Menu Recommender to Enhance Customer Service and Improve Restaurant

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Abstract **-** *The proposed menu recommender enables service staff to immediately identify a customer's status, favorite menus, preference, and consumption record by smart card and utilize the built-in menu recommender to offer optimal menu choices to the customer and pay the bill. To reach this goal, this study integrates smart card, Zigbee, database technologies, technology acceptance model (TAM), and a menu recommender to develop an intelligent e-restaurant for customer centric service. Based on menu materials or meal popularity service staff can provide for new customers and that store the customer's preference in the system. This system useful for service providers increase their customer interactions and provide fast and thoughtful services.*

Keywords: Smart card, zigbee, database technologies, technology acceptance model (TAM), Menu recommender.

1. Introduction

Restaurant dining is not just about the food, at least from the customer's perspective. when customers eat out, they seek an experience that leaves them feeling good. The study also showed that customers are more likely to spend more money and patronize a specific restaurant more often when they feel engaged -- if they're greeted warmly and treated with care and respect by the staff, for example. A restaurant's managers and its employees all share the responsibility for ensuring the customers are treated well and left with an overall positive impression of their dining experience. Customer service is key to most successful businesses, but especially in restaurants and food service. With a limited profit margin and tons of competition, restaurants need to keep customers happy to keep them coming back. Here are some ideas develop good customer service. Achieving high levels of satisfaction at a restaurant through good customer service, quality food and making diners feel valued is important because satisfied customers are more likely to return. On average, a satisfied customer will tell two to three people about your good food and service, whereas an unhappy one will tell five to 10 people how dissatisfied he was. Customer satisfaction or expectation surveys are an important tool that will aid you in reaching your high customer satisfaction goals.

Zigbee is a technology of following IEEE 802.15.4 Protocol. Low complexity, low cost, low power consumption, low transmitting rate, high reliability, wireless short distance transmission (compared with global Internet), and being capable of ad-hoc networks are all its features. It is suitable for the fields of automatic control and remote control, and it can be embedded in many different devices. In short, Zigbee is a wireless ad-hoc networks capable communication technology which is cheap and low power consumption. The principle of Zigbee is not very complex.

The smart card is one of the latest additions to the world of information technology. Similar in size to today's plastic payment card, the smart card has a microprocessor or memory chip embedded in it that, when coupled with a reader, has the processing power to serve many different applications. As an access-control device, smart cards make personal and business data available only to the appropriate users. Another application provides users with the ability to make a purchase or exchange value. Smart cards provide data portability, security and convenience.

Smart cards today achieve much more than their original application of replacing cash and coins. Smart cards grant access to secure areas, confirm a person's identity via biometrics, and retain large quantities of personal data (such as medical records.) More important than these specific applications are the recent trends in how the smart cards are used – to facilitate the exchange of information between customer and proprietor, which is much broader than the concluding financial transaction. Smart cards are plastic cards that contain a computer chip. Smart cards store larger amounts of information than magnetic stripe cards. They can also update this

information and secure it at a higher level than a magnetic stripe.

Smart cards have the same three fundamental elements as all other computers: processing power, data storage and a means to input and output data. Processing power is supplied by a microprocessor chip (e.g. Intel 8051 and Motorola 6805), and data storage is supplied by a memory chip (EEPROM, FLASH, ROM, RAM). In some instances these elements can be combined in one chip. The means in which data is transferred varies from card to card. In order to operate, each card must have a power source, whether in a card reader or on the card itself. Below figure shows the main elements of microprocessor used in smart cards – CPU, ROM RAM and EEPROM

The recommendation system, help researchers to construct their own recommender system, taxonomy of intelligent recommenders has been explored

2. Framework of Improve Restaurant Industry

The framework overview of the proposed intelligent e-restaurant for customer-centric service. The chefs could prepare the meal from the message shown on the order display system built in kitchen. The restaurant manager could use the system to view statistics of the current inventory, sales records, staff information, and so on. The waiter could use the PDA to make order for the customer at dining table. The stock-keeper could also use the system to systematically record order information from the suppliers and monitor the available stocks in the shopping floors and refrigerators. In addition, the system will send information and alert to the suppliers as inventory is lower than the stock level. After finishing the meal, the cashier can use an Smart card in order to make out the bills. Furthermore, the cashier could use the Smart card-based PDA to perform the valued-added for customers. This system provides online menu-ordering and reservation-making functions as well as a personal menu recommendation service. The menu recommender enables waiters to immediately identify customers via smart cards and then actively recommend the most appropriate menus for familiar customers according to their consuming records. The proposed system also recommends the most appropriate menus for new customers according to menu material, price, and multi-criteria decision making analysis.

To illustrate the hardware structure of the proposed menu recommender system, which consists of a counter Server with smart card reader, an order display system in kitchen, and several PDAs, each equipped with a smart card reader and software for dining table service application. This system provides two service models as follows.

1. When a customer carrying a smart card enters the restaurant, the smart reader at counter actively identifies the customer and obtains the customer information and expenditure records. The waiter at the counter makes order for the customer and then the order is shown on the PC screen for confirmation. Simultaneously, the order is transmitted to the order display system via zigbee.
2. When a customer carrying an smart card enters the restaurant and sits at a dining table, the waiter can use a hand-held PDA equipped with smart reader to take the customer order. The order is shown on the PDA for confirmation by the customer and is then transmitted to the counter Server and the order display system in kitchen via zigbee.

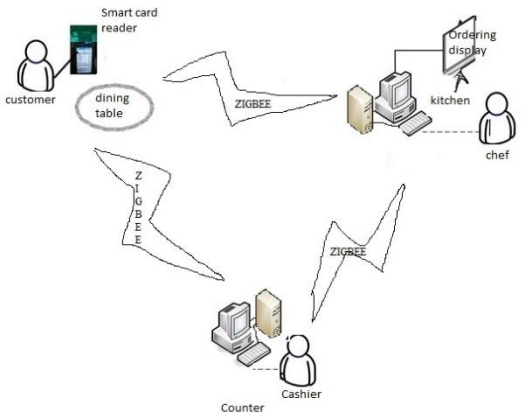


Fig.1: Implementation of smart -based meal ordering subsystem

The system login interface and the member registrations on the counter Server, respectively. This system actively serves customers and allows the smart card to be used as an electronic wallet. When a

customer enters the restaurant, the counter clerk can check the Server to determine whether any tables are available. If so, a waiter is assigned to guide the customer to the table, and the status of the table is changed from "available" to "occupied". After the waiter escorts the customer to the dining table, the waiter asks the customer to show his/her membership card. The waiter can then use an smart card reader on a PDA to access the smart card. Therefore, the background, expenditure records and personal preferences of the customer can be retrieved immediately from back-end database. The waiter can then provide suggestions and applicable offers to the customer. After confirming the order, a message is immediately transmitted to the kitchen, and then all details of the order are shown on the order display system in kitchen. The customer can use either cash or a smart card to pay the bill after having finished the meal, for convenience, the system allows the use of PDA to activate membership card, identify value-added services and checkout. Customers can thus enjoy cash-free convenience.

The amount of e-money, customer background and expenditure records are stored in the back-end database for ease of backup, query and statistical reporting. Customers can also visit the restaurant website and use smart card ID to access the back-end database and retrieve related information. At the counter or dining table, the waiter can also manually look up customer expenditure information, sales ranking of meals and revenue. After checkout, the table status is immediately changed from "occupied" to "available" while awaiting the next customer. Figure 3.11 shows a list of forms available on the counter Server. Briefly, the following forms are used.

(i) Product sales check: A list of products ranked by popularity is provided, form specified date to the present.

(ii) Customer search: Operators can use any key term of customers to search for specific customer data. Additionally, past expenditure amounts and preferences can also be retrieved by means of membership card ID.

(iii) Sales performance check: Historic data, including number of customers and income, can be retrieved.

3. Working Mechanism

The proposed system is a low-cost, convenient and easy to use system for automating order placement system for restaurants. Each table of restaurant has a menu display unit which is powered by microcontroller. The client will scroll menu list using keypad provided along with. Customer could order his food or drink just using this keypad. Our aim is to build an automated order system using ZIGBEE. We shall provide each table with a microcontroller based order placement unit. The unit shall have a keypad to browse through the menu. The menu items, their cost and information shall be displayed on the LCD connected to microcontroller. User can navigate through menu using keypad provided. The data for the menu can be written on an EEPROM connected to each such microcontroller based unit, so that portable data updating is possible (by changing only the EEPROM). Upon finalizing the order the user will be able to place it using keypad. The order placed shall be transmitted to the central server (PC) which will also have a ZIGBEE module connected to it for data reception. Multiple such slave units can be installed.

A. Keypad

Keypads are a part of HMI or Human Machine Interface and play really important role in a small embedded system where human interaction or human input is needed. Matrix keypads are well known for their simple architecture and ease of interfacing with any microcontroller. In this part of tutorial we will learn how to interface a 1x4 matrix keypad with ARM LPC2148 microcontroller.

B. Pin Description

The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers. Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).Pin description is shown in the table below.

Fig. 2: Character LCD type HD44780 Pin diagram

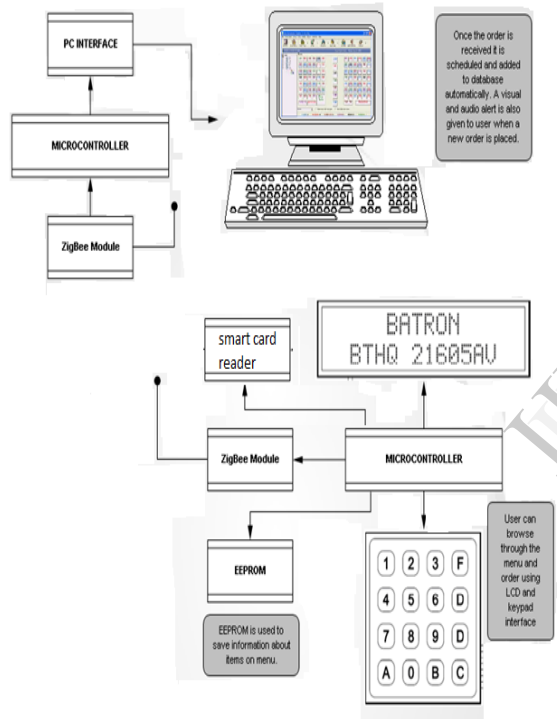


Fig.3: Basic Block diagram of menu recommender Using ZIGBEE Module

C. Zigbee Module

ZIGBEE is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. ZIGBEE devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZIGBEE networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver able to reach all of the devices. Any ZIGBEE device can be tasked with running the network.

ZIGBEE is targeted at applications that require a low data rate, long battery life, and secure networking. ZIGBEE has a defined rate of 250 kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at less expensive than other WPANs, such as Bluetooth. ZIGBEE protocols are intended for embedded applications requiring low data rates and low consumption. The resulting network will use very small amounts of power — individual devices must have a battery life of at least two years to pass ZIGBEE certification. Typical application Home Entertainment and Control, Home automation, smart lighting, advanced temperature control, safety and security, movies and music.

4. Menu Recommender

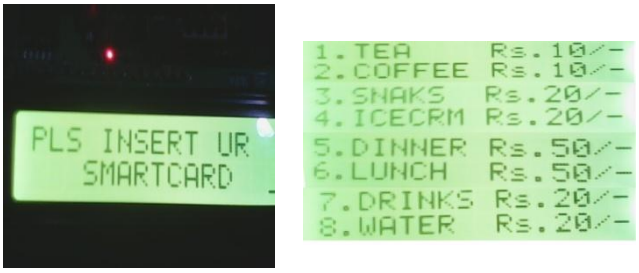
A. Numerical Example

This section illustrates a numerical example to explain how the proposed menu recommender works. A menu recommender to enhance customer service provides eight alternatives, each of which is characterized by two criteria: price (CR-1) and items (CR-2). The recorded data including price and items of the all ordered menus were used to construct the PFM model for an individual customer. Using the control criteria of the PFM model, the normalized value of each criterion and the value function can be obtained. Since a set of preferences is nonempty and contains more than one element, dominance relations have to be checked via a mathematical program.

B. System Implementation

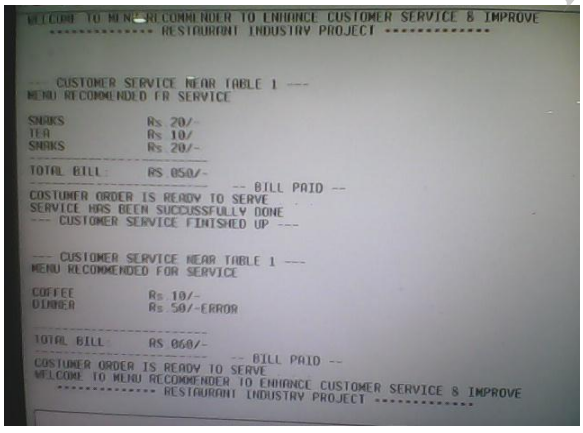
The user interface of the proposed system is built with Keil u-Vision and Embedded 'C'. Fig. 4(a)–(b) shows the system login interface, menu

information, and food inventory level, respectively. The ordering result, recommended result, and ordering information that are displayed in kitchen side are presented in Fig. 4(c)–(d), respectively.



(a) (b)

(c)



(d)

Fig. 4. (a) Login interface. (b) Menu information. (c) Ordering result. (d) Ordering information displayed in kitchen side.

C. Advantages

1. Fast response
2. Error free input
3. Easy to install
4. Use finger, fingernail, gloved hand, stylus or any soft tip pointer to operate.
5. Easy to clean & maintain.
6. Make computing easy, powerful and fun.
7. Compatible with window, Macintosh and Linux.

D. Disadvantages

1. Stress on human finger when used for more than a few minutes at a time
2. Problem to handle for illiterate people.

E. Applications

1. Time saving
2. Computer based training:

5. Conclusion

This menu recommender to offer customer-centric service to enhance customer service quality and improve restaurant industry competitiveness. It enables servers to immediately supply customers via their own RFID-based membership cards and then actively recommend the most appropriate menus for customers. On the other hand, customers can also use the smart card to pay bills instead of using cash. The proposed system enhances dining table service by enabling waiters to access customer information and make orders using the PDA. The PDA-based service unit enables customer orders to be instantly transmitted via zigbee to the kitchen for menu preparation. Expenditure information can also be sent to the cashier for bill preprocessing. Restaurant managers can access the database to evaluate business status anytime and make appropriate redeployments for food materials. All ordering and expenditure information is digitized for database storage, which allows restaurant owners to consider discounts or customer promotions based on expenditure statistics. Customers can thus appreciate high quality service, which in turn highly promotes enterprise image and increases business revenue for the restaurant.

The proposed menu recommendation procedure consists of creating the PFM model,

estimating the PWD relationships using the proposed HMPSO algorithm, transforming the dominance values into the strength of preference, and calculating the DD of menus for each customer. The greater the DD of a menu, the more it is preferred. An additional concern is that although the system provides recommendations only to members, the waiter also records the menus for other nonmember customers if the orders are made jointly. At the same time, the waiter convinces nonmember customers to join customer-centric service. The recommendation system is effective to foster customer relations and increase the working efficiency of waiters, while not affecting the waiter's benefits. A case study is conducted in two Taipei restaurants with a questionnaire survey to 30 waiters in terms of perceived ease of use, perceived usefulness, and BI toward using the proposed system based on the TAM and another survey to 90 customers in terms of outcome quality being administered. The survey results verified the effectiveness of the proposed system in providing customer-centric service, thus facilitating the developments of smart card-related industry, ultimately raising overall global competitiveness. We will conduct a full-scale experiment in the near future with more restaurants and improve system functions based on the experimental results and participants' feedback to meet practical application requirements. In addition, user and customer behavior and social impact after the adoption of information systems and technologies need to be further studied in the future. Furthermore, a comparison between recommendations made by the waiters and by the recommender system will also be conducted.

6. References

1.Tan-Hsu Tan, Ching-Su Chang, and Yung-Fu Chen, "Developing an intelligent e-Restaurant with a menu recommender for customer-Centric service" IEEE Transactions On Systems, Man, And Cybernetics—Part C: Applications And Reviews, Vol. 42, No. 5, September 2012

2. Y.F. Wang, D. A. Chiang, M.H. Hsu, C.J. Lin, and I.L.Lin, "A recommender system to avoid customer churn: A case study," Expert syst. Appl., vol.36, no.4,pp.8071-8075,2009.

3. Y. Xiao, X. Shen, B. Sun, and L. Cai, "Security and privacy in RFID and applications in telemedicine," IEEE Commun. Mag., vol. 44, no. 4, pp. 64–72, Apr. 2006.

4. E. Budak, B. Catay, I. Tekin, H. Yenigun, M. Abbak, S. Drannikov, and O. Simsek, "Design of an RFID-based manufacturing monitoring and analysis system," in Proc. IEEE Int. Conf. RFID Eurasia, Sep. 2007, pp. 1–6.

5. T. C. Poon, K. L. Choy, H. K. H. Chow, H. C. W. Lau, F. T. S. Chan, and K. C. Ho, "A RFID Case-based logistics resource management system for managing order-picking operations in warehouses," Expert Syst. Appl., vol. 36, no. 4, pp. 8277–8301, 2009

6. http://www.garmin.com/products/gps35

7. V. Swapna , M. Firdouse Ali Khan, " Design And Implementation Of Ordering System For Restaurants" IJERT, Vol. 1 Issue 10, December- 2012