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Entrepreneurship and Education through Mobile Phones in Kenya

The functionality of today's mobile phones can now include the potential for gigabytes of storage, wireless connectivity, and processors more powerful than the one in my first desktop computer. However this wearable infrastructure is being severely underutilized. Despite the new capabilities of mobile phones, most have not transcended the 'phone' paradigm, in large part due to the proliferation of alternative mobile computing devices such as laptops and PDAs. However, for most of the 1.4 billion mobile phone users on Earth, their phone is their personal computer - and Africa is currently the fastest growing mobile phone market in the world. Over the past five years the continent's mobile phone use has increased at an annual rate of 65 percent - twice the global average. In June of 1999, Kenya had 15,000 mobile phone subscribers. By the end of 2004 the country had 3.4 million subscribers, and at the time of writing this application in mid-2005 the number is currently estimated to be over 4 million.[1] It is clear something extraordinary is happening. Last year, according to the government's 2005 Economic Survey, Kenya's small business sector, which employs the majority of workers in the nation of 32 million people, created approximately 437,900 new jobs. The boom of mobile phones in Kenya has been credited for much of the activity in its small business sector. It has been shown that adding an additional ten mobile phones per 100 people boosts a typical developing country's GDP growth by 0.6 percent.[2]

This boost comes from the innovative use of mobile phone technology by local entrepreneurs. Kenyan business men, farmers, and laborers of all sorts are finding new uses for a tool thought of as two-way voice communication devices in the traditional Western paradigm and coming up with original methods for solving their own problems. For example, contract laborers can now provide their phone numbers to potential employers and move on, instead of having to wait for hours at a workplace in case a job arises. Access to market information through mobile phones also provides rural communities with invaluable information about centers of business. The Kenya Agricultural Commodity Exchange (Kace), now provides crop growers with up-to-date commodity information - farmers can access daily fruit and vegetable prices from a dozen markets through a text message (sms). Now many rural farmers have quadrupled their monthly incomes because they have access to information about potential buyers and prices before making the often arduous journey into urban centers to sell their produce. The community payphone, known in Swahili as "simu ya jamii", has helped bring mobile phone usage to the poorest areas of Africa. These payphones are created by entrepreneurs who buy airtime from the network and subsequently sell it to local people who don't own phones themselves. According to the CCK, over 5,000 of these community phones had been established by the end of 2004. The payphones are easy to operate in isolated areas far from the nearest traditional telephone landline, and can be used even where there is no electricity, as they can be powered by either solar or car batteries.

Clearly, this adoption and widespread innovative use of mobile phone technology makes Africa an ideal candidate for the development of localized mobile phone applications. These applications could have profound implications for the economic development of some of the poorest African communities. Despite the unprecedented growth of mobile phones in Kenya however, the custom applications (such as Kace's real-time vegetable pricing over sms) are quite rare. The computer science curricula of universities throughout the continent still concentrate on traditional desktop computer programming. As a result, African computer science graduates are not equipped to deal with the computing needs of African people.

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[1] Statistics from Kenya's telecommunications regulator, the Communications Commission of Kenya (CCK).

[2] The London Business School

MOBILE PHONE CURRICULUM

While traditional desktop computers (PCs) have not seen the penetration in Africa that they have had in the developed world, the adoption of mobile phones has been remarkably rapid and widespread, reaching even the poorest African communities. A recent survey in Tanzania reported that thanks to the community payphone model, 97% of the people there now have access to a mobile phone, despite the lack of electrical infrastructure for much of the country. In Kenya, only 200,000 households have electricity, which has not seemed to have deterred the 4 million Kenyan mobile phone subscribers. Having an infrastructure of devices that have the computational horsepower of the PCs from a decade ago while not being dependent on a steady supply of electricity makes exclusively teaching Western PC-centric computer programming in African universities increasingly misplaced. At such a critical point in the evolution of computing technology, Africa's adoption and innovative use of custom mobile phone applications confirms the need to equip African computer science students with the skills to develop mobile phone applications specifically for African users. And Africa's adaptation of mobile phone technology shows the value of inexpensive, mobile computing for a people representative of an increasing majority of the 1.4 billion mobile phone users today.

Given their massive adoption and widespread use in Africa, as well as the recent technological advances in their computational power, mobile phones are ideal substitutes for the personal computer throughout the continent. In collaboration with Professor A.J. Rodrigues, the Director of the School of Computing and Informatics at the University of Nairobi, we plan on introducing mobile phone programming classes will be designed to empower students to build applications specifically for the unique needs of African communities. The proposed curriculum has now been approved by the Principal of the College and Deputy Vice Chancellor of Academics. Students who take these courses will be enabled to take an active role in the creation of an African community of mobile phone application developers. By creating a mobile phone application developer community in Kenya, Professor Rodrigues and I hope to provide a foundation for the development of mobile phone applications that are not only tailored to local needs but also applicable globally in other developing countries.

COLLABORATION: MOBILE PHONE EXPERIMENTS

In addition to formal courses on mobile phone programming, we also will be studying behavioral and mobile phone usage patterns in Africa. Dr. Peter Waiganjo Wagacha and I will run an experiment similar to my doctoral work at MIT. We are proposing to distribute Nokia 'smartphones' to thirty individuals in different demographics and log their behavior over the course of six months. The phones will have a custom application that continuously logs location, nearby peers, communication and phone usage statistics, similar to the data I collected for 100 people during the Reality Mining project at MIT. In this previous research, we generated models of our subjects' lives with such precision that they could be used to accurately predict subsequent behavior. Based solely on data logged by our custom phone application, we have successfully shown that after two months logging it is possible not only to predict behavior, but also to infer friendships, differentiate demographics, validate survey responses, and even quantify the dynamics of an organization.[3] With the help of two research assistants who have taken Dr. Wagacha's course on machine learning, it is our hope that this data will provide an analogous quantitative description of Kenyan social networks and mobile phone usage behaviors.

Dr. Wagacha and several of his colleagues have agreed to collaborate with our multi-university group of over a dozen researchers whose intent is to analyze the massive amount of behavioral data currently being collected from mobile phones. The objective of the initiative is to create a unified, interdisciplinary academic community incorporating disciplines such as urban planning, statistical physics, social science, machine learning, computational epidemiology, and organizational behavior. With Dr. Wagacha's help, we will be addressing the issues and outcomes involved with learning about phone usage data for different demographics in Kenya and contrasting it with my previous work from students in North America. I would like to use this publicity to draw attention to the new knowledge and attitudes Kenya mobile phone users are acquiring, as well as the lessons we can learn from them.

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[3] http://reality.media.mit.edu.

CONTRIBUTIONS

Today's phones are programmable, powerful, and capable of accessing the internet. Lacking a traditional PC, many Kenyans are turning to their mobile phones to connect with people, information and services. Empowering Kenyan computer science students with the skills necessary to program these increasingly ubiquitous devices is the first step towards nurturing an African mobile phone application developer community. This new community of programmers will be focused on building entrepreneurial applications, designed specifically to meet the unique needs of the African people. My intent while at the University of Nairobi is to build such a community while expanding my own research direction to include collecting and modeling behavioral data logged by mobile phone users in Africa.