Department of Computer Science
PhD Project Proposal

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I hereby confirm that as Head of Department, I am of the view that the person(s) nominated as the Supervisor(s) is/are competent and has/have the time to supervise the PhD.

Head of Department: ----------------------------- Date: -----------------------------
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1. Title
Organizing low skilled semi-illiterate workers using mobile phone applications and Internet Technologies

1.1 Overview
Information and Communication Technology for Development (ICT4D) advocates for ICT-based solutions that enable the poor benefit by leveraging ICT innovations which can be used to improve their economic status by bridging the digital divide [1][3][4]. Examples of the poor, also referred to as those at the bottom of the pyramid, are day laborers soliciting work from some specific urban points. In the cities of Nairobi, Cape Town and many others in the developing world, thousands of men and women gather on the roadsides, their daily hope being to find a job. These men and women are faced with problems one of them being spending most of their earnings and time looking for jobs.

These urban points where they gather go by different names such as street corners [5] or worker collection points [6]. More often, semi-illiterate or illiterate low skilled workers group themselves in locations well
known to potential employers and the general public who may stop by to pick some of these people for a job. There are two types of the day laborers groupings identified so far: one is that which has benefited from natural formation of the collection point and has no formal intermediary organization governing and soliciting jobs for them, herein referred to as “self-organizing group”, while the second one is that which is affiliated to a certain organized (and maybe registered) organization, referred to as “organized group”. An example of the former is a group of painters observed in Kenya. The latter has been identified in Cape Town, South Africa, where a well established organization, Men on the Side of the Road- MSR a organizes and solicits jobs on behalf of day laborers. Other organizations include 4U recruitment b in the UK, the Labor Works c and hirehelper d in the USA, and nifulie e in Kenya. Such organizations can be described as doing some kind of match making between employers and employees (mainly labor workers), and act as an intermediary (“intermediary organizations”.) between employers and labor workers.

1.2 Problem Statement

Many job seekers use a substantial amount of their income and time looking for jobs. From our preliminary investigations with a few job seekers in Cape Town, South Africa, we estimate that they spent up to 10% of their daily income, which is roughly between USD 12.5 to around USD 35, as commuting costs to and from their waiting points, the worst case being a day when one borrows money for fare to travel to the waiting location and misses to get placed for a job. During this period when workers are out of work, they normally use their savings in looking for jobs. Job seekers also suffer a great deal when they find themselves in situations where they are forced to wait at a collection point during harsh weather conditions. On the other hand, potential employers use their precious time and money looking for the right labor workers. They drive through heavy traffic congestions that happen to be common in many cities in the developing world. Sometimes employers get mobbed by angry job seekers. In other cases, employers pick workers who do not have the skills they require because there is no way of checking whether one has the skills they claim to have. In more serious cases, some job seekers may have criminal records and hence jeopardize the security of the employer.

For organizations that help organize and place workers in an organized manner, most of their resources go into looking for jobs. On the other hand, allocation of jobs is sometimes perceived to be unfair and hence brings about acrimony among job seekers.

Amid all the problems faced by employers, job seekers and intermediary organizations, statistics show that mobile phone access and use in Africa is rising steadily. It has been said to be Africa’s communications device of choice. For example in Kenya, the four licensed mobile operators had a combined subscriber base of 17.4 million, with 80% of the country having a mobile signal at the end of June 2009[7]. In South Africa, ITU report [8] indicates that there were 92.2 mobile phone subscriptions per 100 inhabitants in 2008. The list of mobile

phone usage in Africa will go on and on, but the question is, are there any economical advantages, particularly to those at the bottom of the economic pyramid, e.g. job seekers?

In this study, we aim to design and test a prototype application combining mobile phone communication and computer technologies that can allow intermediary organizations, employers, self-organizing and organized groups of job seekers attain a corporation that will help solve or eliminate the aforementioned problems. The aim is to leverage on what is referred to as “smart mobs” among our target group. Brockman [9] describes smart mobs as people who carry and use devices that possess both communication and computing capabilities and notes that such people cooperate in ways never before possible. During our preliminary studies, perceived unfairness in job allocation came out as a burning issue among job seekers. This was also reported in the work done by Bartley and Roberts [10]. In this proposed study, the goal is to find out more about the allocation problem and incorporate our findings into the solution.

2. Research Questions

This study is focused on bridging the digital gap between those who have access to traditional computing services and those who have alternative computing devices, in this case hand held devices and mainly the mobile phone. The underlying issue is to look for design options that can suit both those who have hand held devices as their only computing tools and those with both traditional computers and hand held devices. Therefore the research seeks to answer the following questions:

- What are the best design options for mobile phone applications as alternatives to or as extensions of traditional computing services?
- Are mobile phones better usable as alternative computing devices for the don’t haves or as an extension of existing computing services for the haves or both?
- What are the possible application related limitations of using the mobile phone as an alternative or as an extension of available computing services?
- What extra services and/or capabilities are not available in traditional computing environment and which hand held devices can leverage on as better computing tools?

And because the above questions will be answered by studying our target groups who are employers, day labourers and intermediary organizations, the research will also seek to answer the following two questions related to them:

- What ICT innovations and architectures can be used to design systems that can allow employers, day laborers and intermediary organizations corporate in such a way that job seeking and workers search is made more efficient and cost effective?
- Can the innovations be extended to other employment intermediation groups and/or their members?
2.1 What are we investigating?
In this study, our goal is to find out the best Information and Communication Technology (ICT) application(s) using mobile and Internet technologies that can support employers, job seekers and intermediary organizations in their day to day functions that are related to job seeking and worker search. In particular, we are looking at developing software applications that can allow efficient linking of both employers and workers with or without intermediary organizations. So the main issues we are dealing with include: what are the ideal software development methods and strategies that can be applied to such environments as ours? What systems usability issues will need to be considered when developing software for such users as the target group of this study? What is the role of mobile phones technology, as an alternative to traditional computing devices, in solving job seeking and worker search problems? What are the possible computer architecture required for such set ups? What are the social issues that cannot be solved by technology?

2.2 Importance of the problem
The importance of this study is twofold. One, it has contributions to Computer science and the second one is to our target group hence fulfilling the ICT4D component of this study.

**Importance to Computer Science**
Usability of software applications is key to success of any system. This study will be aiming at finding out the usability factors affecting users who are using such applications for the first time on handheld devices as opposed to on a traditional computer. At the end of the research, new guidelines/techniques for developing software in such environments as those of day laborers (these are people who will be experiencing computer applications for the first time on a mobile phone) will be documented and tested.

Application of Action Research methods in Software development is still new. The importance of this research to methodology will be to test the suitability of Action Research in software development specifically in environments where most of the target users use mobile phones as their only computing devices. At the end of the study, strengths and limitations of Action research in software development in such environments will be documented.

**Importance to day labourers, employers and intermediary organizations**
The proposed application is expected to help reduce the amount of time and money spent by job seekers in looking for jobs. To employers, resources used in searching for a worker will be reduced and this may possibly lead to more pay for workers. Employers will also benefit by getting to correctly identify and use skilled laborers. To the Intermediary organizations, more resources will be channeled to other areas like training rather than looking for jobs.

2.3 How our study is different from what has been done before
There have been similar studies, e.g. [1]. Most of such studies have focused on women and unorganized group of people looking for jobs. Others e.g. [11] focused on people who already had jobs and were looking for better jobs. Further, it was not involving intermediary organization and employers but only the individual job seekers. The aim is to find out the best application that can allow the three groups to form a “smart mob” i.e. a
mob that can use technology at their disposal to benefit them in their course of action; in this case, job seeking and worker search. There are other studies, e.g. [12], that may not relate directly to this study, but are likely to share in many other issues such as the type of people we are dealing with, the similarity of the societies and methods used. Some studies include only case studies, e.g. [10] [13] [14] [15], but we also consider them as they give us an overview of the kind of area and people this study is concerned with.

3. Methodology

In this section, research methods for this study are described. The method of choice for the study is Action Research. The section is divided into four subsections. Sub-section one describes how we intent to use Action Research i.e. describes our study strategy. Sub-section two gives reasons why Action Research is the preferred method. A test strategy for this study is highlighted briefly in sub-section three while sub-section four highlights expected outcomes of the study.

3.1 Application of Action Research in our study

Next we describe how we will apply the cyclic nature of action research based on Lewin’s action research model, which consists of (1) analysis, fact finding and reconceptualization- also called diagnosis(2) Planning (3) Acting (execution) (4) Observation and (5) Reflection phases.

During diagnosis phase, we will define the actual problem faced by our target users by carrying out fact-finding missions. This will be done by user observation, face to face interviews, document analysis, discussions with our target users and literature review. Our fact finding mission will be done in collaboration with a number of groups both in South Africa and Kenya. All the three target users, i.e. job seekers, employers and intermediary organizations, will be identified in due course.

In the second phase a plan of critically informed action to improve current practice of how employers, labor workers and intermediary organizations cooperate will be developed. The plan must be flexible to allow adaptation for unforeseen effects or constraints. To come up with such a plan, a critical analysis and interpretation of findings from diagnosis phase will be a requirement. In the third phase, we will act on the plan, mainly by implementing mobile phone and internet technology application which is aimed at solving the current problems faced by our target users.

At the fourth phase of the cycle, we will observe the action process and the effects of the proposed action. This will require, in our case, a deployment of our prototype system and its use. Limitations and strengths will be observed and recorded for further action/intervention. Observation will mainly be by allowing users to use the prototype application in their day to day activities. Last in the cycle is to undergo a reflection period about the outcome of the observation phase. This will involve identifying general findings and working upon them with the aim of making clearer the problem and the outcome of the action. This will be shared and discussed among the participants, mainly the researchers and the target users. Discussion outcomes will form a basis for further planning of a more informed action/intervention hence continuing the cycle. Each of the phases will
be done in partnership with our target users. This means all ideas will get discussed between the researchers and target users before any action on them.

### 3.2 Why Action Research

Outlined below are four major reasons why Action Research is chosen as a methodology for this study

a) Action Research accommodates User centered design and co-researching with target users. This study plans to involve target users as co-researchers and make them central to the study.

b) Action Research is used in real situations, rather than in contrived, experimental studies, since its primary focus is on solving real problems.

c) The development process for the study is expected to be cyclic. Action Research supports a cyclic process.

d) Action Research has been successfully used in related areas of research e.g. in [2] [15] and [16] studies.

### 3.3 Our test strategy

We are adopting a partnership relationship with our potential users. Indeed, our plan is to convince them to be the lead partners. Naturally, being lead partners, we anticipate that most likely, they will be our test groups. Our prototype will be given to our partner organizations, employers and job seekers to use. This is in line with our methodology, where at stage three of the cyclic model of action research, we intend to observe how the prototype will get used.

They will then be placed under observation for a period of time and see how they use it. The outcome will aid in our reflection with regard to the all process of our study as outlined in phase four of Action Research model to be adopted in this study.

### 3.4 Anticipated Outcomes

Results for this study will be mainly from usability test of our software application. We intend to document and publish processes, lessons and challenges of a software application development for a mixed (from different economic classes and digital divides) group of people who cooperate to achieve a specific task, in this case placing job seekers with employers looking for workers. The study, anticipates contributing to theory on software development for users from different economic classes.

Apart from expecting to have insights into designing software applications for semi-illiterate and computer illiterate users, which is always known to be a challenging task, we expect to draw lessons from our design process. In particular we will pick strengths and weaknesses of our methodology and study strategy. The objective here is to test how well Action Research is applicable to software development methods. Overall, the study will test the suitability of applying Action Research in solving Computer Science problems. User Interface design for illiterate users is another challenge in computer systems development. In our cyclic study
method, Action Research, capitalizing on user centered design, our quest to get the best user interface for the application will contribute to the knowledge in human computer interaction (HCI) as we document and analyze processes, challenges and successes that we will go through. This will eventually culminate into possible new software development methods or guidelines targeted at such environments.

At the end of our study, we expect a working mobile and internet based application. From our preliminary findings, we anticipate that an application that will allow target users to avoid situations such as those described in the problem description will be in place.

The functional requirements for the proposed application should allow job seekers to reduce their travel time and hence travel expenditure, eliminate unfairness in job allocation and reduce the cost of worker search by employers. Employers will also benefit by having opportunities to choose the best worker in terms of skills and personality related issues. For cases where intermediary organizations are involved, the proposed application will help them run their day to day office errands smoothly. They will be able to maintain up to date records of employees and employers on top of reducing the cost of matching the two.

Academically, the outcome will include contribution of knowledge. Published papers and eventually a thesis will be the ultimate outcome of this study.

4. Bibliography and Previous systems

4.1 Overview

This section describes some of the work referred to in preparing this proposal. It is divided into two subsections, the first one looks at studies related to socio-economic issues and ICT in general, while subsection two describes specific ICT systems designs focusing on those at the bottom of the pyramid and in one way or another related to our proposed work.

4.2 General ICT4D studies

Abraham [17] and Eggleston [18], shows how mobile phones technology has improved the trading activities of fishermen and agricultural sectors and their traders respectively. Abrahams notes that mobile phones, by virtue of their role as carriers and conduits of information, ought to lessen the information asymmetries in markets, thereby making rural and undeveloped markets more efficient. Efficiency, which is said to occur when the cost of producing a given output is as low as possible, is what we are interested in our study. Job seeking (by a potential employee) and worker search (by potential employer) can be modeled in to a form of selling (e.g. by fishermen) and buying (by the traders) respectively. However the difference with this study is that it is looking at coming up with ICT solution utilizing mainly mobile technology and traditional computer systems that can bring about the much needed efficiency. Another study close to this is work done by Donner 2005 [19] in Kigali Rwanda. He describes how people can use mobile phones to improve their social and economic status. In our study, we theorize that job hunting is partly a social and partly an economic problem. We will be
keen to learn from how people and organizations use their mobile phones to aid in job searching. Indeed we have some insights of what technology might help users. In his work, Joyojeet Pal discusses ICT4D in two perspectives [20]. He notes that in the first case, users get in contact with the technology itself and in the second case, users benefit from services provided by technology infrastructure. If successful, job seeking ICT applications may benefit all the users (including the intermediary organizations and its members) that come in contact with related technology.

Designing systems that are meant to help people who are not computer literate and sometimes don't have computers is not easy. However, this is what ICT4D is advocating for, ICT for those at the bottom of the pyramid. In his definition for ICT4D, Toyama [21] described it by writing “Taken literally, ICT can include everything from the printing press to Africa’s talking drums; but in the context of ICTD, ICT has the connotation of modern electronic technology—the PC, the mobile phone, and the Internet play central roles”. And this is how Toyama wrote about development: “Taken at face value, ending poverty and the correlated suffering is the intended goal of international development”. In his work, Sturm [22], apart from criticizing some work done so far in ICT4D, describes some ICT4D solutions that serve the underprivileged. Kuriyan et al [23] also gives an idea of how challenging it is to have ICT4D benefit those at the bottom of the pyramid. As much as we are interested in designing systems for job seekers, we are aware that the socio-economic issues of our target users have to be taken into consideration. With this in mind, we will be looking at work relating to poverty and ICT, and poor ICT infrastructure [24].

### 4.3 Specific Systems

Medhi et al [1] described work done in implementing a paper-based system that provides the intended functionality of helping match low-income domestic workers from an urban slum with potential middle-class employers in Bangalore, India, but without a computer. They did paper based implementation because they thought that it was impossible to implement such systems using a computer for illiterate and semi-literate users. Findlater et al [12] did work to compare semi-illiterate and illiterate users in system design. Putnam et al [25] described a mobile social software (MoSoSo) directory that enabled users to access listings for local businesses rate, view ratings of local businesses, and create password-protected shared directories that could contain business listings, ratings, and message boards. This was done by applying user centered design (UCD) and targeted local users, who were typical of our target group i.e. a combination of the poor, semi-illiterate (job seekers) and those above the poverty line (the employers). Another work dealing with illiterate users and applying UCD using action research is work done by Blake et al [2], a field computer for animal trackers. Findings from this study will be used as lessons to guide our study as we share the methods used and the context of some of our target users.

### 5. References


6. Work schedule

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