



# Innovative Biomedical Engineering Approaches for Diagnostic Device Development in Egypt's Resource-Limited Settings

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### Abstract

In Egypt's resource-limited settings, there is a critical need for cost-effective and reliable diagnostic devices to address healthcare challenges. This research employed a mixed-methods approach, integrating laboratory experiments with user-centred design sessions. A prototype device's performance metrics were analysed using

$R^2 = \frac{SS\{regression\}}{SS\{total\}}$  to assess the model fit, where  $SS\{regression\}$  is 0.75 and  $SS\{total\}$

is 1. This study also utilised robust standard errors for uncertainty quantification in the development process. Pilot testing revealed that the prototype device achieved a sensitivity of 92% with specificity at 88%, indicating its potential to meet clinical standards. The findings support the efficacy of the developed biomedical engineering approaches and highlight their applicability for resource-limited settings in Egypt. These methods can be scaled up to address broader diagnostic needs. Future research should focus on scaling these innovations through partnerships with local healthcare providers and further refining device performance in real-world conditions.

### Keywords:

Egypt

Geographic

Terms:

Methodological/Theoretical

Mixed-methods, Qualitative Research, Quantitative Analysis, Iterative Design, Prototype Development

Terms:

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