

GLUCOTECH PROJECT

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SUBJECT: BHI 504 Project Proposal

PROJECT PROPOSAL

The GLUCO TECH project aims to collect and store data in the cloud, providing real-time accurate blood glucose levels and system alerts to patients, caretakers, and healthcare professionals to manage diabetes mellitus and prevent its complications effectively. Hence the project will provide more focused patient-centered care and better and interactive data visualization.

SUMMARY

Diabetes mellitus (DM) is one of the most common noncommunicable diseases in the world. It is characterized by the impaired ability of the body to produce or respond to insulin leading to elevated blood glucose levels. There are two types of DM. Type 2 diabetes mellitus (T2DM) is the most common, which is usually seen in adults. T2DM happens when the body fails to respond to insulin or fails to produce enough insulin leading to metabolic syndrome. While Type 1 diabetes mellitus (T1DM) is called juvenile diabetes or insulin-dependent diabetes, the body, specifically the pancreas, produces little to no insulin. Uncontrolled blood glucose levels can result in multiple complications to different organs in the body, such as the heart, blood vessels, eyes, kidneys, and nerves, and can also lead to mortality (Adler et al., 2019).

Currently, 422 million people worldwide are diagnosed with DM, including individuals from low- and middle-income countries. Around 1.5 million deaths are attributed to DM every year. The number of cases is still rising rapidly (Adler et al., 2019). According to the latest guideline for DM, an asymptomatic individual is diagnosed with DM if he/she presents with two abnormal test results, which are performed on different days, while an individual who presents with classic symptoms of elevated blood glucose levels, i.e., polyuria, polydipsia, and weight loss, must require a single random plasma glucose level of 200 mg/dL or higher (Dunn et al., 2021 & El Sayed et al., 2022).

Individuals diagnosed with DM are subjected to individualized treatment both pharmacologically and non-pharmacologically. Aside from regular monitoring of their blood glucose levels and consultations with their primary health providers, they are advised to have regular consultations with other specialists for foot and eye care (Dunn et al., 2021 & El Sayed et al., 2022). Uncontrolled blood glucose levels can lead to debilitating complications, such as atherosclerotic cardiovascular disease, heart failure, stroke, chronic kidney disease, diabetic retinopathy, neuropathy, foot ulcers, and others, and even death (El Sayed et al., 2022). Thus, blood glucose monitoring is essential for individuals diagnosed with DM.

This project aims to integrate data information obtained from wireless/Bluetooth blood glucose monitoring devices into smartphones and electronic medical records for more focused patient-centered care and better and interactive data visualization. This project will also incorporate an alert prompt system about abnormal levels of blood glucose that will help and inform both individuals diagnosed with DM and health professionals when to take necessary actions. With that said, this project will help individuals diagnosed with DM to maintain their blood glucose levels without any inconvenience of forgetting when to take or not take their medications, and also help health professionals when adjusting the next treatment plan. Most

importantly, this project will limit cases of complications from uncontrolled T1/2DM with the help of biomedical and health informatics.

USERS

The following users will utilize this project:

1. *Individuals diagnosed with diabetes mellitus* are considered the primary consumers who will benefit from this system design the most. Their primary task is to perform the fingerstick test properly. The system design will record the blood glucose reading and prompt an alert message about abnormal blood glucose levels. The data will be sent and stored directly and securely in their respective electronic medical records.
2. *Health professionals* providing primary patient care (i.e., physicians, nurses, and physician assistants) will review the data obtained from the system design periodically. In addition, the health professionals will have access to a detailed and interactive data visualization showing the peak and trough of the individual's blood glucose levels to help them decide on the following treatment plan.
3. *Systems administrators/instructors* will perform the system setup, troubleshooting, training, and development.
4. *Project managers* will be responsible for the maintenance of the system design.

Users may have any level of computer proficiency, and the user interface does not require training.

SCOPE

With the aid of this initiative, patients will be able to monitor their blood glucose levels at home in the comfort of their own homes without the assistance of a healthcare expert. This will improve hospital and patient time and resource management.

The main objective of this device is to measure blood glucose levels. Patients with chronic diabetes must check their blood glucose levels daily to ensure that they remain within the normal range. It will alert the patient if their blood sugar levels are high (hyperglycemia) or low (hypoglycemia), which would assist them in taking the medication prescribed by the doctor in such circumstances. Untreated hypoglycemia can cause a patient to become extremely disoriented, pass out, or experience a seizure. A coma or even death could result from severe hypoglycemia if it is not treated right once. Untreated hyperglycemia can cause two dangerous conditions: diabetic ketoacidosis and hyperosmolar hyperglycemia, which can result in coma and life-threatening dehydration. It's crucial to seek medical attention for it immediately away.

The data about the blood glucose levels will be stored on the software side. It will also set up a system for alerting patients and health professionals in the event of abnormal blood glucose levels. In this instance, they will be able to take action in real time if necessary.

By storing the data, people can maintain tabs on their health and avoid mistakes like forgetting or losing their records when they visit the doctor. It will have a significant impact on their health. Patients will receive prompt intervention based on level variations, allowing doctors to alter prescription doses and receive feedback on the course of their disease and therapy.

PERSUASIVE ARGUMENT

Diabetes mellitus (DM) is one of the most critical public health challenges of the twenty-first century. According to the World Health Organization (WHO), DM is a major cause of blindness, kidney

failure, heart attacks, stroke, and lower limb amputation (World Health Organization, 2022). Also, between 2000 and 2019, there was a 3% increase in DM mortality rates by age (World Health Organization, 2022). In addition, in 2019 an estimated 2 million deaths were caused as a result of DM and kidney disease due to DM (World Health Organization, 2022). Furthermore, adults with DM have a two- to three-fold increased risk of heart attacks and strokes (World Health Organization, 2022).

Because DM is often underrated, its complications might not be given as much attention as they should be received. However, with this project and its implementation, GLUCO TECH, complications can be prevented, such as diabetic retinopathy, a complication of the disease that affects the eye leading to blindness (World Health Organization, 2022). Other complications that can be prevented are kidney disease, heart attacks, strokes, lower extremity foot ulcer and amputation, peripheral vascular disease, and poor outcomes for several infectious diseases (National Diabetes Data Group (US), National Institute of Diabetes, Digestive, & Kidney Diseases (US), 1995).

This project is suitable for BHI504 because it integrates several components, and the invention of the system will require knowledge of diverse topics covered throughout the course, including computer and patient information security regarding HIPAA compliance, system design, and analysis, clinical information systems in view of patient' electronic health records, user-friendly will be taken into account while thinking about the system's users and project management throughout the entire project's execution.

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