

## RESEARCH ARTICLE

## SMART Application: One Stop Services to Bridge the Gap Between Doctor and Patients

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### Abstract

A doctor's communication is a way to gather information in order to facilitate accurate diagnosis, give therapeutic instructions, counsel appropriately and establish caring relationships with patients. SMART (sophisticated, modern, affordable, reproductive technology) in vitro fertilization (IVF) created a mobile application that allows registered users to access all information related to their IVF cycle. The software required to create SMART application was the Android 4.0.3 Ice Cream Sandwich. The hardware required to create the SMART apps were 4.0 inch screen, 512 mb random-access memory (RAM), and central processing unit (CPU) with dual core 1.2 Ghz. The application is built using the android software development kit (SDK), the android apps creator. This application has been tested on several android devices such as asus zenfone 5 and samsung galaxy grand prime. This application uses android studio software to transfer the application file into the testing devices. SMART IVF application works well. The SMART application consists of some example features, such as feature doctors profile and information on how to make appointment with doctors. SMART app designed to help parents get directly involved during all the phases of IVF process and reduce their stress during the treatment and pregnancy. Since now this application not yet ready to launch, but hopefully in few months ahead, we can launch soon in google playstore as the first Indonesian IVF application.

**Keywords:** SMART IVF, mobile apps, infertility, assisted reproductive technology.

## Aplikasi SMART: One Stop Services yang Menjembatani Jarak antara Dokter Pasien

### Abstrak

Komunikasi yang dilakukan dokter kepada pasien berguna untuk mendapatkan informasi mengenai keluhan sehingga dapat menentukan diagnosis, pengobatan, konsul dan menjaga hubungan baik. SMART (sophisticated, modern, affordable, reproductive technology) in vitro fertilization (IVF) membuat sebuah aplikasi telepon selular, yang memungkinkan para penggunanya mendapatkan informasi mengenai IVF. Software yang digunakan adalah android 4.0.4 "Ice Cream Sandwich". Dalam pembuatan aplikasi SMART, perangkat yang dibutuhkan adalah android dengan layar 4.0inch, random-access memory (RAM) 512mb, dan central processing unit (CPU) dual core 1.2Ghz. Aplikasi dibuat menggunakan aplikasi android, dan sudah dilakukan uji coba sebelumnya di perangkat android seperti asus zenfone 5 dan samsung grand prime. Perangkat lunak android studio digunakan dalam proses pemindahan aplikasi ke perangkat yang diuji coba. Aplikasi SMART IVF dapat berkerja dengan baik. Dalam aplikasi ini terdapat banyak fitur yang berguna bagi masyarakat seperti fitur yang menjelaskan mengenai profil dokter, dan terdapat fitur yang menjelaskan langkah-langkah untuk membuat perjanjian konsultasi dengan dokter di klinik SMART IVF. Aplikasi ini dibuat untuk mengurangi beban stres selama melakukan terapi. Kami berharap dalam beberapa bulan ke depan, aplikasi ini sudah siap untuk di unduh di google playstore sebagai aplikasi IVF pertama di Indonesia.

**Kata Kunci:** SMART IVF, aplikasi smartphone, infertilitas, teknologi reproduksi berbantu

## Introduction

Sophisticated, modern, affordable, reproductive technology (SMART) in vitro fertilization (IVF) born with the passion to create an affordable IVF facilities in Indonesia; SMART IVF has been advancing since 2014. SMART IVF team is lead by the same highly trained and experienced clinicians, embryologist from Indonesian Reproductive Medicine Research and Training Center (INA-REPMED) and Yasmin Clinic Dr. Cipto Mangunkusumo Natinal Hospital. Together, with the reproductive gynecologist accross the country, SMART IVF offers a modern, yet affordable IVF practice for Indonesia population. The goal is to make IVF available for everyone who needs it, not only for those who can afford it.

SMART IVF created a mobile application that allows registered users to access all information related to their IVF cycle through their mobile device. Full access to their IVF information helps them ease off a lot of stress and anxiety in this very delicate and stressful phase in their lives. Through the mobile app, registered users can schedule an examination, or an appointment with their doctor, and can receive push notifications as the date and time approaches. They can view a list of all the IVF attempts and examinations done in the past with full details. They can view photos and videos of the fetus during the various fertilization phases and save photos of embryo ultrasounds performed at the last stages of the IVF process.<sup>1</sup>

The app has been developed into android-based application as SMART Application.<sup>2</sup> The solution is also future-proof, as SMART Apps is able to manage all updates with no extra effort or cost. The aim is to assess patient and public's need for an IVF App in Indonesia. The secondary aim is expected to become one stop services in IVF bridging the gap between doctor-patient, and establishing a

relationship based on trust and resulting in best health services. In addition, this application also is expected to help patients to effectively plan for IVF process and help the doctor to provide the best service for patients who face infertility problems using assisted reproductive technology (ART).

## Methods

This study is a continuation of a descriptive analitic study conducted at Yasmin IVF Clinic and SMART IVF Clinic networks in Jakarta, during July - September 2016 (Indonesian infertility patients' health seeking behaviour and patterns of access to biomedical infertility care: an interviewer administered survey conducted in three clinics).

The software required to create SMART application was the Android 4.0.3 ice cream sandwich. The hardware required to create the SMART apps were 4.0 inch screen, 512 mb random-access memory (RAM), and central processing unit (CPU) with dual core 1.2 Ghz.

The application is built using the Android SDK (Software Development Kit), the android apps creator. This application has been tested on several Android devices such as asus zenfone 5 and samsung galaxy grand prime. This application uses Android Studio software to transfer the application file into the testing devices.

## Results

### **SMART Application Description**

The SMART application consists of some example features described in Fig 1. A: all about features in SMART application. B: feature doctors profile, consists of a brief description of every member doctors team. C: information on how to make appointment with doctors. Fig 2. Shows the home page of SMART APP.



Figure 1. SMART Application User Profile

**Sign in/Registration Module/Member** is where new patients can register and old patients can sign into the application. Information such as full-name, email address, gender, blood group, address and password.

**Event** is where the patients, doctors and all of the member SMART IVF can find information about upcoming event such as SMART Class for community and SMART Course for obstetrican and gynecologist.

**Our doctors** is contains basic information about the doctors profile and schedules also can

allows patients to enter into doctor’s appointments. The patients can add questions/notes for the doctor and set a reminder for the upcoming appointment.

**Our clinic** is where the patients can find information about the facilities of our clinics, contains information about various departments in the hospital/clinic and the member of doctors/nurses/embryologys/pharmacists available in each of clinic.

**Knowledge center** is where the patients can find the knowledge informations about in vitro fertilization such as video, tutorial and tips.

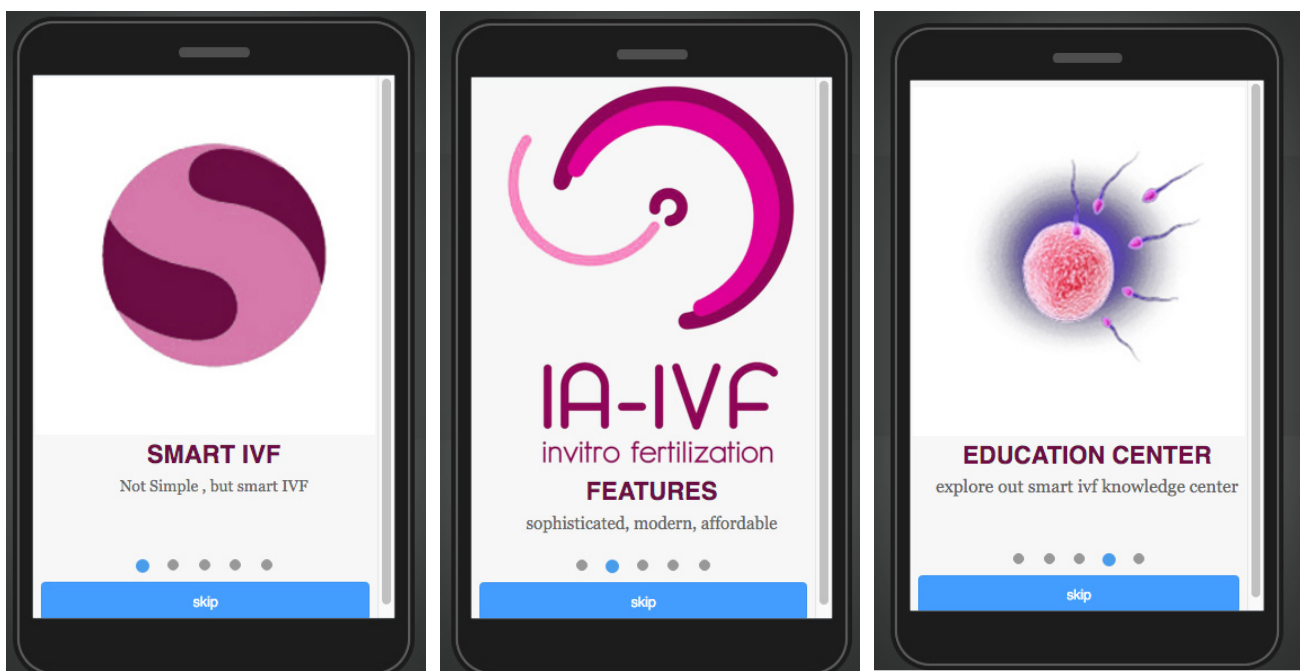


Figure 2. SMART Application User Profile Interface

## Discussion

### **SMART Application Concept**

The rapid expansion of mobile information and communications (ICT) technologies within health service delivery and public health systems has created a range of new opportunities to deliver new forms of interactive health services to patients, clinicians, and caregivers alike.<sup>3-5</sup> Mobile technologies can include, but are not limited to tablets, cell phones (hardware and software) and smartphone mobile-enabled diagnostic and monitoring devices, or devices with mobile alert systems.

Mobile health application can be referred to as the segment of healthcare delivery broadly defined as health-related services to patients, clinicians, and caregivers through mobile technology platforms on cellular or wireless networks.<sup>6,7</sup> The proposed system will be implemented using Java programming language and android development kit which is suitable for the development of SMART application software.

### **Architecture of an Android Operating System**

Android is an open source and Linux-based "Operating System" for mobile devices such as smartphones and tablet computers. Android operating system is a stack of software components which is roughly divided into five sections and four main layers as shown below in the architecture diagram.<sup>2</sup>

### **Applications**

The android application is located at the top layer. The mobile-Health application software will be written to be installed on this layer only.<sup>2</sup>

### **Application Framework**

The Application Framework layer provides many higher-level services to applications in the form of Java classes. Application developers make

use of these services in their applications.

### **Libraries**

On top of Linux kernel there is a set of libraries including open-source Web browser engine WebKit, well known library libc, SQLite database which is a useful repository for storage and sharing of application data, libraries to play and record audio and video, SSL libraries responsible for Internet security etc.

### **Android Runtime**

This is the third section of the architecture and available on the second layer from the bottom. This section provides a key component called Dalvik Virtual Machine which is a kind of Java Virtual Machine especially designed and optimized for Android.<sup>2</sup>

The Dalvik VM makes use of Linux core features like memory management and multi-threading, which is intrinsic in the Java language. The Dalvik VM enables every Android application to run in its own process, with its own instance of the Dalvik virtual machine. The Android runtime also provides a set of core libraries which enable Android application developers to write Android applications using standard Java programming language.

### **Linux Kernel**

At the bottom of the layers is Linux - Linux 2.6 with approximately 115 patches. This provides basic system functionality like process management, memory management, device management like camera, keypad, display etc. Also, the kernel handles all the things that Linux is really good at such as networking and a vast array of device drivers, which take the pain out of interfacing to peripheral hardware.<sup>2</sup>

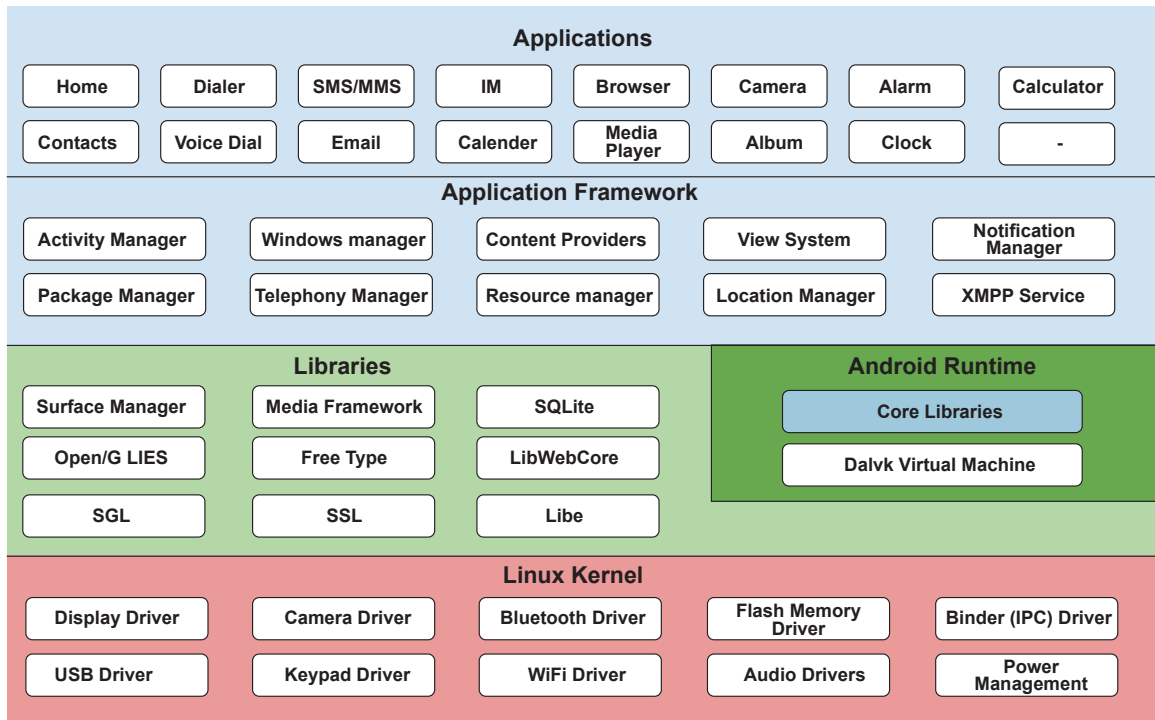


Figure 3. Architecture of an Android Operating System<sup>2</sup>

**SMART Application Implentation**

SMART application is built to respond the demand of technology innovation in health industry. In addition there has been little progress in the use of mobile app technology for research. Smart IVF app is designed into several phases :

- Phase I **Smart IVF as an IVF information center app** where user can access ivf information such as clinic location, doctors schedule, contact clinic, direction to clinic, and latest information about ivf events.
- Phase II **Smart IVF as an IVF knowledge center app** where user can access kndowlegde information such as video, tutorial, FAQ (Frequently, Asked, Question), media, and tips.
- Phase III **Smart IVF as Communication Information** where users (doctors, clinic and patients) can use this app to inputs, notify, ask questions, set up appointment and many others.
- Phase IV **Research Center** is basically after we have so many data that can be accessed, reported, manipulated and finally analyzed.
- Phase V **Researcher and Doctors**, the dream is an app that can be accessed by doctors/researchers to discuss topics, add comment, follow workshop, seminar updates, key note speakers files, etc.

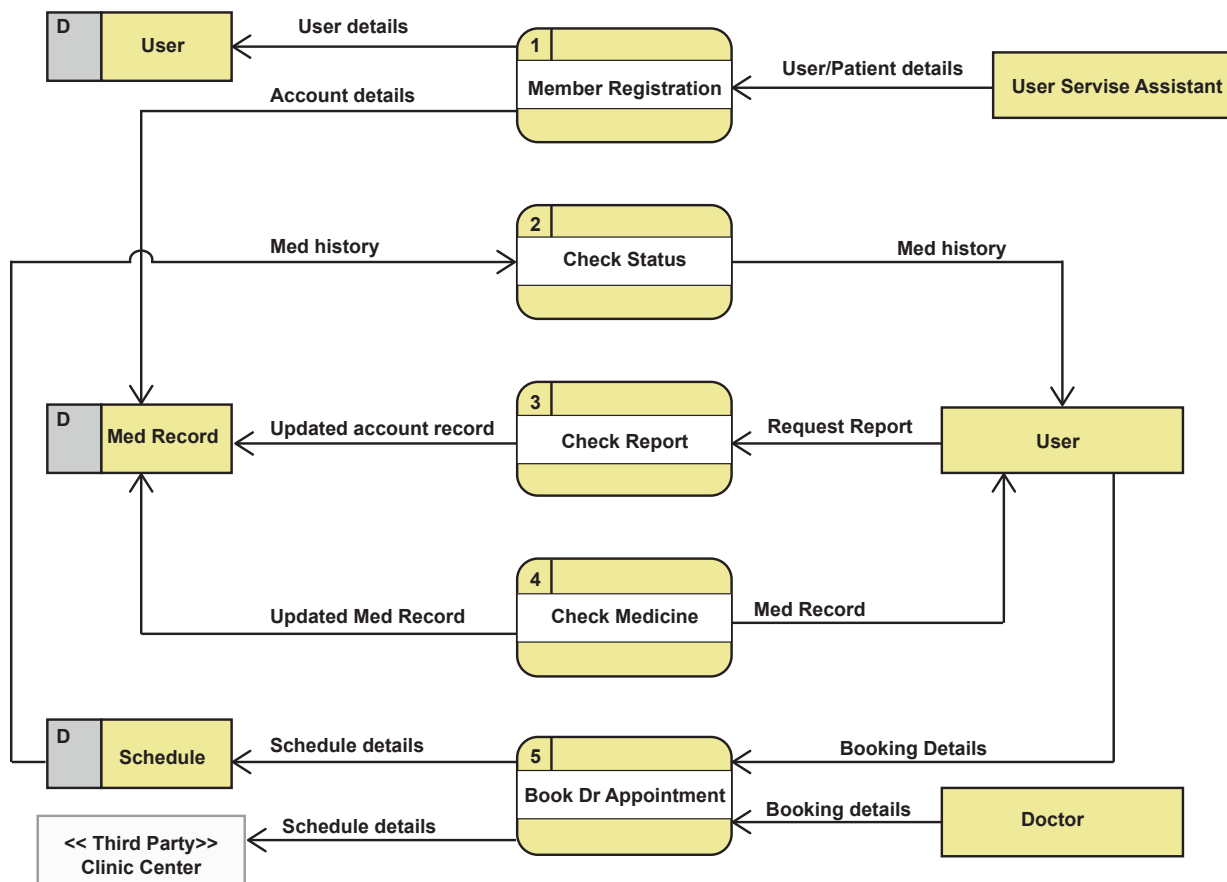


Figure 4. Data Flow of SMART Application

Implementation is the stage in the project where the theoretical design is turned into a working system through the use of a programming language. In the implementation phase, the new system is developed, installed and operated. The system is designed and implemented such that the following are carried out during its use:

**User validation:** To be able to use the application, doctors, nurses, pharmacists are to register into the SMART application software with a create username and password on the first login.

**Patients’ Registration:** Patients are to be registered on the system via SMART application software on smartphones.

**Doctors’ Registration:** Doctors are to be registered on the system via SMART application software on desktop and smartphones.

**Nurses Registration:** Nurses are to be registered on the system via electronic-Health application software on desktop.

**Pharmacist’ Registration:** Pharmacists are to be registered on the system SMART application software on desktop.

**Usage:** Doctors will login to the SMART IVF application to chat with patients and prescribe drugs and tests to the patients. The pharmacists and nurses will also login to SMART IVF application to update the drugs record and also chat with patients to verify drugs in the clinic. Laboratory scientist will login to SMART IVF application to update tests record and chat with patients to verify information about a particular test. The patient will log into SMART IVF application to chat with doctors, nurses and pharmacists and can view drugs and tests prescribed to them by the doctor. Users of SMART IVF Information System can update their profile on the application.<sup>8,9</sup>

**Conclusion**

Assisted reproduction and pregnancy can create high levels of anxiety for expecting mothers and fathers. In fact, the two of most stressful moments during IVF treatment are the fertilization and the development of the embryo in the lab, and after the implantation while waiting for the pregnancy test.

SMART app is designed to help parents

get directly involved during all the phases of IVF process and reduce their stress during the treatment and pregnancy. The goal is to make one stop services IVF application: bridging the gap between doctors-patient and also to make IVF available for everyone who needs it, not only for those who can afford it. At present this application not yet ready to launch, but hopefully in few months ahead, we can launch soon in google playstore as the first Indonesian IVF application.

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