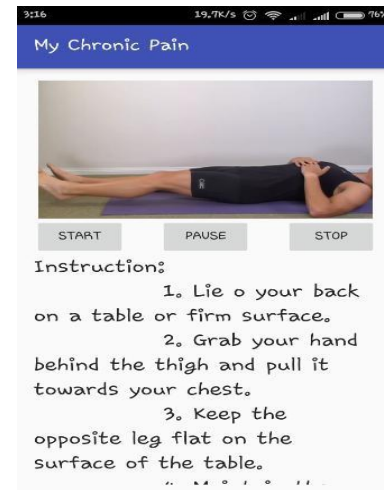

Figure 9: Chronic Upper Back Pain Exercises.

Figure 10: Video Exercises

Conclusion

The proposed mobile application for Self-Management of Chronic Back Pain consists of pain diary and exercises that may help the users or patients to reduce their pains. The email system will encourage the users or patients to self-manage their pain as the doctors and physiotherapist are updated with their patient's health and pain records. If the users or patients did not email their pain records to the doctor or physiotherapist,thedoctororphysiotherapistmaytakeaserioussteptoencouragethem to take care of their health conditions. Some people may be avoiding visiting the doctors so the email system will be the main tools that may help them to change their behavior. The exercises provided in this project are simple exercises which do not need any supervision and may encourage the users to self-manage themselves at home with regular exercises.

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