Automated cashier and product supply system for fast-food industry

Bauyrzhan Ospan*

Nazarbayev University
bauyrzhan@ospan.pro

Abstract

In this paper the author proposes the basic concept of the usage of the automated terminal with the embedded electromechanical system of a product supply to substitute the cashiers in fast-food restaurants. The structure of terminal consists of two main blocks, cashier and supply parts. There are two interfaces, one for users and the other for restaurant workers. The inner terminal communicates with restaurant employee with display of orders and mini button panel for product supply. The outer terminal communicates with user by touch-screen graphical interface, point of sale terminal, cash in/out slots and receipt printer. The process of product supply is modified with a wireless queue pager system and a mini conveyor of the tray. There is a hidden direct command line interface and a web interface for administrator to repair or modify the system.

I. Introduction

Throughout the history we see that technology has been replacing human labor in many areas. Nowadays, it is hard to imagine many people in developed or highly developing countries travelling long distances only on foot, using only human or animal power in heavy work and calculating complicated tasks in economics without the help of computers. Definitely, machines improved people's life. The improvement is true for the service sector, and the improvement is still going on. Latest news implies that Amazon is striving to get drone-delivery despite the strict laws of the US government. It also suggests that drone-delivery can benefit Amazon's costumers (Shane 2015).

Using computers to calculate income, outcome and orders helped to increase quality and efficiency of the service. Nevertheless, it is not perfect yet. Human factor still remains an unsolved problem in fast food, especially the issue of waiters and cashiers, and their relationship with costumers. Many people visit fast food restaurants. They may belong to different classes, races, religions, nations, cultures and ethnic and linguistic groups. Some of them may be tired, annoyed, or have other problems. None of them is safe from conflicts with waiters and cashiers. The conflicts may arise from religious, racial or other type of intolerance or misunderstanding between costumers and waiters or cashiers in fast food restaurant. According to Bailey, for instance, the conflict between Korean immigrant retailers and African American costumers in the United States arose because of cultural and racial differences or misunderstandings. This problem has lasted for about a decade (Bailey 1997).

The problems may or may not be caused by waiters and cashiers, but from customers, nevertheless, it still remains. In addition, they become more important for Kazakhstan as Expo 2017 gets closer: In 2017 Kazakhstan is expecting to receive many foreign guests (Kantchev 2014). Possible conflicts or misunderstandings between clients and service workers in fast food restaurants can be solved by implementing robot waiters and cashiers with touch screens in fast food restaurants. By replacing one party of the conflicting dyad, the waiters

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and cashiers, we can solve the problems. The idea of implementing technology in fast food restaurants is new, but not something unreal. As Giammona noted, McDonald's is trying to implement "touch-screen kiosks" which will allow customers to order food without the interference of waiters and cashiers (Giammona 2015). McDonald's idea is only about touch screen kiosks, but the latter idea is more creative - robot waiters and cashiers with touch screens on them.

II. Overall system characteristics

Fig. 1. shows conceptual design of the automated cashier and product supply system for fast-food industry. The outer terminal (block 1) communicates with user by touch-screen to receive an order, accept a payment, print a receipt and issue a pager of automated queue. The inner terminal (block 2) has a display that indicates the order for kitchen worker and mini touch-screen panel for receiving a commands from kitchen employee. The system of product supply (block 3) has a automated conveyor that supply product for user with automated doors and a receiving point for a pager.

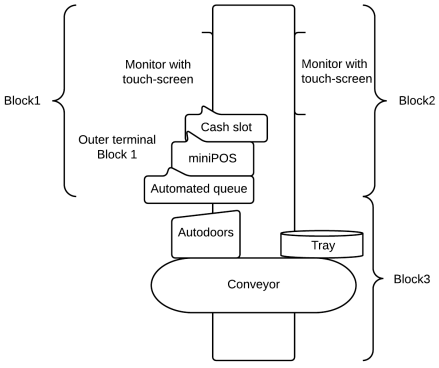

Figure 1: Conceptual design

Fig. 2. shows the functionality of the system by UML behaviour block diagram. The user makes order by using electronic menu with help of virtual assistant. Then user makes a payment by electronic card or cash. System gives changes from cash in operation by outputting cash through cash out slot or by electronic applications such as pay for mobile services or send to a bank account of the user. User takes a receipt from printer and mini pager of the electronic queue. The display in the inner terminal indicates the new order. The kitchen worker encases the order to a tray on the conveyor and inputs to the system by mini touch-screen panel that order is ready. The pager outputs that the order can be retrieved by vibration. The user places pager to the special pager slot. The system opens conveyor doors and energizes the conveyor motors till the tray will locate at the product supply table. The user takes the tray. System closes the doors.

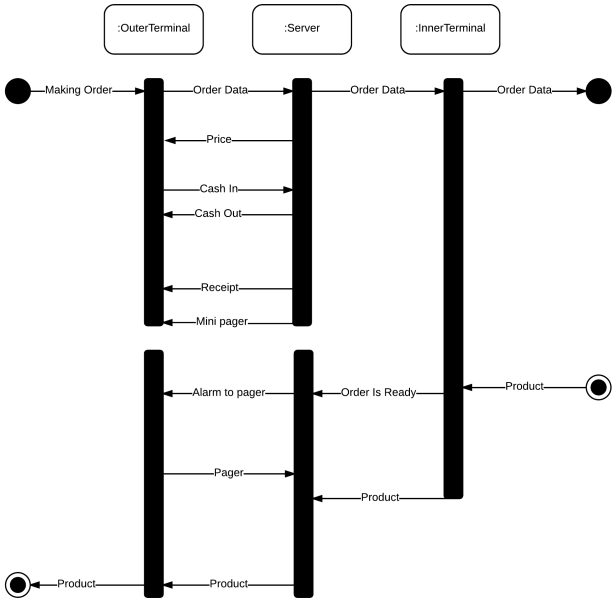

Figure 2: Behaviour block diagram

Fig. 3. shows user cases of the system. User has a abilities to create make a order, cancel the order, reorder, make a payment by a banking card, make a payment by a cash, take change by a cash or send a change to the mobile service account or bank account, take a pager of electronic queue and retrieve the order. Worker of a kitchen has a ability to indicate the order on the monitor, put the order to the tray and send it to the output by selecting it in the list of orders.

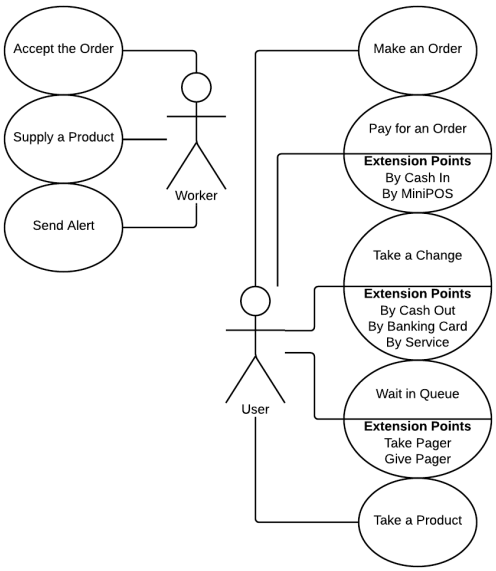

Figure 3: User case diagram

III. Cashier block

Overall computation of the system will be hold on the microcomputer with periphery I/O modules. The low cost and high productivity Raspberry Pi 2 Model B has all characteristics to be used in the system. It has full HDMI port to output the video to displays, USB ports to communicate with peripheral systems and audio port to communicate with mini POS terminals. There is a ability to install Linux distributive Raspberian (Debian based) to create a control unit of the system. There is Ethernet input in the Raspberry Pi 2 Model B that will be used as a internet interface of the system to communicate with bank account and send monitoring data to web interface of the manager of the fast-food restaurant (Bray 2015).

The communication between user and system holds by touch-screen panel on the top of the terminal. Tiny camera will detect the user and the system will welcome the user to use the system.

There are some advantages to use HTML5 based graphical user interface. There are a lot of different technologies to create eye candy beautiful and user friendly interface by using CSS and JavaScript. The backend technologies used in HTML5 like PHP can be used to communicate with other APIs and peripheral of the system. The HTML5 based user interface can be easily moderated and upgraded (Anthes 2012).

One of the main functions of the automated cashier is to take a payment from users. The usage of the mini POS banking terminals has some advantages in compare to standard POS terminals. First of all, the price of the mini POS is 8 times lower the price of the standard POS terminals. The second advantage is that the software used to communicate with mini POS is made on Android, which can easily ported to Debian based Linux distributives like Raspberian of the Raspberry Pi (Hodzic 2012). The second type of the payment is a cash in and cash out slots just like in the ATMs.

IV. Product supply block

The system will use wireless guest pagers for automate the queue. The Apollo Gold pagers have some advantages to prefer them. First of all they are programmable so can be used in automated system as a embedded part. They can vibrate, alarm and flash with LEDs (Alibaba).

The conveyor is embedded to system because of the next purposes. The tray with product has to be supplied to user without help

of the kitchen worker. The system has to be closed, such that worker of the kitchen never sees the user and vice versa. There is used gravity type mini belt structure conveyor for food supply from AMC System Technology Co (AMC).

There is a need to use a programmable logic controller in this system. There is a danger that a break in electric system of the conveyor or pager control box can lead to break of the all system. The best way of safe the main control block from current overflow is to put a communicator between him and actuators. Micro800 type relay like programmable logic controllers of the Allen-Bradley are the suitable solution of the problem. The 2080 Communication Plug-In Module in cooperation with the 2080 Analog and Digital Plug-In Modules can output AC motors of the conveyor and communicate with microcontroller with RS-232 and RS-485 protocols (Rockwell).

V. Results and discussion

The main functions of the cashier of the fast-food restaurants can be substituted by the automated cashier system. The results of this paper can be used as a base for constructing the prototype. Advantages of the automated cashier are that the system has a ability to automate the processes of the food supply and service that leads to the increasing the profit and quality of the service (Lauren 2005).

The only risk of the system is the human psychology factor that can create negative relationship to the system (Lee 1994). The one of the smart ways to control or eliminate this risk is to create user friendly interface with human-like "ghosts" (Walker 1994), which are the graphical or voice interfaces that copies the human behaviour, for example popular "Siri" voice interface of the Apple (Aron 2011).

There are different ways to create such system even in design model. The parts of the system can be changed to other manufacturers and even to other concepts.

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