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Development of Diabetes Monitoring Using Android App

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***Abstract*: One of the fundamental points of diabetes treatment is to keep blood glucose levels inside a predetermined target level. The key is to maintain balanced diet along with some activities, healthy lifestyle and diabetes medicines. By continuous observation of blood glucose levels, one can enable to comprehend the connection between blood glucose, physical exercise, food and insulin. Monitoring for long time, the readings will provide with the data required to decide the best methodology for the diabetes. In order to avoid the complications from diabetes, one has to follow the best blood glucose management. Self-monitoring of blood glucose levels enables a person to check the blood glucose levels as regularly as one have to or as prescribed by the specialist or credentialed diabetes educator.**

Key Words: diabetes monitoring

1. Introduction

Self-management is an idea evolved from Albert Bandura's social cognitive theory, which depends on the standards of self-regulation, control, and efficacy.

Self-regulation is the ability of person to monitor or manage themselves. It comprises of three components: 1) Self-evaluation, Monitoring self-behaviour, 2) self-assessment: Making conclusive judgements around a person's conduct in correlation with their self-particular guidelines and their surrounding and natural conditions, 3) self-reaction: The reactions based on emotions, related to behaviour. Self-control is the process of acquiring skills to gain personal control over one's thoughts and actions to achieve the target behaviour. Finally, self-efficacy is the ability of a person to do a particular task. Self-efficacy includes a persons, attitudes, perceptions, and emotions in connection to the behaviour.

The process of self-management includes, 1) Regular health check-ups and 2) adherence to a doctor prescribed, custom medication, and the person's lifestyle. Because of the major and routine lifestyle changes, challenged by diabetes, consistence to doctor recommendation is regularly analyzed in psychosocial diabetes research. It has been noticed, that the patients who strictly maintain, the suggested diet plan, physical exercise, medicines, and continuous checking of glucose levels suggests that the control of glycemic is better than the patients having poor control of glycemic.

An effective and well planned self-management of diabetes further enhances body weight, lipid profile and blood pressure, and has positive results on an extensive variety of psychosocial and economic perspectives of a patient, like reduction in levels of distress, the anxiety and the depression levels, optimal use of services of health care, and decrease of costs related to diabetes.

The current review will elaborate on the key patients' behaviors linked to self-management, i.e., diet, exercise, self-monitoring, and medical adherence. Following this, the article will examine the current status of diabetes self-management research and interventions in India and conclude with reflecting on the scope for research and practice within this area in India.

2. Existing and Proposed System

A. Existing System

Albert Bandura's social cognitive theory, which depends on the standards of self-regulation, control, and efficacy.

Self-regulation is the ability of person to monitor or manage themselves. It comprises of three components: 1) Self-evaluation, Monitoring self-behaviour, 2) self-assessment: Making conclusive judgements around a person's conduct in correlation with their self-particular guidelines and their surrounding and natural conditions, 3) self-reaction. But nothing proved by anyone. Theoretically no one follows these monitoring so, we have decided in this mobile world will start app for these diabetes monitoring only Android phones.

B. Proposed System

Application support Android KITKAT to ORIO, this application behaves like good coach for all diabetes, and give user friendly easy to access.

Self-monitoring via mobile phones and GCM (Google Cloud Messaging) using to send notification to all app users if any new market update and any exercise and health tips available.

Without medicine:
1. Diet management
2. Exercise management

Medicine in takers:
1. Online medicine order
2. Pill reminder

In case any medical emergency there is option to order medicine online. In case medicine necessary to intake, application will remind user to via alarm.

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3. Software Description

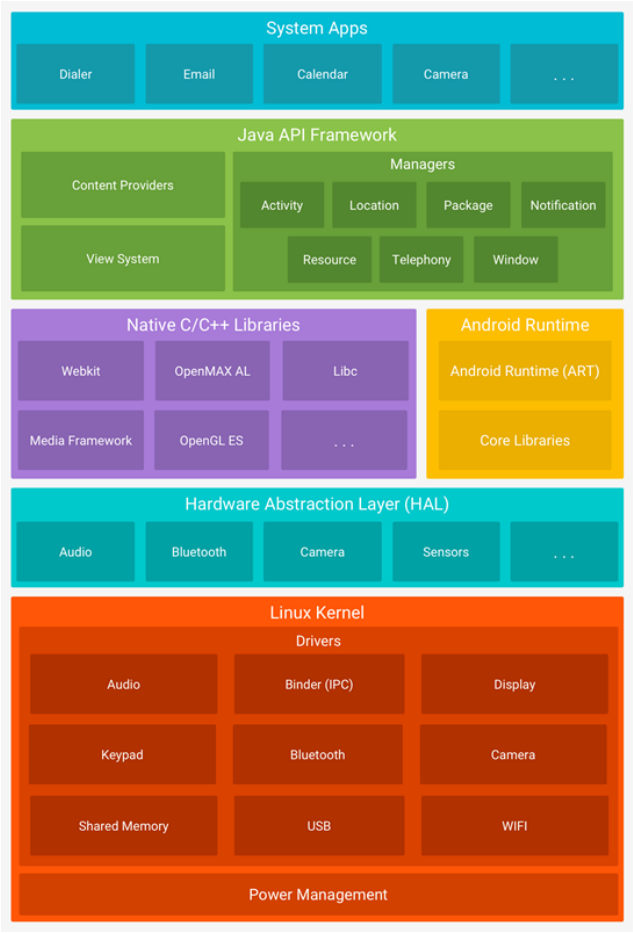

Fig. 1. Components of the android framework

A. Architectural Overview

A Google Cloud Messaging (GCM) application includes, 1) Google connection server, 2) An application server that cooperates with the association server by means of HTTP or XMPP protocol, 3) A customer application.

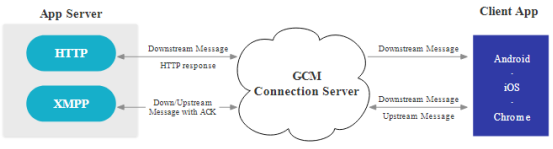

Fig. 2. GCM implementation

- From the app server, the Google GCM connection server receives downstream messages and they are send to a client application. From the client app, the XMPP connection server also receive messages sent upstream and forward them to the app server.
- To communicate with the GCM connection server(s), execute the HTTP or XMPP protocol in the App Server. The GCM connection server gets the downstream messages from the application servers; the connection server enquires and the message is stored, and after that, sends it to the client application. In XMPP execution, the application server can get messages sent from the client application.
- The Client App is a GCM empowered client application. To send and get GCM messages, the application must be enlisted with GCM and secure a unique identifier called as registration token.

B. Lifecycle Flow

Register to enable GCM

- The client app will be registered to receive messages.

Downstream messages (Send, Receive)

1. A message is sent to GCM connection servers by the app server.
2. If the device is disconnected, the GCM connection server inspect or check and the message is stored.
3. The GCM connection server sends the message to the device, when the device is online,
4. On the device, the client app gets the message as indicated by the platform specific execution.

- Receive a message. A client app gets a message from a GCM connection server.

Upstream messages (Send, Receive)

This feature is only available with the XMPP connection server.

1. On the device, the client app will send a message to the XMPP connection server.
2. If the server is disconnected, the XMPP connection server inspect or check and the message is stored.
3. The XMPP connection server will send a message to the app server, after the app server establishes the contact.

After a message is received by the app server from the XMPP connection server,

4. To verify client app sender information, it parses the message header.
5. To acknowledge receiving the message, it sends "ack" to the XMPP connection server.
6. As defined by the client app., parses the message payload.

Sender ID: While configuring API project, a unique numerical value is created. In the process of registration, the sender ID is used to recognize an app server that is authorized to send messages to the client app.

Server key: From the app server side, a key is saved, which provides the app server an approved access to Google services. In HTTP, the server key is incorporated in the header of the POST inquiry that send messages, while in XMPP, the server key is utilized in the SASL PLAIN confirmation request as a password to verify the connection. It's important to note that the client code must not have server key.

Application ID: It is the client application that is registered to accept messages. Its implementation is dependent on platform.

- Android
- iOS
- Chrome

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Registration Token: An ID will be issued by the GCM connection servers, so that it allows the client application to get messages. It's important that the registration tokens must be kept secret.

4. Data flow Diagram

Data flow diagram is utilized to characterize the flow or progress of the system and its resources such as information. Data flow diagram are a method for communicating system prerequisites in a graphical way. Data flow diagrams serves as ingenious tools used for structured analysis. It is also called as bubble chart. It has the reason for clarifying system requirement and distinguishing significant changes that will progress toward becoming programs in system design. DFG is the beginning stage in a design phase whose functionality decays the prerequisite specification down to the most minimal level of details.

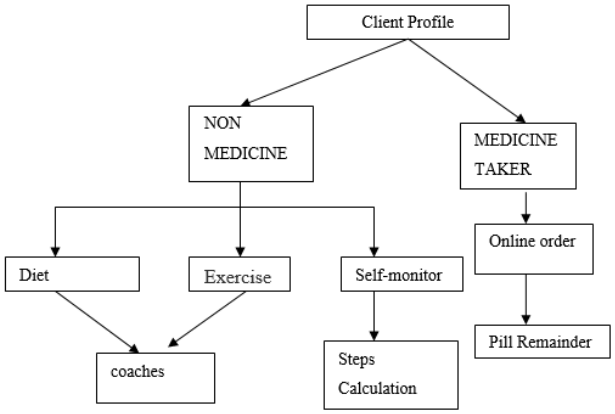

Fig. 3. Monitor

A DFD contains an array of bubbles connected by lines.
1) The bubbles represent transformation of data
2) The lines represents process in the system, in the common or usual convention.
A DFD has important symbols.

- Square, represents source or target
- Arrow, represents the flow of data
- Circle, represents a flow which transforms the incoming data into outgoing flow
- Open Rectangle represents the stored data

In simple words, a DFD is called as a "Context Analysis Diagram".

It is expanded by level, representing the process in detail.

Processes are normally labelled in a block letters and are numbered for easy identification.

5. System Implementation

There exists many mathematical formulas to compute estimated caloric requirement, which are based primarily on the energy balance principle. The energy which is utilized or spend for an entire day must be evenly use up for weight maintenance. When the intake energy is lesser than the estimated energy output, then the weight loss occurs. Similarly, occurrence of weight gain takes place when the intake energy is greater than the estimated energy output. Various parameters that effect a person's energy output, are age, sex, height, weight and energy level. It is essential to calculate day to day intake of caloric content, to accomplish the correct energy input balance to fit a person's lifestyle.

Among Harris-Benedict equation, World Health Organization equation, Mifflin-St. Jeor equation, As per the American Dietetic Association, the Mifflin-St. Jeor equation proved to be most efficient in forecasting the actual resting energy expenditure less than 10 percent. Thus eq. (1) and (2) is suggested by the professionals (nutrition).

Mifflin-St. Jeor Equation:

In 1990, the foresaid equation was developed. As per the Nutrition Therapy and Pathophysiology it has been validated by more than 10 studies. This equation has achieved high importance among the nutrition professionals for estimating the required calories accurately.

Females:

$$10\times(\text{weight in kg}) + 6.25\times(\text{Height in cm}) - 5\times\text{age} - 161 \quad (1)$$

Males:

$$10\times(\text{weight in kg}) + 6.25\times(\text{Height in cm}) - 5\times\text{age} + 5 \quad (2)$$

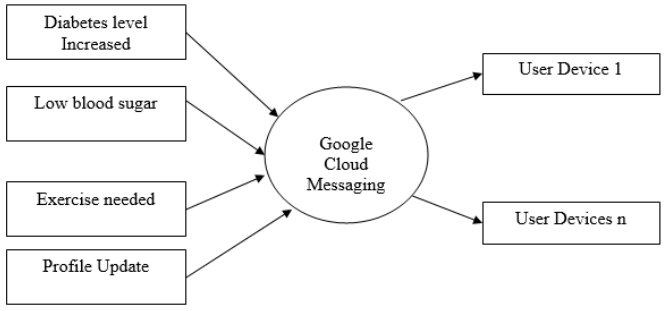

Fig. 4. Google Cloud Messaging

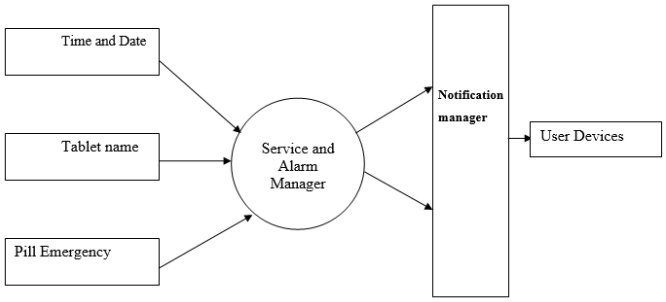

Fig. 5. Pill reminder

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The eq. (1) and (2) are also multiplied by the similar physical activity parameters to evaluating day to day caloric needs.

A. *Input Design*

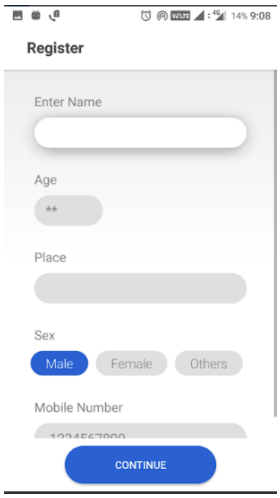

Fig. 1. Profile screen

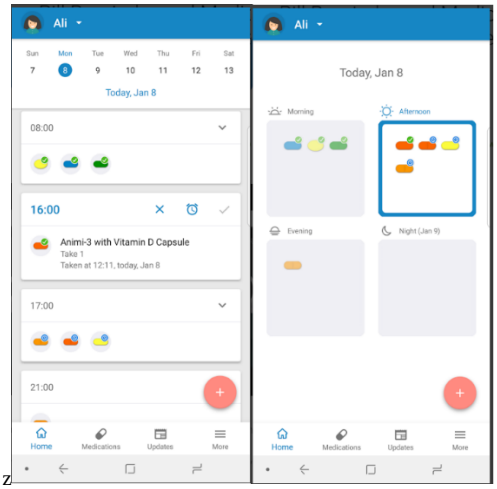

Fig. 2. Pill reminder screen

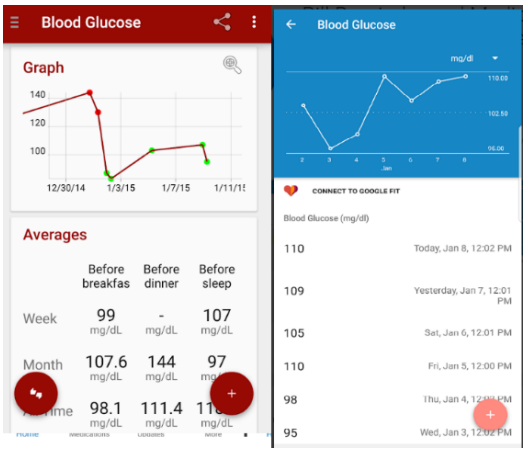

Fig. 3. Blood glucose level

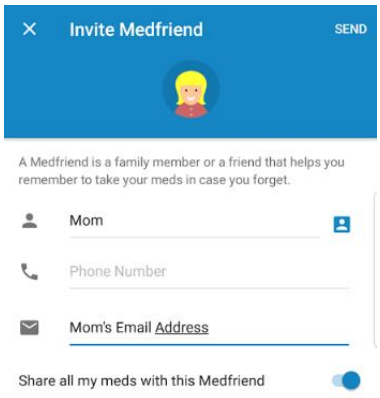

Fig. 4. Medicine order or Invite friend

B. *Output Design*

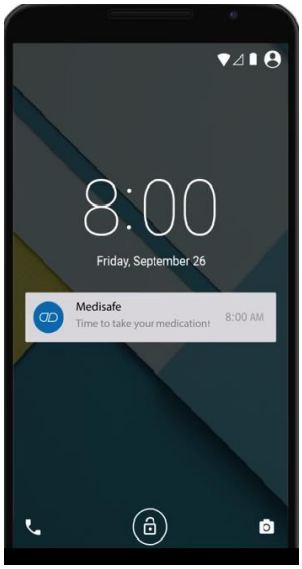

Fig. 5. Notification

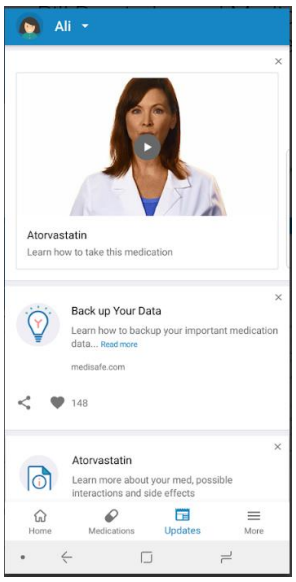

Fig. 6. Coaches for medication or medicine

6. Conclusion

The "Development of Diabetes Monitoring Using Android App" is concluded that the applications works well and satisfy the users. The "Development of Diabetes Monitoring Using Android App" is tested very well and errors are properly debugged. The app is simultaneously accessed from more than one users.

Future Enhancement:

1. Online doctor appointment using Tele conference
2. In app Purchase
3. Premium User

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