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**DISSERTATION TITLE:** *Ultra Low power Digital Circuit Design for Wireless Sensor Network Applications*

With recent developments in the wireless networks field, novel and innovative biomedical applications based on this technology are being developed in the research as well as commercial market. Huge amount of money are spent in research to develop new designs to diagnose the diseases by acquiring the data from the human body. This trend has just started and it is predicted that wireless networks are going to become a fundamental part of medical solutions due to its benefits in cutting down healthcare costs and increasing accessibility for patients as well as healthcare professionals. Having biomedical chips with the least energy per operation is one of the most important factors in this field. As a result, there is a necessity to present new techniques and innovative ideas to improve the lifetime of the biomedical chip batteries while the accuracy of these devices is not degraded. To store the data acquired from body, we need to store the information for a while and then process them to observe the results. Therefore we need a memory and then a processing unit to process the data. Another challenge is having device as small as possible to have a better possibility of implantation inside the body.

In this research we investigate the challenges in ultra-low power digital electronics then present new and innovative designs to reduce the power consumption. Another contribution of this work is developing of the new memory architectures for biomedical applications to store the data at the least power consumption and maximum reliability. Introducing new device with significantly improved characteristics for future especially for low power and robust designs is another contribution of this work.