

# Intelligent Application For Maternal Health Management

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**Abstract**—Maternal physical and mental health is stand out amongst the most essential factors of a woman's life. Physically or Mentally unstable mothers cannot function properly. Therefore, innovative solutions to self-management of maternal health issues are particularly valuable. This paper presents the design approaches of an ongoing project of developing an Intelligent Web Application for Maternal Health Management. The designs were based on creating an efficient and reliable web app for good maternal physical & mental health care, healthy baby birth, baby care and mother care. This web application is consist with the Edinburgh postnatal depression scale to measure the stress , stress meter and technique to connect the users with midwives and doctors. Edingburgh postnatal depression scale (EDPS) is developed as an Expert system and the web application consists with chatbot feature which helps to solve users' problems regarding maternity. This system is developed specially for Sri Lankan pregnant mothers; therefore, language of this application is Sinhala. Automated EPDS concept is not still been utilized by many maternal application developers when designing maternity related web applications. Additional to these two major features this application is consist with a database which keeps patients records and facility for doctors to provide music therapy through this app if needed. The final objective of this project will be developing an intelligent web application which provide guidelines for maternal period and stress managing criteria using expert system technology.

physical and mental health and one potential solution is digital in the form of a web application (known as Happy Pregnancy), which will be design and develop to provide

**Keywords**—Maternity, Expert system, Edingburgh postnatal depression scale, chatbot, web app

## I. INTRODUCTION

Pregnancy and the arrival of a newborn is a very exciting time in any family, it is also a time when emotions, both positive and negative, may impact on the health and well-being of the mother and family. The World Health Organisation defined maternal mental health as "a state of well-being in which a mother realises her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her community." However, there is limited resources to monitor and provide support to mothers and their families in the area of maternal physical and mental health. This paper outlines the problem of maternal

guidelines and manage maternal physical and mental health of expectant and new mothers. While there is a massive advancement in the use of web and mobile technologies for providing healthcare in developing countries, this web application is mainly targeting Sri Lankan pregnant mothers and this app is developed using Sinhala Language since there is no any Sinhala language based maternal healthcare application.

Web applications are soft tools for connecting users to Internet services that are frequently accessed using PCs and microcomputer machines. Web technologies have made life easier, it serves the users in different aspects and it is obvious that specific life-cycle like pregnancy requires the use of modern technology to manage and monitor the pregnancy status, provide feedback information and provide essential support and provide stress management technology. One of the interesting advantages of the proposed web application is that it provides automated Edinburgh postnatal depression scale (EDPS) which helps mothers to measure their stress level and this feature is based on expert system. Since an expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behaviour of a human that has expert knowledge and experience in a particular field, it is efficient and reliable to use an expert system as a stress management system. Another important feature of this application is the natural language processing based chatbot feature which is capable to provide answers for any question regarding pregnancy and baby care.

By using this app, users can manage their mental and physical health throughout the day. User can measure their stress level by using expert system feature and if the user is in depression state, app informed that to a doctor. Then the doctor can check the user's history records which already stored in the app's database and provide relevant guidelines or medicines to the user. User can read the web pages and get to know about the important facts about maternal period. Also, there is a facility to ask any relevant question from the chatbot in any time and find a best solution.

Overall aim of this system is to Implement a web application which calculate the stress level of mothers and help them to manage their mental health and help them to manage their physical health as well and provide guidelines for baby care. This app will also Identify pregnant and post pregnant mothers suffering from

depression, stress etc. and at the same time help them too and provide a facility to doctor or midwife to provide breathing exercises and music therapy to reduce the depression of user. This app has an ability to direct users to specialists and midwives when needed.

that connects mothers with doctors or midwives through the app itself. Most of the existing apps only care about

The rest of the paper is organized as follows: Section II provides background and related study. Section III describe the methodology followed. Section IV detailed the system design architecture and technologies. Finally, I conclude the paper in section V.

## II. BACKGROUND AND RELATEDSTUDY

### A. Existing Apps and Features

Followings are some features of the proposed system and the table shows the comparison of those features using existing maternal healthcare management applications.

- i. Expert system based-(1)
- ii. Address all stress, anger and depression-(2)
- iii. Designed for use by pregnant and post pregnant mothers-(3)
- iv. Provide all physical and mental health management and baby care-(4)
- v. Recommend activities-(5)
- vi. Connects with doctors and midwives-(6)
- vii. Consists with a Sinhala chatbot-(7)
- viii. Simple and intuitive interface and interactions-(8)

**Table 1. Comparison of excising apps**

Name of the app	Features							
	1	2	3	4	5	6	7	8
Anxiety Coach	x	x	x	x	√	x	x	√
Pacifica	x	x	√	x	√	x	x	√
Healthy Habits	x	√	x	x	√	x	x	√
Happify	x	√	√	x	√	x	x	x
Moody Me	x	x	x	x	x	x	x	√
Breathe2Relax	x	x	√	x	√	x	x	√
Heal Yourself	x	√	x	x	√	x	x	√
In Hand	x	√	x	x	√	x	x	√

According to the above table, there are no any existing apps which are based on expert systems and no any apps consists with the Sinhala chatbot. There are no any apps

maternal. mental health management or physical health management.

*B. Internet use by pregnant women seeking pregnancy-related information*

Researchers have found that women most often searched for information on the Internet during the early stages of pregnancy and pregnant women often use the Internet to retrieve information on various topics related to pregnancy, including stages of childbirth, fetal development and nutrition in pregnancy

*C. Web-based interventions for prevention and treatment of perinatal mood disorders*

In the research conducted by Eleanor W. Lee et al on web-based interventions for prevention and treatment of perinatal mood disorders, suggests web-based interventions may be effective for the management of maternal health in the post-partum period and highlights the need for robust, high quality studies conducted during the antenatal period. They have studied about women older than 18 years of age with no history or current symptoms of severe or life-threatening mental illness, proficiency and no participation in psychotherapy at recruitment and found that there has been much less work in this field in relation to the perinatal period.

*D. First Sinhala Chatbot*

Researches have designed and implemented a Sinhala Chatbot System that can communicate between computer and user, through Sinhala language. This is the first ever Sinhala Chatbot. The current chatbot has designed to work on Linux and Windows Operating systems. As such the current chatbot can be queried on operating system related concepts such as date, time, and also identify individuals and greet accordingly.

*E. Femtech (female technology)*

Femtech (female technology) describes digital technologies focusing on women's health, which is gaining enormous growing global attention and investment. One such women's health area is maternal mental health, which is an increasing problem with a lack of accessible resources.

*F. Pregnancy Healthcare Mobile Application*

"BabyApp" is an android mobile-based application for pregnant women. It helps the pregnant woman to manage time and provides all of the information needed during pregnancy period. In addition, the proposed mini-online store provides essential goods for babies. The main audience of the "BabyApp" are pregnant women and it was found that such mobile-based application will make pregnant women life much easier and provide additional support for the complete nine months of pregnancy.

### III. METHODOLOGY

Developing successful software involve that the software pass through specified software development model. System Development Life Cycle (SDLC) is a well-known model in which the proposed software is going through a sequence of ordered phases during the development process SDLC is split into five main phases. once executing every phase deliverable are going to be made. These phases are thought-about as the requirement gathering and analysis, design, implementation or coding, testing and release. In the requirement analysis phase the main target is on collecting and conducting from the concerned parties in the software system, and at the end of this phase a requirement specification document ought to be generated. throughout the design phase the software system and hardware that are needed ought to be specific and a system design ought to be outlined. The implementation is considered because the longest and main phase were the code is generated. within the testing phase the completed software system is being tested to ensure that it works properly and meets the outlined necessities. At the deployment phase the finished software system is being. moreover, there is a sixth phase which is maintenance, wherever the important problems are recognized after the testing the software system and it has to be solved.

To develop the proposed system, I prefer to follow the agile methodology because of its advantages over the other methodologies. When comparing the agile with the other methods, we can notice that it is more effective, cheaper and it has less risks. It ensures continuous improvements, early delivery and flexibility in handling any required changes. In agile methodology, the product development work is broken down into smaller increments which reduces the amount of planning and design. After finishing each stage, the product is reviewed in order to know if there is any required change at this specific stage which reduce the overall risk and costs. At the end, complete software can be released with all the features. Agile benefits include:

- i. Early delivery and less cost.
- ii. Allows to make changes at any stage, even in late stages.
- iii. Better quality because of breaking the software developing process into smaller increments.
- iv. Client satisfaction because of rapid and continuous delivery.
- v. Less planning and design required.
- vi. Easy managing and flexible for developers.

### IV. DESIGN APPROACHES AND TECHNOLOGIES

#### A. Fundamental design

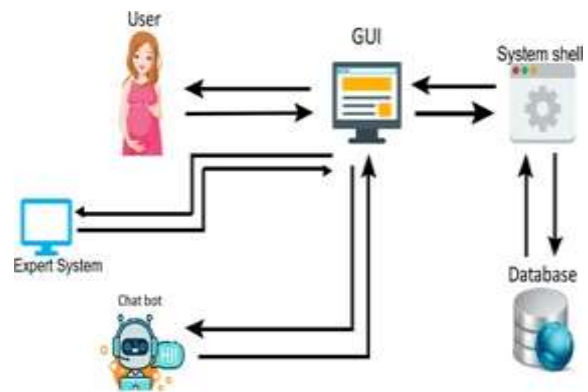


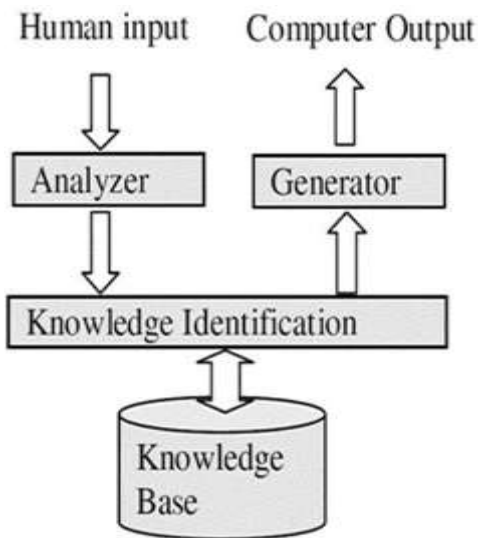
Figure 1. Basic design of the proposed system

System is basically designed as the above diagram and system consists with web interfaces, database, expert system and chatbot. Database is designed to develop using MySQL and it is used to keep user records and login information. Web interfaces are designed using HTML, Java Script, CSS and PHP. Web interfaces provide guidelines for health management and also direct users to chatbot feature and expert system feature. First of all, user has to sign in to the web site and there are two signs in types in this web site. Those two types are login as a user or login as a doctor.

When someone log in as a user, they can use chatbot, expert system and read the web pages but they can't see their stress level and their history information. After logging in as a doctor, system allows you to see patience history and allows you to recommend relevant guidelines or medicines to user. If a user, ask questions about a serious matter then the chatbot send a message to doctor about that. If a user's stress level is exceeded, then the expert system notifies that to the doctor. Doctor can connect users through the app by using a chat feature which connects with the Skype.

#### B. Chatbot

A chatbot is a computer program or an artificial intelligence which conducts a conversation via auditory or textual methods. This system consists with the textual method based chatbot. The chatbot is designed to develop using JAVA and SWI-PROLOG that runs on both Linux and Windows. Chatbot uses Sinhala language and provide answers for user's questions which only regards to maternal physical health care and baby care. Following figure shows the overview of the chatbot system.



current day artificial intelligence, deep learning and machine learning systems.

Figure 2. Architecture of the chatbot system

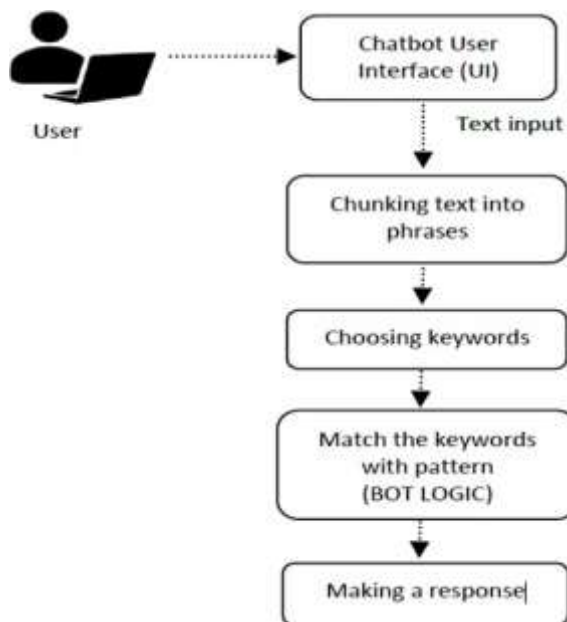


Figure 3. Design of the chatbot system

### C. Expert System

An Expert System is defined as an interactive and reliable computer-based decision-making system which uses both facts and heuristics to solve complex decision-making problems. It is considered at the highest level of human intelligence and expertise. It is a computer application which solves the most complex issues in a specific domain. The expert system can resolve many issues which generally would require a human expert. It is based on knowledge acquired from an expert. It is also capable of expressing and reasoning about some domain of knowledge. Expert systems were the predecessor of the

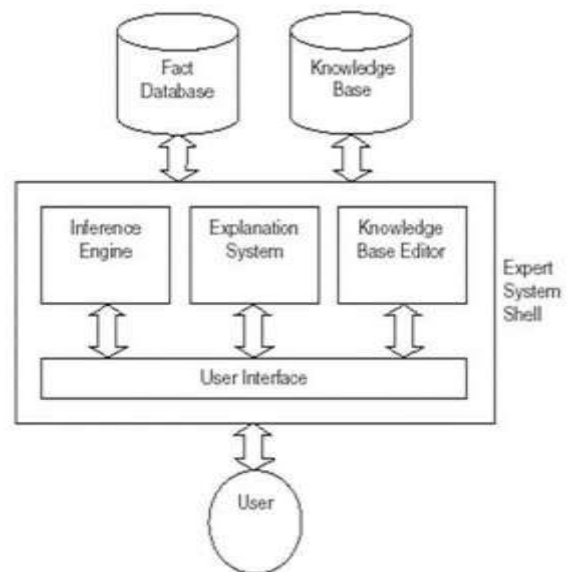
In this web application, expert system is designed to use as a stress calculation feature which provides the automated Edinburgh postnatal depression scale (EDPS) and get user's answers for the provided set of questions. Then it allocates the marks for those answers and calculate the stress level of the user. Following figure shows the general architecture of an expert system.

#### V. CONCLUSION & FUTURE WORK

The purpose of this study is to develop a web application which provides guidelines for maternal mental and physical health care and also help users to manage their mental health during maternal period. This paper presented the concept of having intelligent application which assists the users to behave correctly in their maternal period and solving the problem of having lack of knowledge about maternity and bad behaviours in maternal period. It can be concluded that the main objectives of "Happy pregnancy" web app is to prevent depression in pregnant women and improve physical health in maternal period. It must be implemented under quality criteria and tested by professionals.

Figure 4. Architecture of the expert system

This maternal health management application has the potential to dramatically change the way that patient's health is diagnosed, monitored and treated. In order to fully realize this potential, further studies with neuropsychiatric patients will be necessary to validate the utility of the data. This system can be seamlessly integrated into a patient's daily life. Visualizations will enable clinicians to process both raw data and analytics rapidly in order to assist decision making, the patient



studies will enable to link data with actual outcomes, this allows both specialists and analytic models to learn how psychology affects treatment response.

Future works will also include designing the heart rate recognition software to capture the pulse rate of users and provides better report to doctors. Finally, the integrated and reliable software that will detect users' illnesses, problems, etc and help them to healthy delivery and better baby care.

Postpartum Women Interested in Health-Related Apps?  
Implications for the Prevention of Perinatal Depression.

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