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Project: Ultra Low Energy Microcontroller Architectures

### This project aims at describing different methods for low energy design for typical microcontroller architectures. In this era, the energy and power consumption of devices is of major concern as opposed to the speed. The competitive factor on most devices is the battery life and devices which can last longer are usually favoured by the consumer. In sensor networks, a device is deployed in a location that has very limited scope for power supply and power management is even more crucial. Also, mobile phone companies are focussing on enhancing the battery life on their devices to gain a competitive edge. The focus has been kept to sensor networks and mobile phones as energy consumption is of vital importance in these areas and there is a massive investment in this field.

### In the light of this, the microcontroller unit (MCU) usually consumes the most energy in any embedded system. Therefore, this project looks into the different ways the MCU can be designed to make a power and energy efficient architecture. This would involve techniques like reducing the amount of energy spent executing a particular instruction and new approaches in the power management of devices which would involve looking into the different power modes that is usually present on most embedded devices. There is also a glimpse into sub-threshold design for FFT processors as they are used for many signal processing applications. This domain involves the design of custom sub-threshold cell libraries and memories to achieve the low energy required. These are some of the many areas in which research is taking place.

### From a mobile device perspective, battery life is the most crucial factor. This project also looks at optimizing and suggesting different approaches to improve the battery life on mobile devices. This includes looking at multi-core mobile phones and suggesting methods for improved power consumption. Mobile devices now can perform a wide flavour of tasks so completing these tasks within a specified power and energy budget is of key importance. Established concepts such as power gating, voltage and frequency scaling would be analysed as these are different methods to reduce the power consumption in a mobile device. Also, the possible benefits of introducing Field Programmable Gate Arrays (FPGAs) in the place of traditional custom microprocessors would be discussed as this opens up a whole new dimension in processor design for mobile phones. Other related concepts for energy efficient architectures would also be discussed.

### Therefore, this project draws up the different areas of research in low energy design for microcontrollers and microprocessors in the case of mobile phones. The idea is to present the new, novel research methods and in turn suggest how these methods can be intertwined to make an energy efficient system. The existing methods will be critiqued and the aim is to provide efficient ways to implement energy efficient architectures and identify future areas of research to aid this ever-growing field.