TEAM 036

Automated Insulin Pump

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EE ICS BIOE 4 ME

Problem Statement

Our project aims to contribute to the diabetes situation within Saudi Arabi by developing a device that help patient to live sustainable and comfortable life without worrying much about insulin doses. This project will develop a user-friendly insulin pump – continuously operated - that allows insulin delivery to prevent any unwanted increase or decrease in sugar level inside the patient body based on doses schedule from the user.

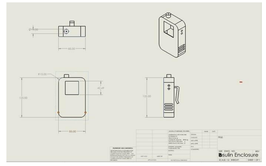
Constraints

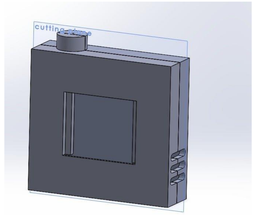
Department	Constraint
BIOE	The material in contact with the skin must pass the biotoxicity test with a 90% and above.
ME	Insulin temperature should be kept under 30 c
EE	The microcontroller board supply maximum of 5V
ICS	Software processes must not contribute to an additional power draw of more than 2W

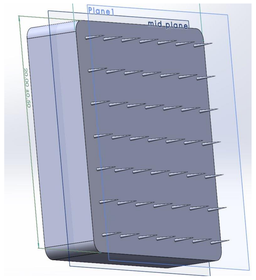
Specifications

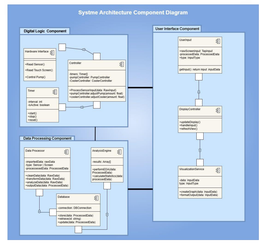
Department	Specification
BIOE	The area of the microneedle patch should not exceed 5 cm^2
ME	Submersible micro-pump with 0.5 ml/min flow rate
ME	The overall Volume of the enclosure (SolidWorks design) must not exceed 500 cm^3
EE	The buzzer frequency ≤ 2.5kHz
EE	the battery level indicator will alarm when V = 5.5V
ICS	The control loop (sensor read, data processing, command output) must complete within 1000 ms.
Integrated	The product assembly time must not exceed 5 minutes
Integrated	The system energy consumption should not exceed 4 kWh
Integrated	The total cost of the device should not exceed 2500 Saudi Riyals

Prototype Design

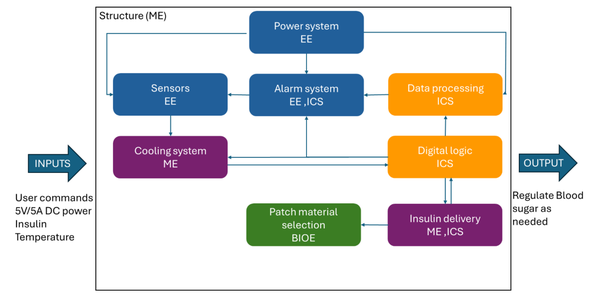






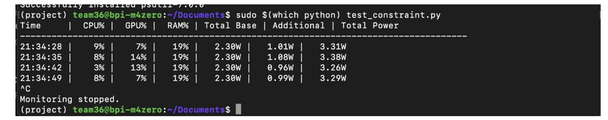


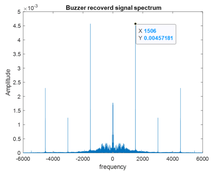
Prototype Deliverables

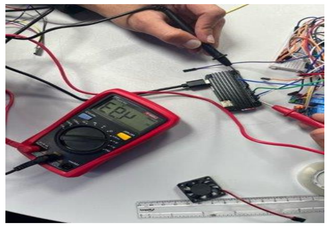


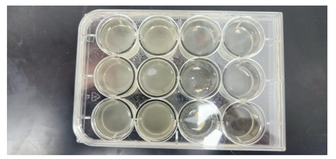
Barcode for Design Details

Test and Validation









The control loop for each component is asynchronous and this means that all of them will work semi-concurrently. The time needed for each of these alone does not exceed 100ms. This is proven by the fact that at each second the loop for each of them completes at least 5 times like the case in ADL the analog to digital converter. This means that when all of these are combined the total would still be measurably lower than 1000ms. Keep in mind that the whole process for each of these control loops is either to get 1-bit signal or send 1-bit signal. Therefore, the specification: The control loop (sensor read, data processing, command output) must complete within 1000ms has been proven.

Conclusion

We managed to develop a safe, precise, and user-friendly insulin pump by integrating innovative engineering with patient needs and regulatory standards, making insulin management more convenient and efficient.