

Developing a Mobile Health Application “I.Diabetic” for Type 1 Diabetic Kids

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Abstract

This paper is involved in the diabetes awareness for kids and teenagers in schools in Kuwait. This paper summarizes the results conducted with real diabetic patients to provide a more realistic and friendly solution through the paper of mobile health application. We developed a mobile health application “I.Diabetic” that can provide kids while they are at school or having a normal life as kids and teens. This mobile health application emphasizes the awareness of diabetes and might insure that kids and teenagers are more able to take a good care of them through using this application.

Keywords

Mobile health application, diabetics, type 1 diabetic kids, application design

1. Introduction

Nowadays, mobile phones have a major influence on the lifestyle of the people. Accordingly, there are many types of applications from various categories such as: music, education, shopping, messaging, health, etc. Our objective is to design a mobile health application that focuses on medical and public health that run on mobile phones. A mobile health application for consumers is an application that offers health information and health services for any mobile device. In addition, it is a medical app that can help the consumer with his/her health problems and everyone can use it by downloading it to his/her mobile, tablet computers or any other devices. There are many consumers' uses a health app and the use of these apps are increase nowadays. That's why mobile apps are very important in market and it allows the customers to have all information quickly. A mobile health app can help the consumers with many different health sectors. In this paper, we are going to apply engineering and ergonomics design guidelines such as DAMES methodology to design and create a mobile health application. Finally, we followed the ergonomics methods and design principals in order to create and design a mobile health phone application. Objectives of this paper can be summarized as follows:

- Create and design a mobile health application for consumers to take advantage from while facing health issues.
- Use DAMES methodology approach to create an easy to use, an understandable mobile health application.
- Use technology to help consumers while applying ergonomics guidelines.
- Use ergonomics design principle and methods to design best possible application.

Diabetes; is a common life-long term health condition where the amount of glucose in the blood is too high because the body is not able to produce enough insulin to allow the glucose to enter the body's cell properly. The insulin is a hormone that works as a chemical messenger to help our body use the glucose in our blood to give us energy. Children with diabetes need adults who are able to help them in order to meet their treatment at school as they do at home with their parents. Each child with diabetes has different needs and must have an individualized care plan. We developed a mobile health application “I.Diabetic” that can provide kids while they are at school or having a normal life as kids and teens. This will result in providing a trained assistant for measuring the status of each kid with diabetes. The schools should ensure immediate actions necessary to manage any dilemma they might face with diabetic kids.

2. Background

Diabetes is a metabolic disorder by which the body either fails to produce adequate amounts of insulin, or cells in the body are unable to react properly to the insulin that is created. There are two major types of diabetes; type 1 and 2. Type 1 diabetes happens when the immune system of human body mistakenly attacks and kills the beta cells of the pancreas that release insulin. As a result, no, or very little, insulin is released into the body that will cause sugar builds up in the blood instead of being used as energy. About 10 per cent of people with diabetes have type 1 diabetes. Type 1 diabetes generally develops in childhood or adolescence. Type 1 diabetes is always treated with insulin. Insulin is a hormone and it causes cells to take in sugar to use as energy or to store as fat. This causes blood sugar levels to go back down. Type 2 diabetes occurs when the body can't properly use the insulin that is released (called insulin insensitivity) or does not make enough insulin. As a result, sugar builds up in the blood instead of being used as energy. About 90 per cent of people with diabetes have type 2 diabetes. Type 2 diabetes more often develops in adults, but children can be affected. Children with no good treatment of their diabetic illness can develop to reach type 2 diabetes. Nevertheless, there is another type of diabetes, gestational diabetes that appears in pregnant women during their pregnancy. This type of diabetes affects only pregnant women if the mother's body can't produce sufficient amount of insulin to help glucose pass their body's cells. Many pregnant women might suffer from this illness after they have given birth and others might safely walk away clean after pregnancy (Diabetes UK and Dasman Diabetes Institute, 2016).

According to the study (Moussa et. al., 2005) type 1 diabetes among 6 to 18 years old Kuwaiti children were identified at 182 schools; 50 in primary, 63 in intermediate, and 69 in secondary levels. Type 1 diabetes is a common chronic issue in Kuwait. Most of schools in Kuwait were unaware of their diabetic students and they were noticed with incidence. However, we have found through our visits to Kuwait schools the lack of knowledge within schools about diabetes which might lead to stigma and discrimination. The lack of awareness about this issue in schools would results in having risk and threats of the children's health.

3. Literature Review

Eric Nilsson (2008) described a set of design guidelines for assisting development of more user friendly applications on mobile devices. A mobile health application is an application that offers health information and health services for any mobile device. There are many consumers' uses a health app and the use of these apps are increase nowadays. That's why mobile apps are very important in market and it allows the customers to have all information quickly. A mobile health app can help the consumers with many different health sectors. According to latest study by Tejaswi, there are more than 97,000 health apps available in the market. In addition, she said that by 2017 the user to mobile apps will be increased by 50%. Also according to her statistics she said that 40% of doctors believe that health app is useful, save time, and reduce waiting list in the clinic. 93% of the doctors said that this app can improve and develop consumer health (Tejaswi, 2016). Tejaswi said also that mobile health app very important and it will benefit your healthcare because of many reasons. First of all, mobile health apps give the consumer the best care, quick response and connection with the doctor. In addition, the mobile health app can give the doctor the ability to monitor his patient situation and respond proactively before any problems happen. Usability factors for mobile health apps are studied by many researchers (Gunduz and Pathan, 2013; Harrison et al., 2013; Zahra et al., 2016).

This "I.Diabetic" application was built with results taken from real diabetic patients to provide them accurate specifications that they need. With the increase of the bad habits in eating food especially kids, we can see an obvious growth in number of kids suffering from diabetes. It is our part to awake their awareness to that issue and give them a solution to follow up their treatment, blood pressure, medicines, and doctor's appointments in a friendly easy way. There where "I.Diabetic" app come to support diabetic patients mostly for kids.

4. Methodology

In order to start designing the mobile health application we should put in mind what the user needs, what features may help the consumers and what can help make the application easy to understand and easy to use. Kuwait is a small country consisting of 4,180 million people and technology is involved an individual's daily life. People use their mobiles wherever they are to find whatever they want. They find what they are searching for within a few seconds and this is what we aim for. The methodology that we used to achieve the "I.Diabetic" application was the DAMES methodology, where D=Define the problem, A=Analyze, M=Make search, E=Evaluate alternatives, and

S=Specify and sell solution, which is considered as one of the most common techniques in implementing engineering projects (Konz and Johnson, 2008).

- *Define the problem:* The problem was to design a mobile health application for consumers more specifically type 1 diabetic kids that can be run on mobile devices or computers. The application should improve the patient's outcomes such as knowledge, safety, adherence, or health.
- *Analyze:* The application affects people who want to track their health. So, we decided to design an application for type 1 diabetic patients. Diabetes is a condition that leads to high levels of blood glucose in the body, in most of the cases it's come from born and sometime its cause from bad nutrition. For example; if the children suffer from overweight and eating unhealthy food this things may cause diabetes. Also, diabetes can cause other diseases such blindness and eye problems, heart disease and stroke and hypertension. So, the children how suffer from diabetes they have to take their medicine on time. There are two types of diabetes type 1 and type 2 people with both types need medication to help keep the level of their bloods sugar normal (Cherney, 2016). Insulin is the most common type of medication used in type 1 diabetes. Also; it's given by injection for type 2 diabetes. So "I.Diabetic" application will provide a reminder for the patient that remained them of the date while they have to take the medication.
- *Make search:* We made researches about type 1 diabetes from different sources. Then, we compiled the ideas about how can we find help for those patients who have type 1 diabetes and design an application that can helps to track their health and to prevent its symptoms as much as possible. We got with twelve sections that are the main parts of the application. Those sections will encourage the patient's health and safety.
- *Evaluate alternatives:* After a lot of consultations, discussions and exchanging ideas, content of all of the twelve sections are decided before implementation of the application.
- *Specify and sell solution:* After the agreement on the content of all sections, we set "I.Diabetic" as a name for this application. Finally, we designed the following application and release it to the public for usage.

5. "I.Diabetic" Mobile Application

The "I.Diabetic" mobile application coding has been done using the Android Studio (Android Platform, 2016). Android Studio is the official Integrated development environment (IDE) for Android applications development and with the powerful code editor and developer tools, Android Studio offers many features when building an Android application. Android application development is the process by which new applications are created for the Android operating system. The application is developed in Java programming language and its application programming interfaces (APIs) that is supported by Google. The application's database is built in Android- SQLite Database; SQLite is an open source SQL database that stores data to a text file on a device. The application stores its data locally on the Android device. It requires no internet connections as it can work as an offline application that allows users to use it any time with or without internet. The design of the application used Adobe Photoshop & Illustrator. Each page and screen of the application was designed using Photoshop & Illustrator programs as an interface. The logo of the app has been designed by Illustrator too. The "I.Diabetic" mobile application mainly targets the kids and teenagers. This mobile application consists of twelve major parts that help diabetic patients follow their status, treatment and other useful details as shown in the figure 1.

1. First part is the "info" page. It will always remind of something important every time you click on this page. It automatically generates different tips for the patient to review. This part has brief information about diabetes summarized in four parts as introduction, type 1 diabetes, type 2 diabetes, and type 3 diabetes.,
2. Second part is the "Blood Pressure" page. User or type 1 diabetic patient can test his/her blood pressure and show the results in a daily, weekly and yearly format in figure 2. The diabetic patient can track down the ups and downs of his blood pressure. He can easily add his blood pressure details.
3. Third part is the "medicines" page offers list of medicines that usually diabetic patient use. It allows the



Figure 1. "I.Diabetic" Mobile Application-Start

patient to search for a specific medicine and choose it. Then the patient can set a reminder that will eventually alert the patient to take the medicine in the right time (Cherney, 2016).

4. Fourth part is the “*recipes*” page provides a healthy menu for diabetic patients that include meals that suit the patient and make it easy for him/her to choose from. The application provides nine different delicious healthy recipes that contain the correct amount of carbohydrate, sugar, different types of meat, and sea food for the diabetic patient to choose from. Each recipe shows the ingredients and its process to make it. Monitoring you sugar levels will be easy with “I.Diabetic” application. These recipes would either change to other new ones or be added to the nine recipes upon updating the application version.
5. Fifth part is the “*new topics*” page offers new interesting topics that every diabetic patient should know about. It provides important news for the patients to review and to get to know about his illness more.
6. Sixth part is the “*carbs counting*” page. The patient can enter the amount he/she took in each meal to keep track of his/her carbs and other elements. It also provides for the patient a list of the food with the required amount to eat to take sufficient carbs, sugar, protein, and fats that the patient need; figure 3. It contains mathematic formulas that could help the patient calculates the insulin doses that he/she took from the test machine that he/she uses. This will help the patient managing the daily dose per meal, correct the dose, and give the carbs needed for each dose. The page provides a formula that helps him know the correct calculations. The formulas work by calculating carbs per meal and testing insulin before the meal.
7. Seventh part is the “*blood sugar*” page. The patient can add/delete or modify his/her blood sugar tests and track them easily. The results are shown in daily, weekly, monthly, and yearly format. The blood sugar page provides a “Blood Glucose Chart” within the application that helps the patient to know whether his test was in the good track or not.
8. Eighth part is the “*weight*” page. The diabetic patient can also add/delete or modify his/her weight to follow up his/her weight’s trail. It shows the results in daily, weekly, monthly, and yearly format for easily reviewing them.
9. Ninth part is the “*step counting*” page. Exercising by walking is so much healthy for patients with diabetes. Walking is the easiest and safest way to be active. Walking provides power and energy to the patient that could support him throughout the day. The “I.Diabetic” application records the diabetic patients’ steps in kilometers and shows them the calories they have burned. In addition, the application also provides daily tips to encourage the patients and push them to exercise;
10. Tenth part is the “*doctor*” page offers a chance to communicate with the medical doctor. The app gives an opportunity of a relationship for the patient with the doctor; through messages, phone numbers, alerts of appointments that he/she has entered in the application to notify him/her in time, doctor’s office hours, and e-mail. For example, when a patient has a question or needed some clarification on his/her condition and his/her test results; the patient can easily take a screen shot of the page and send it to the doctor’s mail. This will help the patient to have a clear vision on what he/she needs directly from the doctor. This part provides GPS Maps for the doctor’s location that the patient has already saved the address and details of the doctor. It is something important for the diabetic patient to include locations of the doctors as an easy way to find them later on.
11. Eleventh part is the “*barcode*” page contains limited amount of data that typically identify a particular thing. “I.Diabetic” application provides a Barcode Scanner of type QR Code; a 2D Barcode. Here, patients can put information about themselves as in names, ages, their diabetes conditions, treatment as in medicine and its schedule time, and other related stuff that could help the supervisor to look into his illness and understands it. This page is especially created for diabetic kids, teens, and diabetic patients with disabilities. The information provided is important for a mature adult or trained adult to help him determine the condition of the patient and



Figure 2. “I.Diabetic” Mobile Application-Blood pressure



Figure 3. “I.Diabetic” Mobile Application-Carbs counting

take the appropriate action if necessary. We can take kids; who have diabetes, at school as a great example to make you understand the benefit of the Barcode in such an application. Parents are always afraid on their diabetic kid and most of them don't trust their kids in having a good care of themselves. With this app, Barcode section helps parents to easily type brief details about their child's condition. When the teacher or school nurse scans a barcode using a barcode scanner, a message will appear in her screen stating what parents have wrote. This information and other details could be written on the page of the Barcode section of the application; to inform the teacher or school nurse about the child's condition to help them follow up his treatment. Note that barcode concept is related with the following part that is neck hanger device.

12. Twelfth part is the "*neck hanger device*" page communicates with the "I.Diabetic" Neck Hanger Device that is explained in detailed in the following section.

6. Neck Hanger Device for "I.Diabetic"

Since there is an increase for the number of diabetes for the age under 12 years, we decided to design a dedicated safe hardware namely a neck hanger device for "I.Diabetic". This device is specially designed for those kids under the age of 12 who still go to school and need more care. It is not only enough for parents to take care of their kids inside home but also a good cooperation with the school itself helps in maintaining the condition of the diabetic kids. Since most of the time spent for these ages is at school, so there should be a follow up on their condition and give them the required treatment. Also in some cases there is the absence of the parents' role at home and not following the child illness condition, commits the school to be an essential part in following up the case of the child and telling the parents about it. As the communication and cooperation between the school and parents provides an opportunity to stabilize the condition of the child and get the needed treatment.

The teacher should know about the condition of the kid and the treatment needed to be taken toward this kid. Here comes the school responsibility to make awareness sessions on diabetes in terms of the kids' condition, treatment, meals, and other things related to the illness. Teachers should be more aware of the kids' diabetic situation to be able to take correct action toward the child. The school also needs to make fun non-educational sessions for the healthy students about diabetes as an illness. Students should be aware of that illness in terms of what it is, how it should be treated, and the patient's condition, kind of treatments, and other useful information that each and every normal student must have knowledge of. In this way, the school guarantees to make the students see the patient as someone normal like any other student in the school. The sessions will emphasize the soul of cooperation and grow their understanding about the illness and the patient with diabetes. This will result in getting no one of the student harms the feeling of the patient or even trying to treat him in a different way. Also, this will create a positive environment for the patient among the school, teachers, and normal students.

This neck hanger device is related to increase the relationship between teachers, school and the parents to follow up the case of the child. The device will encourage them in contributing to support children under the age of 12 to care about themselves for their own interest. The use of this device will increase the acceptance of their illness and make them aware of their condition and the treatment that they should take. Where also parents and school encouragement helps the child to preserve his psyche, health and education. For the child to live a normal life and giving him the ability to study and succeed the school should be aware of his condition and follow-up his treatment.

6.1 "I.Diabetic" Neck Hanger Device Details:

The "I.Diabetic" hanger device is used around the children's neck. It is a wearable hardware device that has mobile health software which is accessible via mobile devices of Android Operating System. It is designed for those kids under the age of 12 who still go to schools. The kid can easily wear it around his/her neck with no physical harm. The device is connected with "I.Diabetic" app using the Barcode and its alert system. The barcode will be containing information about the kid's illness details that will help the school and its staff to know about the kid. The school teachers will be notified to make a scan on the barcode and make an appointment with nurse school for following up and giving the correct treatment as stated in the barcode. This will build a good relationship that is synchronized between the school principle, teachers, school medical staff, and the parents.

6.2 "I.Diabetic" Neck Hanger Device Specifications:

1. The device works in all distance no area restrictions.
2. Material used is safe for the kid to wear it.
3. Doesn't get over heated which make it an un-harmful wearable device.

4. It stays charged for 6 to 8 hours, no need to recharge it multiple times.
5. The device has the ability to receive alerts from the “I.Diabetic” app.
6. It has a red small light that gets on to notify the school and teachers to check the kid’s condition.

In addition to all the stated above, there will be a possibility in the “I.Diabetic” application to count the heart beats of the patient. It will be a device connected to the Neck Hanger which can measure the heart beats which are also connected to the “I.Diabetic” app by Bluetooth.

7. Conclusion

The “I.Diabetic” is a mobile health application for consumers more specifically type 1 diabetic kids but it suits all ages and special need people. The main approach of creating such an application is to make a useful, usable and satisfying user experience while improving patient outcomes such as knowledge, safety, adherence, or health. The application is designed for all patients of any age, however its main target audience are the kids under age of 12 as well as people with special needs are able to use it. The reason behind specifying the app for these category is because they are not aware of their illness and don’t care about themselves as needed. It provides a friendly easy environment that can be used by kids, adult, and people with special needs.

Each and every part of the “I.Diabetic” app is designed as a personal note that he/she can enter the information in each section. No need for parents to be afraid anymore about their kids at school, with the healthcare application “I.Diabetic” they can be relieved and able to trust their kids to take a good care of themselves. On the other hand, the “I.Diabetic” neck hanger device supports the mobile application in its main target mission. It encourages the kid to take care of him/herself while having a normal life of a child on his/her age. It could increase the confident of the child in him and make him see that there is no problem to be a diabetic patient. It is okay to wear this device in front of the school, students, teachers, and staff and knew that you have a special condition so they take care of you and treat you as a normal student in the school.

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Biography

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