PROJECT SYNOPSIS

1. Title of the project with Project proposal reference number: A MODULAR APPROACH TO DIABETIC EXAMINATION WITH ALERT SYSTEM BASED ON IoT (40S_BE_2022).

2. Name of the College & Department: JYOTHY INSTITUTE OF TECHNOLOGY

3. Name of the students & Guide(s):
   a. PRADEEP R (deepu.prads1@gmail.com; +91 9060810940)
   b. PRAVEEN K (praveenkumar951996@gmail.com; +91 8792849904)
   c. SATHVIK B S (sharma.sathvik@gmail.com; +91 9741530481)
   d. YASHAS K R (yashaskr@gmail.com; +91 9591088699)
   e. GURUPRASAD M BHAT (guruprasadmbhat@gmail.com; +91 9036002216) (PROJECT GUIDE)

4. Keywords used in the synopsis: NON- INVASIVE, IR SPECTROSCOPY, IoT

5. Introduction / background:
   Diabetes is a metabolic pathological condition of concern, which affects vital organs of body if not diagnosed and treated in time. The illness is caused by permanent pancreatic damage resulting in insufficient production of insulin hormone in response to high glucose level in organism. Namely, high glucose level after a meal should be attenuated by increased secretion of insulin to blood, diabetic pancreas is more or less "blind" to glucose signal. Then, a patient should inject insulin by himself; it is very important to dose it properly, as he risks falling into hypo- or hyperglycemia.
As per (WHO) Hypoglycemia is when glucose level falls below 50 mg/dl, it results in diminished consciousness, convulsions, coma, and if not counteracted, in death.

Hyperglycemia starts at glucose levels above 150 mg/dl, its immediate consequences are not as acute as for hypoglycemia, nevertheless in long run levels above 200 mg/dl degrade internal organs, especially kidneys.

The obvious solution is to monitor constantly glucose level in blood. It is usually done by collecting blood samples from fingers and testing them in a glucometer. Frequent glucose level measurement by diabetes is a necessity.

6. Objectives:

It is obviously a nuisance especially that it is done day after day in some cases more than 10 times daily. These methods are painful and frequent pricking cause calluses on the skin. Even in some cases, some other illness or unexpected event may destroy every day routine.

The availability of home-use glucometers, as opposed to clinical-use equipment, has greatly improved the quality of life of such individuals.

However, such monitors require a blood draw through finger pricks for each test, which causes pain and inconvenience. Each test also requires a new test-strip, contributing to the recurring cost of such a device.

Optimum insulin dosage, however, requires frequent/continuous monitoring of blood glucose, and currently available glucometers do not address this requirement.

Continuous monitors do exist, but they need to be implanted under the skin, causing trauma while being implanted, and they need to be replaced every week.
This is the reason why several researchers try to invent non-invasive methods of blood glucose level evaluation.

Our design has two objectives: firstly, to provide a simple and compact device to measure blood glucose levels in a non-invasive way. Secondly to provide an android application for the patients to continuously monitor their glucose readings.

7. Methodology:

**NON-INVASIVE METHODS:**

Amongst the Non-Invasive methods employed in glucose measurement, the oldest are techniques based on infrared (IR) spectroscopy of blood through skin.

There are also some unusual approaches, like those based on Raman Effect, or glucose level measurement using the secretion from lacrimal secretions (tears). The most accessible location for IR radiation is blood circulating in fingers, and earlobes.

Therefore there is a need to develop a non-invasive monitoring system which can measure blood glucose continuously without posing much problem and easy to use for the diabetic population.

**WORKING PRINCIPLE OF NEAR IR SPECTROSCOPY:**

Spectrophotometry, or spectroscopy, consists in analysis of attenuation of electromagnetic radiation by chemical compounds for different frequencies [2]. Chemical compounds have bonds of different nature between elements, which vibrate when excited by particular energy quanta.
The energy can be taken from photons of appropriate energy (radiation frequency), hence, characteristic "dips" in continuous radiation spectrum coming through a compound solution, see Fig below for a spectrogram example. Spectrophotometry is a very exact tool, it is possible to determine not only chemical components of a solution, but also their amounts.

Fig 1. EXAMPLE OF A SPECTROGRAM (ETHANOL)

Near infrared optical measurement is applied to overcome the invasive method drawbacks like frequent puncturing, high recurring consumable cost and danger of spreading infectious diseases.

The signal is then amplified and fed as input to microcontroller for displaying glucose signal on a computer after carrying out Regression analysis.

By analyzing the variation in voltages received after reflection of incident light in the cases the approximate glucose level of the individual is going to be predicted. A compact framework for non-invasive blood glucose measurement has been designed and tested.
8. Results and Conclusions:

It is important to monitor and record the parameters such as blood pressure, heart rate of the patient as the base data and to check if the patient is sick or is recovering from illness and also to check if the patient is responding for the given treatment. It is usually the case when the patients go
for a self-healthcare or go to the hospital after feeling uncomfortable that often greatly increases the possibility of accidents. In addition, currently, most healthcare devices are of large form factor and are for limited healthcare area, which would reduce the desire of usage and quality of everyday life of the patient. The concept of mobile care service is, thus, to overcome the foregoing restrictions to reduce the volume of healthcare devices and to prevent interfering with patients’ daily life and still be able to provide long-term monitoring healthcare services. We thus propose to use a commercial mobile phone as the processing core for symptom recognition and alert message generation in collaboration of physiological signal extraction devices with wireless transmission capability and back-end healthcare center as a platform for message processing and data storage to construct an intelligent mobile care system with alert mechanism.

9. Scope for future work:

To ensure that most of the infrared signal is focused, the transmitter can be designed to be an optical design. By doing so, the signal can be directed towards the receiver (photodiode) without being scattered to the surroundings. As for the consistency of the output voltage, the IR transmitter should be kept fixed by using any aid of stabilizing apparatus.

The key feature of this app is the alert mechanism that it inhibits when critical sugar levels are notified. Under such circumstances, an immediate text message is sent to the doctor of the patient, a care taker and family members, to provide necessary human intervention, this will be an added feature to the app. The app also will provide the medication that needs to be during such desperate times in order to provide a possible control over the
situation. The patient medication history can also be updated in the app, so that it is easier for the patient to keep track. Appointment history will be another feature that will be added to this app. The app will be released for iOS platform.