

Ontology-engineered MSME Framework

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Abstract: Micro, Small and Medium scale Enterprises (MSMEs) hold an unfailing distinction of being pillars of equitable economic growth. Lack of proper business platforms and knowledge of marketing strategies render MSMEs vulnerable to middlemen exploitation. The Web has extended e-business platforms, e-commerce and micro financing solutions to assist MSMEs. These web-based solutions fail to obliterate intermediation. In view of the advancements and customers' growth in the telecommunications field, we utilize the mobile platform to offer trading solutions to MSMEs. In this paper, we propose a *mobile phone-based ontology engineered framework* for MSMEs that can achieve disintermediation. The framework has been tested on mobile cloud akin to EC2 cloud environment and integrated with an android application that provides easy access - anytime, anywhere. The envisioned framework will boost MSME margins, build healthy business-ties and transform MSMEs into self-sufficient establishments equipped with full-fledged trading systems that operate in mobile phone enabled environment.

1 INTRODUCTION

Micro, Small and Medium Scale Enterprises (MSMEs) hold a trustful distinction of being pillars of equitable economic growth and account for 90% of global businesses (Abor and Quartey, 2010). Middlemen - wholesalers, distributors, agents and brokers, perform essential trading tasks for MSMEs. Middlemen primarily focus on identifying interdependencies in the market, in terms of 'exchange opportunities' between MSMEs (Gadde and Snehota, 2001). Middlemen tend to misuse their market knowledge to exploit MSMEs and reap excessive profits. MSMEs often lay claim of middlemen pocketing their margins besides indulging in unfair trading practices like adulteration and hoarding (Himachalam, 1991). Significant development in the fields of Information Technology and World Wide Web has aided in providing Internet-based solutions for MSMEs but, fail to obliterate intermediation. However, small business owners are unable to comprehend and use PC-based Internet solutions due to limited knowledge of technologies (Cooke, 2000). This calls for a standard framework that can extend 24 × 7 support to MSMEs through mobile phones.

Remarkable advancements in the telecommunication field and mobile phones in particular, have provided viable alternatives to web solutions. The paper aims at utilizing the mobile platform to offer trading solutions for MSMEs. We propose to build an ontology-engineered framework for mobile networks environment that can effectively replace middlemen. The overall system architecture is shown in Fig 1. Considering the explosive volume of data to be stored and processed, the proposed system runs on mobile cloud environment for high scalability. A user friendly Android application is integrated to assure quick, easy and round-the-clock access to the *middlemen replacement* components on cloud. Ontology is defined as a "formal, explicit specification of conceptualization" (Gruber, 1995). Ontology represents knowledge of a domain in a declarative language, by defining a set of representational terms. Ontology can be represented as a hierarchical structure of domain knowledge by subcategorizing entities observed to be existent in the domain. This paper focuses on such an ontology built for MSME domain. The framework supports the process of generating and storing JSON (Java Script Object Notation) for representing ontology. JSON is also used as an electronic data exchange format for communication between client and server.

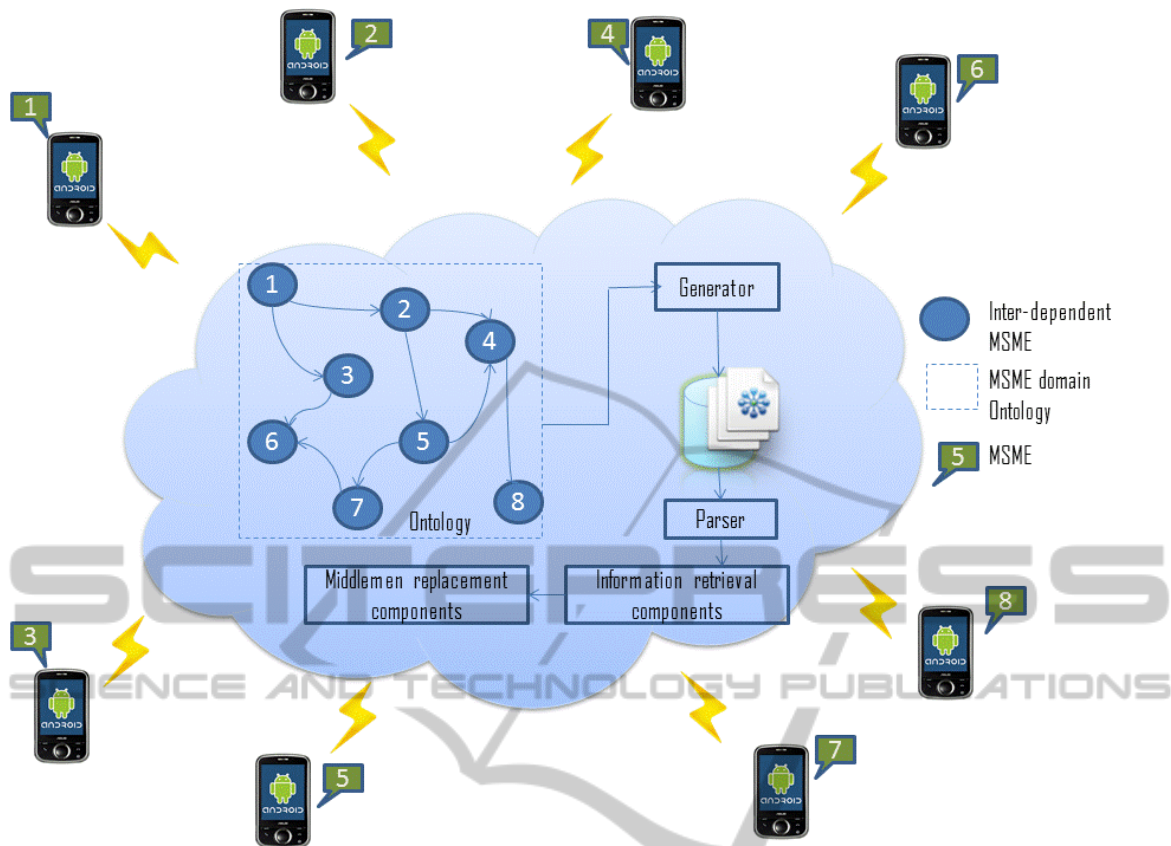


Figure 1: Overall System Architecture.

An ensemble of the MSME domain ontology, JSON Library, mobile cloud and android application end point constitute the Ontology engineered MSME framework.

2 RELATED WORK

The recent past has witnessed development of a multitude of applications and services to assist MSMEs. Popular web applications provide CRM systems (Achuama and Usoro, 2010) and human resources management (Andersen, 2003) solutions. Most of the web solutions aim at providing a business platform for the small-scale firms to sell their produces in the online market. E-commerce applications have been developed to cover business transactions (Olatokun and Kebonye, 2010). But in reality, MSMEs turn to another class of middlemen to carry out their online trading (Cooke, 2000). Consequently, MSMEs end-up paying two different classes of middlemen.

A significant related development in the telecommunications field, pertaining to ontology is

the *Ontological Framework for Mobile Health Services* (Saravanan et al, 2010). In the framework, health ontology was used to provide location-based assistance in case of medical emergencies.

Mobile cloud, considered as the next-generation technology, is extensively used to provide services to mobile phone networks (Stuart et al., 2011). The Amazon EC2 is one of the recent developments in the field of cloud computing that offers many cloud related solutions as web services (Varia, 2010). This paper describes a highly scalable system developed for MSMEs using the ontology-engineered framework that uses cloud for data storage and processing. The android application has remote access to framework components that run on cloud, for effective and efficient processing.

3 PROPOSED FRAMEWORK

The proposed framework as shown in Fig 2 is explained through following components.

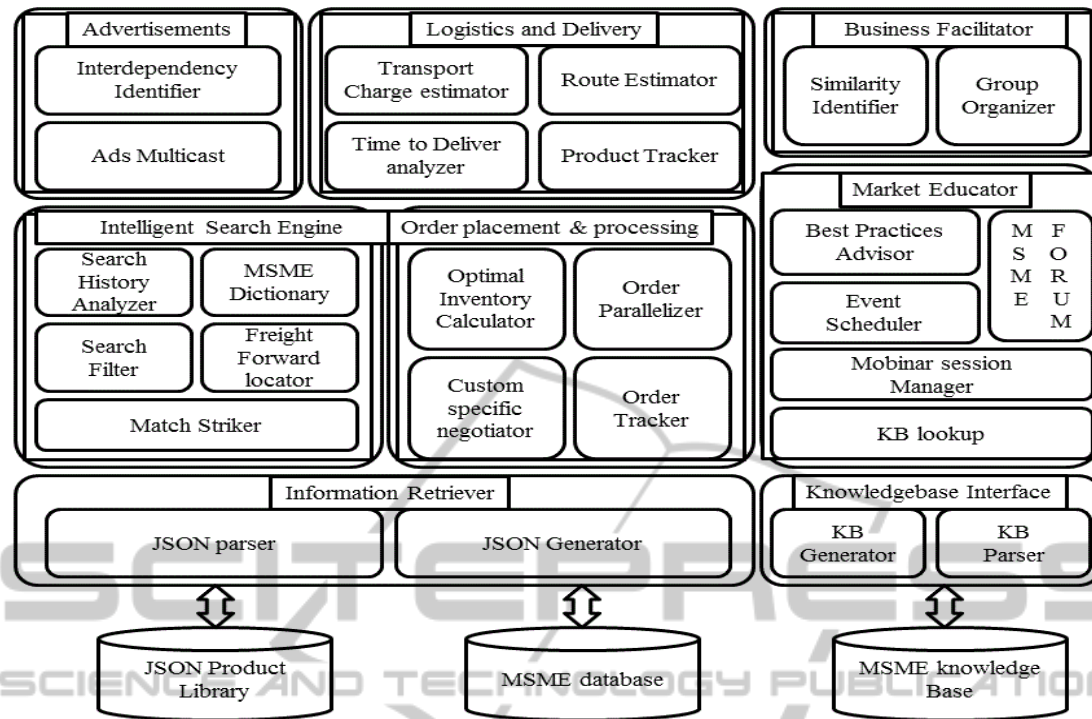


Figure 2: Component diagram.

3.1.1 Intelligent Search Engine

The search engine retrieves relevant search result for products searched by MSMEs within the system. Any query given to the system is first built to a format understandable by the engine. The Search History Analyser suggests the products an MSME meant by a given query by analysing search history. Context of query is identified by considering purchase history and the nature of MSME business. Moreover, spellcheck algorithm provides 80-90% tolerance to spelling mistakes. The search engine provides location based search results.

3.1.2 Order Placement and Processing

The system calculates the optimal order quantity and the minimal buffer quantity of raw materials using the EOQ (Economic Order Quantity) model. When the inventory nears the minimal buffer quantity, the system suggests the reorder quantity from statistical analysis of purchase history. MSMEs can parallelize order for readily available products and use custom-specific negotiator for custom-made products.

3.1.3 Logistics and Delivery

Logistics and delivery component derive the most suitable logistics service provider for a given order.

The most suitable logistics service is identified by considering purchase history, time-to-deliver, distance between and cost estimation.

3.1.4 Advertisements

Product promotion is automated by the Advertisements component. Product based interdependencies are identified from the MSME ontology. Advertisements of products required by MSMEs are automatically multicast to the mobile phones of prospective buyers.

3.1.5 Market Educator

The component aims at imparting market knowledge to MSMEs by creating and managing an MSME knowledgebase. Input for the knowledgebase is derived from domain experts to assist MSMEs with quick lookup of solutions to problems they face in trading.

3.1.6 Business Facilitator

The component identifies product based similarities between MSMEs and groups them together. Similarities are identified by querying MSME domain ontology. Besides, the component provides platform for MSMEs within a group to involve in

collaborative investments and purchases.

4 OTHER RELATED COMPONENTS

4.1 Mobile Cloud

The framework executes on a mobile cloud for efficient information processing and storage. The architecture of the mobile cloud environment is very similar to that of EC2 cloud (Varia, 2010). The mobile cloud extends various services to the mobile phone registered with the system. The cloud spawns a new virtual machine containing an instance of the framework for every new session.

4.2 Android Application

The android application acts as an entry point to the mobile cloud which hosts the framework. Using the android application, MSMEs can Search for products, Take advice on optimal order quantity, Distribute order quantity to purchase from a combination of different MSMEs, Customize order specifications to suit the ever-changing needs, Hold negotiations and transactions directly with the concerned MSMEs, Track products and obtain delivery updates as simple text messages, Promote products to prospective buyers.

5 DISCUSSION

The Ontology-engineered framework makes all aspects of intermediation available to MSMEs, without middlemen's intervention. Every factor that makes MSMEs dependent on middlemen has been analysed and provided with a viable alternative. It is evident from the information outlined in the paper that the framework, together with mobile cloud and android application end point, play a vital role in eliminating the need for middlemen.

6 CONCLUSIONS AND FUTURE WORK

The framework discussed in the paper possesses the potential to introduce a revolutionary breakthrough in the MSME market structure. In order to further ease out the comprehensibility and usage of the

android application, we plan to integrate a regional language translator with the MSME framework.

We plan to build a domain-independent, generalized framework as an extension of the MSME framework. The generalized framework can be easily extended and integrated with applications pertaining to any domain like Finance, Healthcare, Education, etc. The generalized framework introduces a new medium to build domain-specific ontologies. It is to be bundled with an easy-to-use interface that will enable developers to integrate domain ontologies with applications pertaining to their domain of interest.

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