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DESIGN AND DEVELOPMENT OF AN E-RESTAURANT USING RTOS PROGRAMMING TO ENHANCE THE QUALITY OF SERVICE

***Kiranmai Ande, **NagaRaju Sonti**

**M.Tech Student,Vignan's Lara Institute of Technology and Science, Guntur, A.P., INDIA*
***Assistant Professor, Department of ECE,Vignan's Lara Institute of Technology and Science, Guntur, A.P., INDIA*

ABSTRACT

Generally, in normal restaurants the service is passive. Customers will be provided a menu containing a list of items. Waiters have to interact with the customers to take their orders and process them. This entire process involves enough time and requires more men. However, a high quality service system is discussed in this proposed paper. It consists of touch screen cum graphical liquid crystal display (GLCD) which acts as a menu recommender. These are arranged at each of the customer tables. An ARM controller module at kitchen section and a PC with real time operating system (RTOS) at billing counter are to be placed. A multi-point wireless communication network—Zig-bee network was created between the customer's tables, kitchen module and billing counters. This system enables customers to select their favorite menus just by tapping on the GLCD and that input is transmitted subsequently to the kitchen section for processing the order and to the billing counter for automatic bill generation. The PC at billing should have frontend software and in this application VB.net was used for developing frontend. Obtained experimental results indicate that the proposed system has a potential in providing high quality customer service.

Keywords:*E-restaurant, Real time operating system (RTOS), Zig-bee wireless network, ARM controller, touch screen menu, front-end software.*

INTRODUCTION

Conventional restaurant service such as making reservations, ordering meals, processing the orders and delivering them takes place with the interaction between the waiters and customers. Before processing the orders waiters must directly interact with the customers. During the bill payment, amount to be paid by the customers is calculated by the cashier. Although this procedure is simple, customers often need to wait to give their order during busy hours and waiters may fail in prioritizing customers. Also there will be a chance of occurrence of errors in processing orders and bill calculation. This ultimately leads to degradation of overall service quality. Therefore, embedding advanced technologies for improving service quality is attaining much interest in recent years.

Number of efforts have been taken by restaurants to embed information and communication technologies such as personal digital assistant (PDA), radio frequency identification (RFID), touch screen, wireless local area network (LAN), etc., to enhance dining experience. PDA was

adopted into conventional restaurant service system to replace the way of taking orders by using pen and paper. However this method has known limitations such as requirement of training of working staff, need of attendants to operate and inefficiency during busy hours. Another recent technology RFID, has been adopted into restaurant system to identify the customers and to extract their preferences through their buying behaviors and histories of purchased items. Though it can identify the customers actively, it can do that only when the scan is successfully done. Customers must be provided with RFID based membership card to get identified. Wireless LANS are also proposed for the restaurants in enhancing the service quality. This is costlier and requires continuous and uninterruptable internet facility.

In order to overcome these limitations zigbee network has been introduced in commercializing an e–restaurant. For instance a restaurant is equipped with a touch screen menu, a wireless communication network interfacing user's input, kitchen module and automatic bill generation unit that system will automatically enhances the overall service quality.

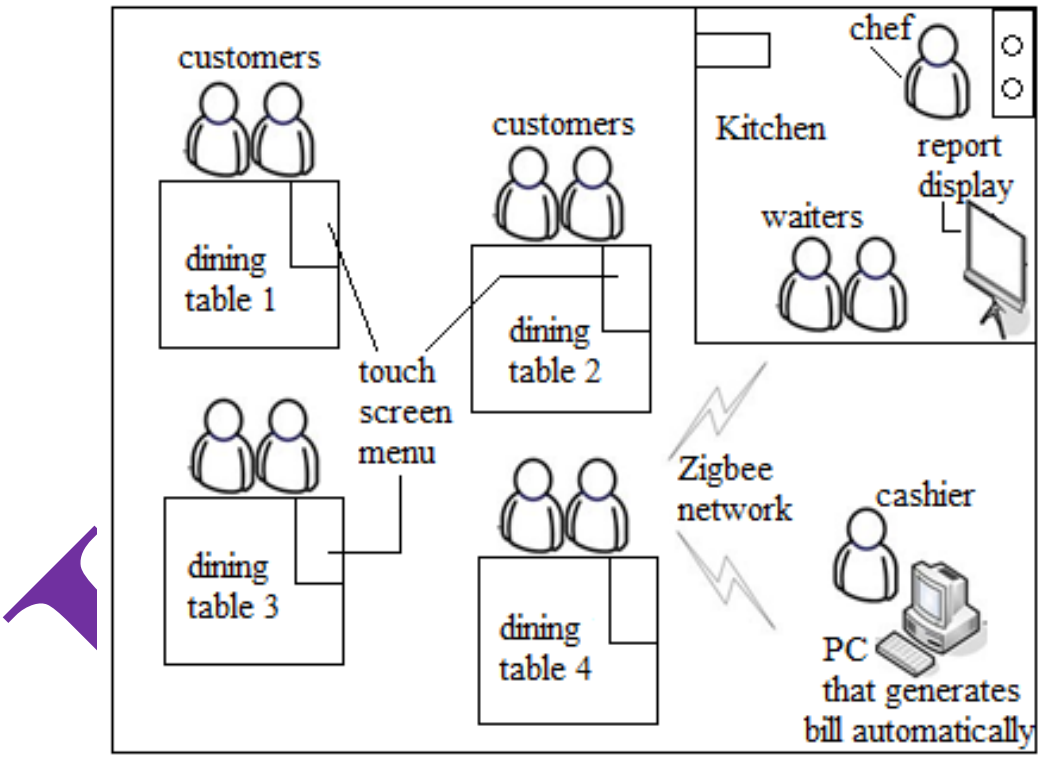

Figure 1: Frame work of an E-restaurant to enhance quality of restaurant service

ZIGBEE TECHNOLOGY

The growth of Telecommunication in the world has brought about the need for regular update, research and findings, to meet the demands of the global world. Since the technology of the global world is fast changing, it therefore brings about a very high level of competition and challenges among developers, programmers, systems engineers, telecommunication engineers

and a host of others. With the rising demand of home automation and sensor network, the Zigbee protocol has been identified to target on low power devices, Personal Area Network (PAN) and sensor nodes. At a technical level, it is more reliable, supports larger networks and is more fully featured.

The communication layer of Zigbee is at level 3 and upper layer in the OSI model. Zigbee provides a network topology to let a network of devices communicate between them and to set extra communication features such as authentication, encryption, and the association and in the upper layer application services. A reactive Ad-hoc protocol has been implemented to perform the data routing and forwarding process to any node in the network. The main application of Zigbee is clustering. Zigbee has a lot to offer in industrial applications such as low cost deployment and redeployment, mesh networking to cover entire industrial plants and factories, an open standard with multiple vendors, battery operation.

In this e-restaurant service Zigbee is mainly adopted because of its sole features such as multi point wireless communication, low power consumption and its range of coverage which is appropriate for the application. Its range is 50m (typical) and data rate is 250kbps at 2.4GHz (an be varied based on the application's environment).

HARDWARE DESIGN AND WORKING

Hardware design of the E-restaurant can be categorized into three modules. One at dining section, second at kitchen section and the third at billing counter. All these three modules are connected through a wireless communication network.

DINING SECTION

This module consists of an ARM controller, touch screen cum GLCD and a zigbee unit. It should be placed at the customer's tables and is used by the customers for giving input. They just have to tap on the touch screen showing the list of items. This input is read by the controller and is given to zigbee unit which transmits this data to the remaining modules through wireless communication network. On-board ARM controller consists of MAX232, serial communication ports, zigbee unit and a common power supply unit.

LPC2148 is used as MCU in this design. Because of the advanced 32 bit architecture, it can detect changes as low as 3 millivolts and faster compared to PIC's and other 80XX series micro controllers. Inbuilt ADC is an added benefit of LPC2148. The LPC2148 has 512 kb bytes of RAM, three timers and a 32 -bit A/D converter. It has RISC architecture and can use oscillators, thus it is ideal to be used as an embedded system. The sampling rate of the system is 1 KHz which means 1000 simples were acquired in a time period.

The MAX232 device is a dual driver/receiver that includes a capacitive voltage generator to supply EIA-232 voltage levels from a single 5-V supply. Each receiver converts EIA-232 inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V and a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels

into EIA-232 levels. The driver, receiver, and voltage-generator functions are available as cells in the Texas Instruments Lin ASICE library.

KITCHEN SECTION

This module will be used by the cooking staff and serving staff. It comprises a controller, an LCD display unit, a switch, zigbee unit and a buzzer. All the peripherals are interfaced with controller. Input given by the customers reach the kitchen section through wireless zigbee network and will be displayed on the LCD screen.

BILLING COUNTER

One of the most effective part of a restaurant service is automatic bill generation. At the billing counter a PC has to be placed and that should receive the customer's input. This generates the bill automatically at the time of payment. In the previous models LAN was used to receive users input. Unlike those previous models here zigbee wireless network is being used to receive the data. Visual Basics .net (VB.net) is used for the development of frontend frame work in the PC.

SOFTWARE DESIGN

The software tools used in designing this E-restaurant are Keil UV5, flash magic, topwin and VB.net.

SOFTWARE PROGRAMMING TOOLS:

The Keil Microcontroller Development Kit (MDK) helps us to create embedded applications for ARM Cortex-M processor-based devices. MDK is a powerful, yet easy to learn and use development system. MDK Version 5 consists of the MDK Core plus device-specific Software Packs, which can be downloaded and installed based on the requirements of our application. MDK Core includes all the components that are needed to create, build, and debug an embedded application. The Pack Installer manages Software Packs that can be added any time to MDK Core. To get access to devices and example projects we should install the Software Pack related to our target device or evaluation board. In this proposed e-restaurant programming is done by writing it in RTOS. Other than general embedded C programming in keil, RTOS programming contains events and tasks that helps our application to perform in a more efficient way. It enables different tasks to perform simultaneously.

Programming part for the application that has done in the keil is verified and ported to the ARM board using a tool called flash magic. Flash Magic is Windows software from the Embedded Systems Academy that allows easy access to all the ISP features provided by the devices. It provides simple and clear user interface and only obtains access to the selected COM Port when ISP operations are being performed. Topwin is another tool to port the program onto the controller board from the keil. Flash magic allows porting only onto the ARM boards. To dump the program on the microcontroller of 80xx series we have to use topwin. In this the IC is detached from the PCB and placed onto the dumping board to dump the program.

FRONT-END SOFTWARE:

At the billing section a frontend software has to be developed in a PC which has to receive customer's order and generates the bill automatically. Visual basics .net (V.B.net) is used for the development of frontend software. Visual Basic is a computer programming and integrated development environment (IDE)-enabled system developed by Microsoft. It is a high-level programming language with an integrated implementation of .NET Framework. Visual Studio is the next-level pack for further development of Visual Basic.NET using integrated development environment (IDE). More important is to know about VBC.EXE, which is a freeware command line compiler. It was included in the .NET Framework SDK.

WORKING ALGORITHM

Arrival of customers

↓

Customers are escorted to a table

↓

They are presented with a touch screen menu recommender

↓

Customers give their orders by tapping on the touch screen menu

↓

Customer's input is sent to kitchen and to the billing counter via multi-point wireless zigbee network

↓

A message is sent from the kitchen to the customer's table when the order is ready (Also useful in self-service system)

Waiters serves the food

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Customers tap on close switch after completion of their meal

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PC at the cashier receives this input and automatically generates the bill of that particular table

↓

Customers pay the bill and checks out

DISCUSSION AND RESULTS

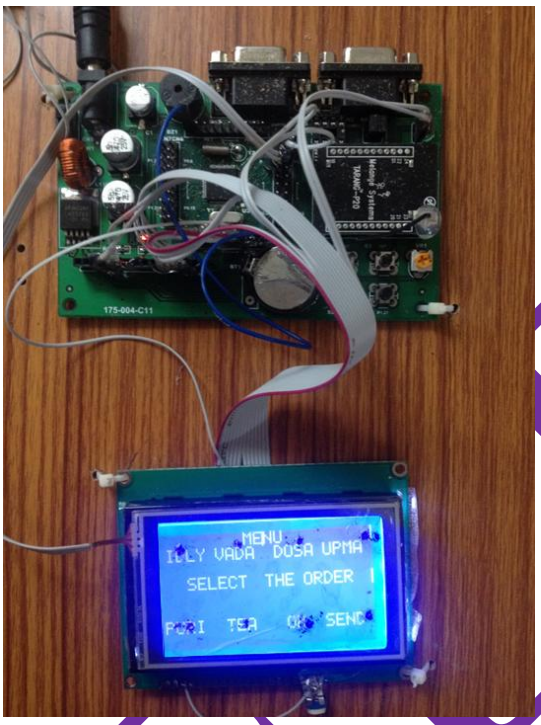

Figure 2: Hardware module at dining tables (contains inbuilt ARM board and touch screen cum GLCD)

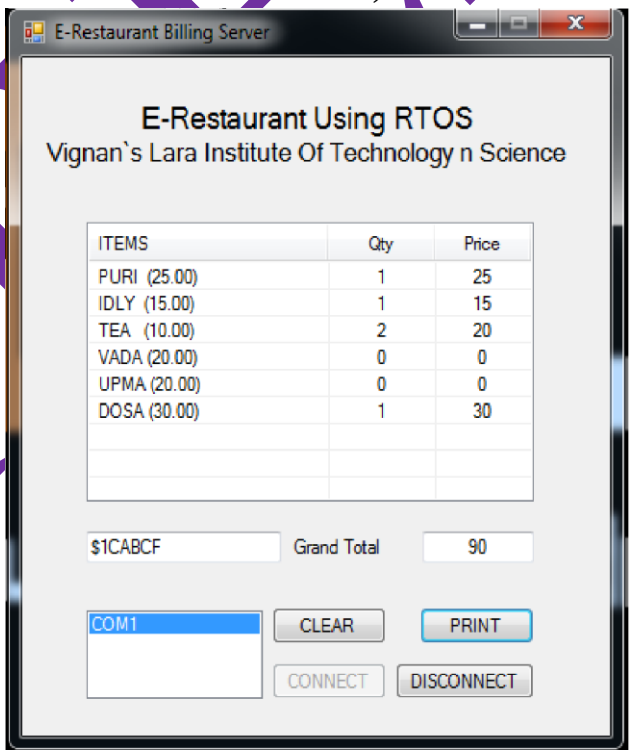

Figure 3: Output at the billing counter. Window showing total bill of items selected by the customer at a particular table.

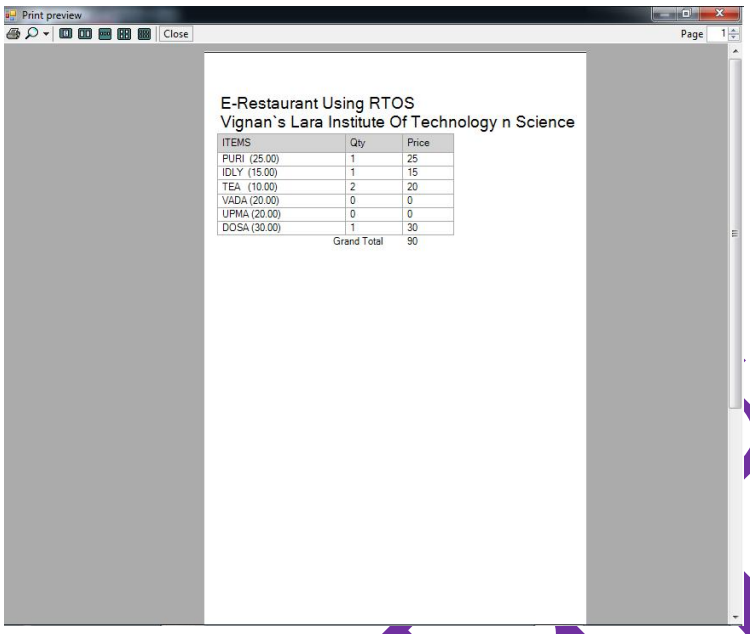

Figure 4: Window showing print preview of the final bill i.e., generated.

Fig 2 shows the hardware module at a particular customer's table. It consists of a graphical LCD with a touch-screen interface that enables customers to tap on the screen for the selection of items. ARM controller processes that input and sends it to the other modules though the wireless zigbee network. This is received at the kitchen module which is used my cooking/ serving staff and allows them to know the customers choices without directly interacting with them. Fig 3 is the screen shot showing the desired output at the billing counter. It shows the selected items of customers at a particular table and the generated bill of the items selected. Fig 4 is the print preview of the final bill.

CONCLUSION

E-RESTUARANT system that saves time and improves quality of restaurant service was designed, developed and tested accordingly. The survey results verified the effectiveness of the proposed system in providing enhanced customer centric service. Zigbee is the main communication network which performs the whole operation in the system. This should be conducted with more experiments in the near future to meet the practical application requirements. Final goals of this paper is to reduce time and provide improved quality of service, ultimately raising overall global competitiveness. Furthermore, it is believed that these kind of systems will get more benefited.

REFERENCES

[1] Y. Wang and G. Shen, "Zigbee Wireless Sensor Network Technology and Application," Ship Electronic Engineering, 10th ed, vol. 28, pp. 32-34, 2008.

[2] ZigBee Alliance, ZigBee Specification[z]. Version 1.0, http://www.ZigBee.org, 2006.

[3] ShizhuangLin; JingyuLiu; YanjunFang; Wuhan Univ., Wuhan"ZigBee Based Wireless SensorNetworks and Its Applications in Industrial", IEEE International Conference on Automation and Logistics, 2007.

[4] AngZhimin, JIN Haihong, FAN Zhiguo, DUAN Yong, "WSN Node Design and Communication Realization Based on ZigBee protocol [J]," Modern Electronics Technique, 2007.

[5] Y. PENG, LI Yingli et al, "Method for Saving Energy in Zigbee Network," WiCom' 09. 5th International Conference on, pp. 1-3, 2009.

[6] Tan-Hsu Tan, Ching-Su Chang, and Yung-Fu Chen, "Developing an Intelligent e-Restaurant With a Menu Recommender for Customer-Centric Service," IEEE Trans. Syst., Man and Cybernetics, VOL. 42, NO. 5, 2012.

[7] Soon Nyean Cheong, Wei Wing Chiew and Wen Jiun Yap, "Design and Development of Multi-Touchable E-Restaurant Management System," IEEE International Conference on Science and Social Research, Kuala Lumpur, Malaysia, 2010.

[8] Song-Ching Fan a, An-Shin Shia a, Jason C. Hung, "A Study on the Restaurant Industry Implementing E-Commercialization- Taking Dragon Food Company as an Example," IEEE 2010.

[9] Hung-Wen Tung and Von-WunSoo, "A Personalized Restaurant Recommender Agent for Mobile E-Service," IEEE International Conference on e-Technology, e-Commerce and e-Service, 2004.

[10] Ching-Su Chang, Che Chen Kung and Tan-Hsu Tan, "Development and Implementation of an E-restaurant for customer centric service using WLAN and RFID Technologies," IEEE Proceedings of the Seventh International Conference on Machine Learning and Cybernetics, Kunming, 2008.

[11] 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.

[12] W. S. Yang, H. C. Cheng, and J. B. Dia, "A location-aware recommender system for mobile shopping environments," Expert Syst. Appl., vol. 34, no. 1, pp. 437–445, 2008.

[13] D. H. Choi and B. S. Ahn, "Eliciting customer preferences for products from navigation behavior on the web: A multi criteria decision approach with implicit feedback," IEEE Trans. Syst., Man, Cybern. A, Syst. Humans, vol. 39, no. 4, pp. 880–889, Jul. 2009.

[14] Jin-Shyan Lee, Yu-Wei Su, and Chung-Chou Shen " A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi," The 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON) Nov. 5-8, 2007, Taipei, Taiwan.

[15] H. Xu, B. Tang, and W. Song, "Wireless food ordering system based on web services," in Proceedings of Second International Conference on Intelligent Computation Technology and Automation, Washington, USA, pp. 475–478, 2009.