Final Year Project Showcase Batch-2020
Year 2024

	Department: Telecommunications Engineering Programme: Telecommunications Engineering
1	**Project Title** IoT-Enabled Patient-Centric Non-Invasive Blood Glucose Monitoring System

2	**Project Idea**
	
	The objectives of the proposed glucose monitoring system are:
	  a. Design and develop a patient-centric and non-invasive system to measure blood glucose levels.
	  b. Upload the measured blood glucose levels to the cloud wirelessly using IoT against patient identification.

3	**Process** The device takes PPG signal as an input obtained from MAX30102 Heart rate sensor and correlates it with invasive blood glucose readings using a machine learning technique called Linear Regression. Through this calibration model, it predicts the blood glucose levels of an individual in a non-invasive way. The data set used in the calibration model is specified according to the Body Mass Index (BMI) Ratio, such that it improves the accuracy of prediction by considering BMI ranges.
4	**Outcome** Successful development of a reliable non-invasive blood glucose monitoring system, with clinically acceptable results.
5	**Evidence (Theoretical Basis)** The overall findings of the project are explained here, detailing the journey from conceptualization to the realization of a non-invasive blood glucose monitoring system. Key accomplishments include: 1. **Development of Predictive Models**: The project successfully developed both personalized and generalized predictive models for non-invasive blood glucose monitoring using PPG signals. The personalized models addressed individual variations, while the generalized models, categorized by BMI, enhanced the accessibility and accuracy of glucose readings for a diverse user base. 2. **Integration with ThingSpeak**: The system incorporated ThingSpeak as a database for real-time glucose monitoring, ensuring secure data management and dynamic monitoring capabilities through updated plots. This integration facilitated better patient care by enabling real-time data analysis and visualization. 3. **Accuracy Metrics**: The reliability and effectiveness of the predictive models were evaluated using key accuracy metrics such as RMSE and MARD. The system achieved an RMSE of 13.84 and a MARD of 12.08%, performing well compared to existing research. The Clarke Error Grid Analysis showed 100% of measurements within clinically acceptable zones, underscoring the system's high accuracy and reliability. 4. **Real-World Implications**: The non-invasive blood glucose monitoring system demonstrated potential transformative benefits for diabetes management. By enabling continuous, non-invasive monitoring, the system enhances patient comfort, compliance, and provides healthcare professionals with real-time data for

	timely interventions and adjustments in treatment plans.	
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence	
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) • **SDG#3, Good Health and Well Being:** This project offers a painless and accessible way to manage diabetes, improving health outcomes in Pakistan, where the disease is prevalent. • **SDG#9, Industry, Innovation and Infrastructure:** This innovation has the potential to drive technological advancement, boost local industry, and strengthen healthcare infrastructure in Pakistan, especially related to diabetes management.	
b	**Cost Reduction of Existing Product** A non-invasive glucose monitoring system reduces costs by eliminating the need for consumable strips and lancets, which are required for traditional glucometers. This leads to significant long-term savings and more affordable diabetes management.	
c	**Process Improvement** **Issue with Invasive Glucometers:** Current invasive glucometers require frequent finger pricks, which can be painful, inconvenient, and costly due to the ongoing need for strips and lancets. This can discourage regular monitoring, leading to poor diabetes management. **Improvements with Non-Invasive Monitoring:** A non-invasive system eliminates the need for pricks and consumables, making glucose monitoring painless, more convenient, and cost-effective. This encourages more frequent monitoring and better diabetes management.	
d	**Expanding of Market share** We plan to increase market share by raising product awareness through targeted marketing and partnerships with healthcare providers. Competitive pricing and collaborations with insurance companies will enhance accessibility and appeal, positioning our device as a leading choice among glucose monitoring solutions.	
e	**Capture New Market** To capture new markets, we will target regions with high diabetes prevalence and limited access to traditional monitoring. By leveraging market research and forming partnerships with global health organizations, we aim to introduce our device to underserved populations and integrate it into emerging telemedicine platforms.	
7	**Target Market** The target market for this device consists of Diabetic Patients, Health Conscious Individuals and Athletes, Clinics, Pregnant individuals and healthcare providers.	
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