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# Location Aware Applications to Support Mobile Food Vendors in the Developing World

**Rahmad Dawood**

School of Information,  
University of Michigan,  
Ann Arbor, MI 48109 - 2112 USA  
rahmadd@umich.edu

**Jude Yew**

School of Information,  
University of Michigan,  
Ann Arbor, MI 48109 - 2112 USA  
jyew@umich.edu

**Steven J. Jackson**

School of Information,  
University of Michigan,  
Ann Arbor, MI 48109 - 2112 USA  
sjackso@umich.edu

**Abstract**

This paper describes an ongoing research project to explore the potential of location aware mobile phone-based applications to support mobile food vendors in the developing world. These vendors are a ubiquitous phenomenon in the developing world and can be seen hawking their wares in carts, bicycles or motorcycles. We report preliminary findings from nine interviews conducted with various mobile food vendors in Indonesia. Based on these findings, we present our initial system design for a mobile phone-based application that allows these vendors to advertize their current location, accept orders from customers, and have customers recommend particular vendors.

**Keywords**

Location aware, ICT4D, Mobile phone, Micro-entrepreneurs

**ACM Classification Keywords**

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**General Terms**

Design, Economics, Human Factors.

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### Introduction

In developing countries, the majority of the poor work in the informal sector, the so-called shadow economy. Studies have shown that this shadow economy has an enormous impact and contributes substantially to the formal economy, between 38% - 41% of formal GDP [7]. In the informal sector, a big chunk of the economic activities are conducted by microentrepreneurs and at the same time these microentrepreneurs also provide employment for the majority of the developing country's work force. For example, it is estimated that, in 2007, Indonesia had 47,702,310 microenterprises that provided jobs for a whopping 77,061,669 people (81.7% of at that time employed workers) [2]. Thus, an intervention that targets microenterprises is a good approach to tackle the poverty issues in developing countries.

In this project we focus on one type of microentrepreneur: mobile food vendors. This focus was motivated by three major reasons. First, these vendors are very common in developing countries and can be seen along major streets, residential areas, schools, and office complexes offering various types of food and snacks (see Figure 1). Most of these vendors resort to this line of work because they have no other means to earn a living for their family [3, 4]. Second, the incomes these vendors generate are relatively small, vulnerable, and highly variable from day to day. Their ability to conduct business is heavily dependent on the vendor's health, the day's weather conditions, and geographic constraints related to legal and social norms and the mobile nature of the work. Such conditions create notably uneven and fragile income streams, limiting the sustainability of livelihoods in the sector. Third, due to the mobility of these vendors we believe that real-time location and customer information can play an important role in their business. In this project we are proposing a mobile

phone-based location aware application to support the business activities of these mobile food vendors. The application will provide a platform that will deliver various information that these mobile vendors can use to better operate their business, better manage their customers, make better route decisions, reduce waste, and, ultimately, increase their daily earnings.



**Figure 1.** Mobile Food Vendors in Indonesia

Our work contributes to the CHI literature by extending the use of location-based information to support the lives and livelihoods of food cart operators in Southeast Asia and other developing country settings. We also contribute by characterizing the practices and needs of mobile food vendors. Our predominantly urban focus also helps to correct the subtle but important rural bias that has tended to characterize design-focused ICT4D work to date.

**Interviews with mobile food vendors**

In order to better understand the practices and needs of mobile food cart vendors, we have initiated an ethnographic study of such vendors in Indonesia. At present, we have carried out nine preliminary interviews with various types of mobile food vendors from different urban locations across the country. These preliminary interviews enabled us to better understand the context in which mobile food vendors operate and the various constraints that mobile food vendors in Indonesia face. Based on these interviews, we have developed a taxonomy of characteristics mapping work conditions and technology

needs among mobile food vendors (see Table 1). This taxonomy reveals a wider spectrum of practices and needs than documented in existing studies of microenterprise to date. Our taxonomy will also guide more sustained ethnographic fieldwork to be conducted in summer 2010. Additionally, mapping out the characteristics of mobile food vendors will enable us to better identify and focus on particular aspects of the mobile food vending that our application will help support. In the case of our project, we will be focusing on the vendor and his/her relationship with the customers.

**Table 1.** Taxonomy of mobile food vendor characteristics

Characteristic	Description	Types
1. Production	How the food is produced	a. Pre-packaged: ready-made, prepackaged food (e.g. bread, ice-cream); b. Pre-cooked: food is cooked beforehand and vendors portion and serve; c. Made to order: Ingredients for dishes are cooked on the spot.
2. Business location	Where vendor conducts business	a. Mobile: constantly moving; b. Semi-mobile: stay in one location until no more customers and then move to another location; c. Permanent: vendor can be consistently found in one location; d. Invisible: prepare and deliver food at the customers' residence.
3. Business ownership		a. Franchise: holds license for a particular brand of product; b. Outsourced distribution: a food producer that employs numerous street peddlers to sell their product; c. Self/family owned.
4. Employment	Time allocated for the business	a. Full-time: vendor allocates all of his/her time towards vending; b. Part-time: vendor is doing this for side income; c. Seasonal: vendor only sells at certain times of the year.
5. Customers	Frequency of buying from the vendor	a. Permanent: have special arrangement with the vendor; b. Regular: buy frequently from particular vendor; c. Occasional: not as frequent but buy at times; d. Incidental: buy as needed only from the vendor

**Information needs of mobile vendors**

Analysis of our preliminary interviews suggests some of the distinctive needs and challenges faced by mobile food vendors. First, an important reason these vendors are always on the move is because this is their main method for finding customers. This action of moving around to find customers can be equated to an information search activity [6], albeit an extremely costly and physically exhaustive one. The physical nature of the search activity vastly limits the geographic scope of the vendor's efforts thus resulting in a low probability of finding customers and generating only small number of buyers. Therefore, these mobile vendors need a better way of searching for, and more reliably finding, customers.

Second, given the limited number of new customers they can reach, retaining their current customer base is very important for these vendors; this is especially true for repeat customers that will buy from them on a regular basis. Losing a regular customer is therefore very costly and detrimental for these vendors. One less customer for that day will mean less money to support their family and/or require vendors to spend more time and effort in an exhaustive search for 'replacement' customers. Having information beforehand whether their regular customers are in need of their offerings would therefore provide significant strategic benefit.

Third, in general these vendors have very low disposable incomes. The little money that they have is mostly used to finance the daily expenses and supplies needed by their business. Because they do not have a good estimate on the number of customers for a given day, they bear the risk of not earning enough to cover the day's business expenses. Mirroring patterns seen in

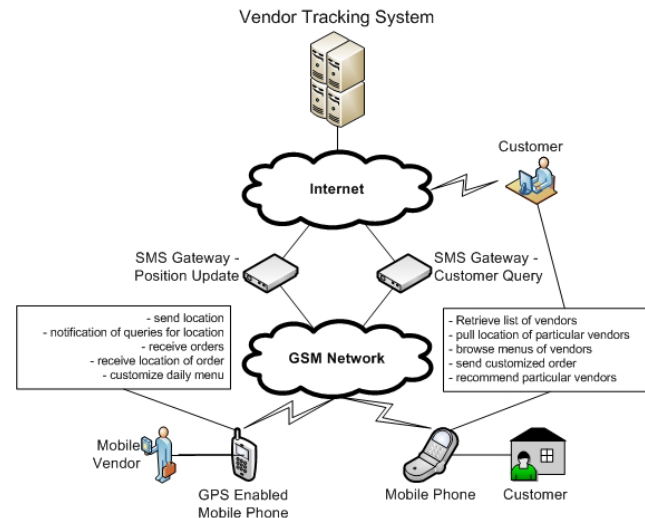
other economic development contexts (e.g., the cropping decisions of poor subsistence farmers) this results in the vendors being notably risk averse; they will avoid spending too much for their business needs, and will only buy supplies as well as stock materials enough to service a small average number of customers. But because the number of customers in a day can greatly vary, there will be days where they will have scores of potential buyers but not enough supplies to accommodate them, forcing them to turn down business (and perhaps sacrifice growth in their long-term customer base). Mechanisms for better predicting and regularizing demand may therefore improve both short-term earnings and the long-run growth and sustainability of these enterprises.

The low number of customers willing to try out a vendor is potentially caused by two major factors: not knowing the existence of a particular mobile vendor and customers' lack of knowledge about the quality of a vendor's food. One response to such information asymmetries [1] are new signaling mechanisms whereby vendors may communicate the availability and quality of their wares to potential customers [5]. Beyond basic location information, recommendations or suggestions by the mobile food vendors' existing customers may assure and attract other potential customers. Currently, there is no easy and cost effective way for either location information or customer recommendations to be shared.

**Usage Scenarios**

The service we are proposing is a location-aware application whereby mobile food vendors are given real-time information about their customers and potential customers are informed of the location and

availability of their favorite vendors. (See Fig. 2) The vendors are equipped with a GPS-enabled mobile phone and given an ID that can uniquely identify them to their customers. The mobile phone is subscribed to a standard prepaid plan, enabling it to be used for other communication purposes. To limit technological barriers to use, we have designed the service to be accessible through basic SMS, but with the additional possibility of access via Internet and/or smart phone connections.



**Figure 2.** Usage scenario.

At the start of their day, the vendor sends an SMS querying the application for that day's weather forecast and predictions on the number of customers they may get for the day. Customer predictions will be based on trend data of previous purchases and received orders from the vendor's regular customers. Armed with this information the vendors will load their cart accordingly to meet their expected sales for the day. Before

starting their route, the vendor will attach the GPS-enabled mobile phone somewhere secure and sturdy in their cart. Once moving, the mobile phone, at preset intervals, will query the onboard GPS for its current location, which is then sent via SMS to our application and will update the vendor's location information.

Potential customers can query the location of a vendor by sending a ping request via SMS, noting the vendor ID, to a predefined number. The SMS gateway will forward this request to our application, which will query its database for the current location of the vendor and relay back this information through the SMS gateway to the potential customer. Customers of the vendor can also register their number to the service and associate it with a valid address. This registration process will enable these customers to access additional functionalities such as preordering and notifying the vendors that they are waiting for their arrival. Lastly, customers can also recommend their favorite vendors to their friends by informing them of the mobile vendor unique ID, which later they use to query and try out the vendor's offerings.

At the same time, the vendors, during their route, will receive SMSs notifying of the various queries, information requests, and orders they have received from customers or potential customers.

### Application Architecture

Figure 3 depicts the general architecture of the application. Vendor position updates and customer queries are received by the SMS gateway, transformed into web requests, and forwarded to the Web Server. Required SMS responses are generated by the template manager and sent back to the sender via the SMS

gateway. In addition, a web interface enables access to the service through a browser from a standard computer or smart phone. This option is also used for application testing and monitoring purposes.

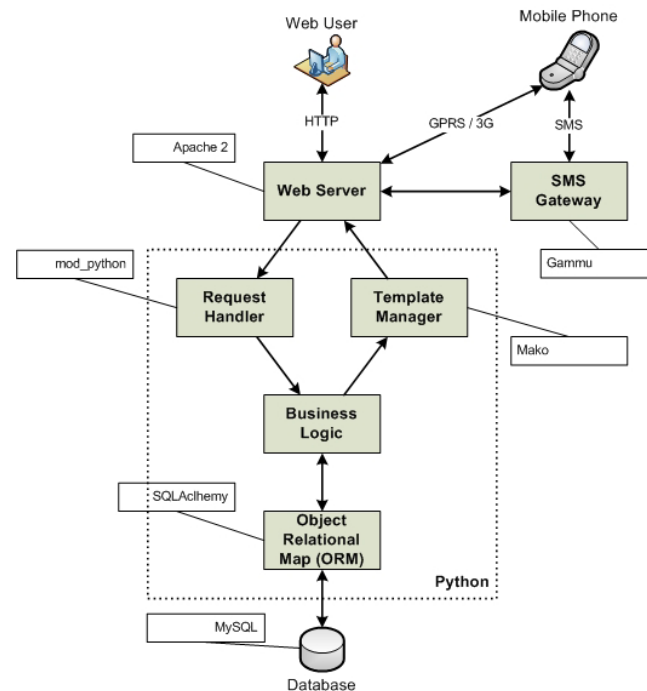


Figure 3. Application architecture.

### Conclusion

Applications providing real time location and customer information can provide immense business and broader developmental benefits for mobile microenterprises in developing countries. They also constitute important practical and theoretical contributions to the growing ICT4D field. In this paper, we draw on preliminary

interviews in Indonesia to outline a mobile-based application that allows mobile vendors to signal their current location, accept orders from customers, and enable recommendation of vendors to others. A field trial and further ethnographic work, planned for summer 2010, will test and refine current functionalities and suggest additional features that can further support the livelihoods of these mobile food vendors. Additionally, our future work will explore privacy issues and pricing models that may affect the adoption of our application in the mobile food vending context.

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