**USE OF INBUILT SENSORS IN SMART PHONE TO DEVELOP FETAL DOPTONE**

**SOFTWARE REQUIREMENTS SPECIFICATIONS**

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**1.** **INTRODUCTION**

1.1 Purpose

The purpose of this document is to describe the software requirement specifications for future reference. This is to avoid incoherence in the understanding of the project during the design and development phase of the app or when the need of providing future updates in the case of iterative development occurs. This also greatly helps in reducing later re-design. This document provides an early description of the functional aspects and services provided by the software. Lastly this document only details all of the software requirements and does not describe any design, verification, or project management details of the development process.

1.2 Intended Audience

This document mainly acts as the future reference for the software developers of this project and the concerned course instructors of IIT INDORE. The contributors to this document are students of the Computer Science Engineering Branch of IIT INDORE specified on the cover. This document has been made under the specifications of Software Engineering course.

1.3 Definitions and Acronyms

* User: The user is the person who uses the software after it has been fully developed, marketed, and installed
* MMR : Maternal Mortality Rate
* IMR : Infant mortality Rate
* IUFD : Intrauterine Fetal Demise

**2.** **GENERAL DESCRIPTION**

2.1 Client’s Message

‘The test of any civilization is based on the quality of care that it offers to the most vulnerable members of the society, especially the pregnant mothers, new born and children below 5 years.’

But, unfortunately, even in this technologically advanced 21st Century, when science has enabled mankind to explore the hidden world of the galaxy, we are not able to offer quality health care services and complete assurance of safety and life to all our pregnant mothers and children.

As per the Niti Ayog data, the Maternal Mortality Rate in India in 2016 is 130 deaths per 100,000 live births. Region-wise the MMR in Central and North - east region is as high as 300, whereas in the states of Southern India it is far below national average. Broadly, it is inversely proportional to the literacy rate and women empowerment i.e. those states where literacy rate, awareness, women empowerment and health services are high, the MMR is low, while the states which are low in these parameters have higher MMR.

The Neonatal, Infant and Children mortality rate also follow the same pattern. According to GOI date, the IMR in India in 2018 is 30 deaths per 1000 live births. With higher rates above national average in Central states of India and lower rates in southern and western states.

According to one study published in International Journal of Pregnancy and Child birth, the incidence of IUFD in India is around 39 per 1000 live births (March 2017 by Jayshree V Kanavi et al). The major causes responsible for around 60% of IUFD, are cited as Severe pre-eclampsia, Maternal Anemia and late referral to tertiary health centres, all of which are preventable to large extent. To highlight, it is the failure of our health care services to prevent these otherwise preventable IUFDs.

Before IUFD, many mothers may experience reduced or loss of fetal movements. The surveillance of fetal wellbeing at basic level can be done by fetal doptone and fetal cardiography, by assessing the fetal heart rate and pattern.

The objective of present project is to use the ubiquitous availability of smartphone and its inbuilt sensors to develop a program to detect and record the fetal heart rate and pattern and empower all the mothers and ensure their fetal wellbeing.

The mothers shall be able to share the recorded graph with their concerned doctor or on the Happy Sansaar Forum, where the team of obstetricians can guide them for the further course of action.

2.2 Aim

The main purpose of this app development project is to design an android application program which uses the various sensors available in smartphones to develop functionality similar to that of a fetal doptone which detects and measures fetal heart rate. The fetal heart rate is plotted in a graph after it is distinguished from the mother’s heart rate to detect any abnormalities. The app also provides the ability to share this information with certified doctors in the case of any abnormalities being found. The complete description of objectives and the functional requirements of the application software are detailed in the **specific requirements** section.

2.3 Scope

This app is intended for the use of everyone with an android device, especially pregnant women to check the fetal heartrate of the baby to prevent IUPD. This helps in providing assurance to the user about the safety of the baby by monitoring the fetus’ health condition. The intuitive interface of the app ensures the software to be incredibly accessible to any user with very limited experience with the android applications. This also creates a comfortable atmosphere to the user to easily use the software for monitoring their baby’s condition instantaneously.

**3.** **SPECIFIC REQUIREMENTS**

3.1 Functional Requirements

* OBJECTIVES
* To use audio sensors(audio recorder) to detect fetal heartbeat

* To use camera and flash to calculate mother’s heartbeat
* To plot the fetal heart rate pattern in graph (with BPM on Y - axis and Time on X - axis) once it is distinguished from the mother’s heart rate
* To apply 3 conditions to the observed graph and classify the graph pattern as normal or abnormal
* To display a message reassuring the user of the healthy condition of the baby in case of a normal heart rate and pattern

* To generate a detailed report including the graph in case of abnormal heart rate and pattern and alert the user regarding the fetal condition
* To provide the document to the user in a simple format (pdf) for them to be able to easily access the information and send it to their preferred doctor

3.2 Non-Functional Requirements

* RESOURCES
* Operating System: As the software being developed as an app for the android system, the OS required for the software to run is Android.
* Interface: The user-interface for the android application is being developed by using Java programming language.
* Functionality: Similarly, the functionality part of the software too is being developed using Java programming language which provides more flexibility in development of android applications.
* Architecture: The app needs to be compatible with Android 4.4.1 (KitKat) or any higher version of android and should be able to run on most of the processors available in the market. The app should not use more than 512 mb ram and should occupy more than 75 mb of storage. This is in widely increase the target audience by making the app accessible to as many people as possible.
* SOFTWARE ATTRIBUTES
* Efficiency: As previously stated in the **resources** sub-section, the application software is focused on not making any wasteful use of the available resources and is required to use as minimum memory as possible.
* Maintainability: After the software development phase has been completed, the app should be able to evolve to include additional features and functionality. The application software in question is being developed in a manner to be easily modifiable for this very purpose.
* Functionality: As previously stated in the **resources** sub-section, the functionality part of the software is being developed using Java which provides more flexibility for developing the functional features of the app properly as per the intended requirements.
* Dependability: Since the app is intended for a large target audience, namely pregnant women, and a faulty judgement might mean IUPD, the analysis and report given by the app must be extremely precise and correct with a very high degree of accuracy.