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Uberization of Business Entities in A Smart City

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Abstract: The sharing economy paradigm has resulted in many successful systems such as Uber, Airbnb, Grab. This paper presents a share economy system for business entities in a smart city with high speed internet connection. The business entities can be a commercial entity with address, GPS location, service type, etc. The city must establish a central server so that a business entity can register their profile as defined by the operator. Then a user can construct a request vector to identify the availability of a desired service by UBEN Matching Algorithm at the server. This paper describes the UBEN matching algorithm and a Shophouse Service Matching Algorithm. The ramification of implementing this kind of service is discussed.
Key words: sharing economy; UBEN; smart city
JEL codes: M15

1. Introduction

Under the context of share economy, there are some successful systems disrupting the traditional businesses. The well-known success stories are Uber, Airbnb, and Grab. For Uber, the model is that a mobile app is used by the consumer to submit a trip request to a central system. The central system then broadcasts the request to the vicinity of the requester for the cars that have been registered with the system. Once one of the cars accepted the request, and consumer accept by not rejecting the offering. The transaction can be completed. This kind of system is then called Uberization as mentioned in Wikipedia, it is a neo-euphemism for a property of a highly tele-networked business to hit the peak efficiencies in operations, providing highly economical and efficient services.”

Let us consider the economic sharing model for the business entities along the route of street, highway, or in a city. The key idea is that, at present, the business entities in a city is quite passive. They are waiting to be found. Each business entity such as a noodle shop, a gas station, a coffee stand, a clinic, a Chinese restaurant, a market, a pharmacy store, a Thai massage shop, etc., residing in a city or on a street side, basically, are invisible to a person in a car, or walking on a pedestrian walkway, unless they are familiar with that locality.

Basically, it is very difficult to find the business you want to contact. In another scenario, for a person in car, and want to find a drug store, it is also very difficult to identify the nearby drug store. The google search would be helpful to a certain extent since it is designed in a very generic sense lacking specific assistant. Moreover, consumers usually will go to the main service, and then will visit some secondary services nearby. The system that

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can help consumer to choose a group of services like that would be highly valued.

In this paper, we will propose a new business sharing model for business entities in a smart city. The Airbnb is the business sharing model of accommodation in the hospitality industry. The Uber is the economic sharing model of taxi for transportation business.

Our business sharing model is for any fixed location business entity. All these types of business sharing is to increase the utilization of the business or increase the traffic of the business. Hence, maximum efficiency is possible with consequence of generating high incomes and returns, and provide convenient for the consumers to find them.

2. Previous Work

Only a small number of research papers published on the algorithmic aspect of sharing the entities or services. P. Veerayuttwilai (2019) has proposed a model and algorithm for passengers in a vehicle in a congested road to request services from roadside business establishments. On the other hand, S. Kim and Y. Yoon (2016), explore a recommendation system for sharing economy based on multidimensional trust model using Tensor Factorization and Skyline algorithm. Most of the published research work is in the area of studying the economic aspects of the sharing economy as exemplified by the following reviews. The sharing economy, as pointed out by Herald Heinrichs, can provide a new approach to sustainability. Seoul is raised as an example of Sharing City (Heinrichs Harald, 2013). G. Zervas and D. Proserpio (2015) conducted an empirical study on the impact of Airbnb service entry into the state of Texas over the five-year period from 2003 to 2013, they found that there is an impact on decreasing in total hotel revenue. However, the benefit to overall tourism industry might be true in the sense that Airbnb generates the demand for cheap accommodation for the travelers and consequently increase the travel and tourism spending.

3. Architecture of the UBEN

A business entity is a fixed location business establishment with an address. It can be a shop house, a department store, a hospital, a coffee shop, an apartment. The UBEN architecture is designed to support open visibility of the business entity in a narrower band of search economy. Here the architecture as shown in Figure 1 consists of a cloud server with UBEN application in client-server form. The business entity, BE, will be registered with UBEN service providing the GPS location, types of service, opening time, etc., The system will implement a taxonomized service map to facility search and identification.

Let RV be request vector from a user or group of users who want to identify s business entity defined as (r_1, r_2,..,r_s). This request vector be constructed and sent from the mobile phone to the UBEN server. The matching algorithm will then generate the matched business entities and send to the user with GPS location of the business entity. Once a business entity is selected, the google map API will set up the route from the current user location to the business entity’s location.

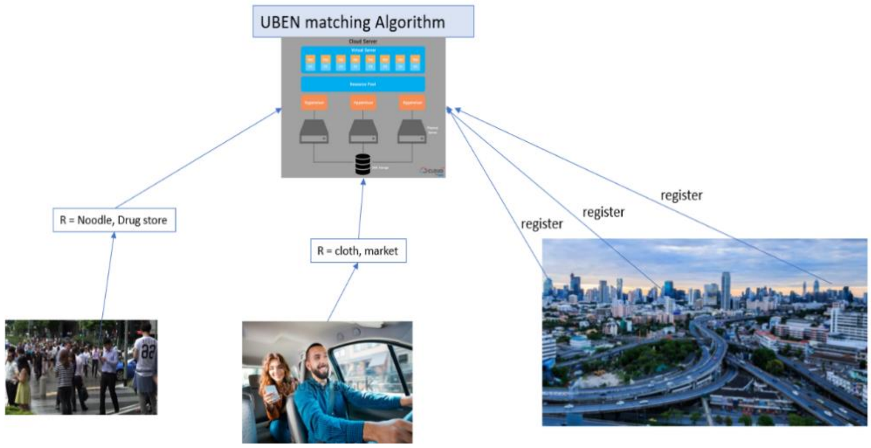

Figure 1 Business Sharing System in a Smart City

4. UBEN Algorithms

In order to implement the UBEN architecture of business entity sharing. Let us define BE is set of p business entity {BE_1, BE_2,..BE_p} , each with attributes (GPS location, service type, opening time, address, phone, URL). Let GPS (BE_n) be the GPS location of BE_n, SERVICE(BE_n) be the type of service of BE_n.

The request vector RV = (r_1, r_2,..,r_s), in which r_1 is the request of main service type needed and r_2 to r_s are secondary service types needed that the business entities satisfying these requests should be in the vicinity of the business entity offering r_1 service. To find the solution, we must first find business entity with r_1 service then we need to consider all the business entities within the radius of q meters centering on the BE(r_1). This basically a special case of more general request vector. We want to find out if the secondary requests can be satisfied by the business entities within the circle radius q.

To simplify our presentation, Let BE (GPS, Service type) be represented by either BE(GPS) or BE (service type) or just BE. Let BEC be the set of BE within the circle radius q centering at GPS(BE(r_1)). If a user or a group of users issues a request vectors RV, r_1 would be the primary service they want. The algorithm will then find the BE that matches r1. Then the algorithm will identify all the BE, BEC, within the radius q centering at the BE(r_1). The next step is to identify the degree of matching between the requests r_2 to r_s and the set BEC. If the requests r_2 to r_s are all in BEC, then BE(r_1) is the solution. Otherwise, find the number of non-matching services in RV, Nj. We will repeat this process to find the next BE that satisfy r_1, and has the Nj = 0 for the solution, or Nj is the number of non-matching requests. At the end of this process the list of Nj will provide us information to select the BE that has the least number of non-matching requests as the best solution. This concept is illustrated in Figure 2.

There are a number of business entity types labelled h_1 to h_9 in the city. The request vector, RV= (h_5, h_4, h_1, h_2). First, we find BE with service h_5 and the circle has h_5, h_1, h_2, h_1, h_3. In this case $N_1 = 1$. We repeat this process every time a BE with service h_5 is found, then we have $N_2 = 1$, $N_3 = 3$, $N_4 = 1$, $N_5 = 0$. In this case the solution is at the circle with $N_5 = 0$ since all the Bes in the request vector are in that circle centering at h_5.

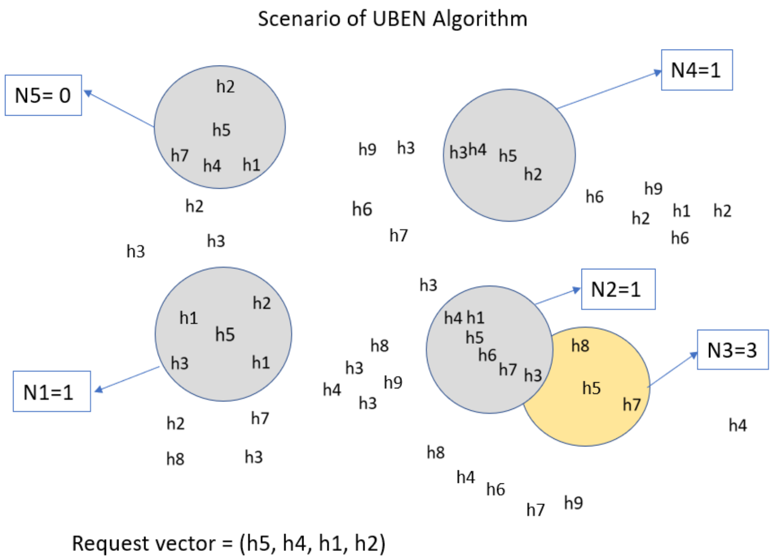

Figure 2 UBEN Algorithm Scenario

UBEN Matching algorithm:

$R = (r_1, r_2, r_3, \ldots. r_s)$

For j =1 to p do

If r_1 matches BE_j then set g= GPS (BE_j); define q;

Then find all BE within the circle centering at GPS(g) with radius q

k =1

For j = 1 to p

If DISTANT(GPS(BE_j), GPS(g) <= q

Then $BEC_k = BE_j$; k = k+1;

End;

If (BE(r_2), BE(r_3),…,BE(r_s)) is a subset of BEC

Then choose BE (g); exit

Otherwise Nj is the number of requests not covered;

j = min Nj; Choose BE (r_j)

End;

4.1 UBEN Matching Algorithm for Linear Row of Business Entities

In many cities, the business entities are shop houses connected in a linear configuration. Here, if we allow the registration of business entities as a group with a service profile vector of length L. For example, if L = 5, which means that 5 shop houses will be grouped. The profile can be (noodle shop, Thai food shop, coffee house, convenient store, hairdressing shop). So, in this model, a user can submit a request vector to find the max match of what he wants to find.

4.2 Shophouse Service Matching Algorithm

Let the request set be $RE = (s_1, s_2, s_3, s_4, s_5, .., s_L)$

The business entity k now represented by BE_k with the elements (GPS, Service set of size L, …).

Let business entity service of size L be $BES_l = (BES_1, BES_2, .., BES_L)$

NP be the set of numeric elements of size G

Assume that there are G groups of linear shophouses BES_{gl} G =1..G, l = 1..L

For g = 1 to G

If $RE_{gl} = BES_l$ then solution is BE_g; exit

Otherwise intersecting set BES_l with Set RE_{gl}, let M_g be the number of elements in the intersection. $NP_g = M_g$

End

Solution is BE_j where NP_j has the max value.

5. Conclusion

The concept of business entity sharing is proposed in this paper. The business benefits are for the smart city to help the citizens to find the desired business establishments faster than using google search. Since google is a wideband search providing a wide spectrum of information items for the users to choose. Identifying the target items is a time-consuming task.

The UBEN algorithm proposed in this paper works on the business establishments that have been registered with the UBEN server in a smart city. The user sends a request vector using r1 to specify the main target service to be located, and the remaining requests are the locations in the vicinity of r1 that they want to visit, most likely within the walking distant, after visiting the main service.

In our algorithm, the search circle around the main service can be adjusted in UBEN to provide the optimal vicinity to satisfy the need of the citizens. In other words, we will find the solution with the maximum requests satisfied or minimum number of requests not satisfied (j = min Nj; Choose BE (r_j))

Also, the shophouse service matching algorithm can also be set up to facilitate the identification of a service rows as the nature of business establishments in a city is the row of shops aligned linearly along the side of a street. In this case, we want to find the shop house row with maximum matching of what a user wants. The number of matching shophouses are tracked in the vector NP_g, and where the solution is where the element of NPg is maximum.

In conclusion, this paper presents a new economic sharing concept that has not been proposed before. The algorithm presented can be used as the foundation for creating a new service that adds the economic benefits to the city and hence can be established as a startup business with some venture capital funding. Our suggestion for the future work is to find the algorithm that can share all classes of city establishments and the routing algorithm to locate the right establishment for a user. Also, recommendation algorithm can also be integrated to provide a layer of intelligence for the user to find the establishment that might be interested to the user.

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