

## ***Part B: Project Summary***

### **ITR: A Scalable Enabling IT Infrastructure for Developing Regions (ICT4B)**

There are thousands of stand-alone projects that aim to bring information and communication technology (ICT) to developing regions, but nearly all of them depend on existing hardware and infrastructure developed for affluent regions. As such, these imported technologies fail to address key challenges in cost, deployment, power, and support for populations with low levels of literacy and multiple languages. This project, *ICT4B* (Information and Communication Technology for Billions), develops the key technologies and infrastructure to enhance these projects, and enable new, previously intractable projects.

The proposed work directly addresses these challenges with novel technology, and tests the impact through the use of two real-world pilot deployments in two different developing regions. The purpose of these two deployments is not just to understand and address two specific ICT applications, but also to demonstrate and validate that the underlying ICT architecture and associated technologies are truly enabling for developing regions. Towards this end, the multi-disciplinary proposal includes two faculty and three students from the social sciences to ensure that the work enables real-world solutions. In addition, supporting partners, such as Intel, HP, UNDP, IIT Delhi, Markle, and Grameen Bank will provide project guidance and on-site help with deployments.

**Intellectual Merit:** The technology strategy is to attack directly the key challenges of cost, power, deployment, support and literacy. ICT4B will provide order-of-magnitude improvements in device cost, infrastructure and networking cost, and power consumption. Key deliverables include 1) novel low-cost, low-power devices, 2) a new approach to low-cost networking based on intermittent connectivity (rather than persistent connectivity as assumed by the Internet), 3) a user-interface toolkit that supports poor literacy through novel speech recognition, and supports a variety of sensors for environment and health applications, and 4) a three-tier architecture that uses proxies and data centers to support low-cost devices with more functionality, easier development, over-the-wire reprogramming, and usage monitoring for social science research. The expected 10-100 times reduction in device cost stems from the co-design of the devices and infrastructure, system-on-a-chip integration, and the extensive use of open standards. The 10-100 times reduction in device power usage stems from the use of low-power circuits, the need for less CPU power due to help from the infrastructure, and novel low-power intermittent networking. The 10-100 times reduction in infrastructure cost comes largely from 1) the focus on intermittent networking, which avoids the substantial costs due to real-time constraints and persistent connections (both present in cellular telephony systems), 2) extensive sharing (across applications and possibly even regions), and 3) novel architectural approaches to user and system support in the field. From a social science perspective, this project will create unique opportunities to develop and test propositions about the role of digital technologies in helping to overcome long-standing and intransigent development problems.

**Broader Impacts:** ICT4B initially targets five application domains for the ICT framework: commerce, health, education, government and location-based services, as presented in detail below. Although the two pilot deployments will have substantial impact for the (developing region) users of those applications, the true impact of the proposed work is its ability to enhance nearly all of the existing developing-region IT projects, and to enable new projects that would otherwise be intractable. The nature of this leverage may vary: some groups will directly use the artifacts such as the low-cost devices, some groups will exploit the architecture and networking protocols with their own devices, while some groups will leverage the core technologies for low-cost displays, low-power radios, or user interfaces and speech recognition. This project is unique in that makes nearly all of the existing IT projects better: for example, reducing device costs and improving network usage both imply that many more users can achieve the benefits of any given project. ICT4B does not *require* infrastructure for every rural village in the developing world from the outset (over 500,000 villages in India alone). Rather, the architecture will be economically viable, and deployable as such, often in the micro-franchise model of Grameen Bank. Even with only a 5% penetration of a large and developing population, the effect would be very significant. Finally, ICT4B will inspire students, universities and corporations to take bolder, more direct, and better-integrated approaches toward IT for developing regions.