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ScienceDirect

Procedia CIRP 62 (2017) 106 – 110

www.elsevier.com/locate/procedia

10th CIRP Conference on Intelligent Computation in Manufacturing Engineering - CIRP ICME '16

Staff motion reduction at a Japanese restaurant by kitchen layout redesign after kitchen simulation

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Abstract

This study was conducted to decrease the moving distance of kitchen staff at a Japanese cuisine restaurant store by remodeling the kitchen layout according to simulation results. Restaurants must reduce moving distance because it deeply affects employee fatigue. Furthermore, moving distance reduction is important for customers because it reduces cooking times and therefore waiting times. Conventionally, kitchen architects conduct kitchen layout design mainly to maximize cooking capacity, minimize investment, and optimize cooking capacity and customer orders, not to minimize staff burdens. Reducing kitchen staff burdens is discussed by experienced chefs, but they cannot assess motion in a redesigned kitchen. A kitchen simulator is applied to simulate moving distances of individual kitchen staff members in an existing kitchen of a Japanese cuisine restaurant. Based on simulation results, a kitchen layout is remodeled by a kitchen architect, a chef of the restaurant, and a supervisor to reduce motion for tasks. To confirm the efficacy of the remodeled kitchen, actual moving distances of kitchen staff members were measured using a pedometer before remodeling, immediately after remodeling, and 2 months after remodeling. Results show that actual moving distances were reduced to the level of the simulation at 2 months after remodeling. However, moving distances lengthened immediately after the redesign because kitchen staff members were unaccustomed to the new kitchen layout. They required some time to become accustomed with new kitchen layout. Moreover, kitchen staff members continually change the placement of kitchen utensils and ingredients because they seek better placement of cooking utensils and ingredients for the new kitchen layout. To resolve the difficulties, site remediation such as quality control activities are necessary to promote moving distance reduction.

Peer-review under responsibility of the scientific committee of the 10th CIRP Conference on Intelligent Computation in Manufacturing Engineering

*K*eywords: Service engineering, restaurant, simulation, moving distance

1. Introduction

In the 1970s, the Japanese restaurant industry introduced the chain store system to improve cooking operations of restaurants [1] [2]. The system introduced a central kitchen to cook dishes together and reduced the total number of kitchen staff workers at restaurants. Moreover, the system simplified menu assortments to reduce cooking operations and cooking machines at restaurants. Menu simplification can reduce dependence on experienced chefs and increase the usage of part time staff at restaurants. Consequently, Japanese restaurant companies have rapidly increased the total number of restaurants and sales revenues. The industry has become a key industry, hiring over 4 million staff members. The industry market size reached 3 trillion yen in the 1990s [3].

In the 1990s, the industry strove to improve cooking operations at restaurant kitchen. For instance, production capacities and numbers of cooking machines were assessed and optimized to satisfy customer demands [4]. Moreover, new cooking devices were adopted to reduce the number of kitchen staff members and to increase production capacity. Particularly, sushi cooking machines and sushi serving systems increased sushi production capacity and reduced floor service workers at sushi restaurants [5].

Peer-review under responsibility of the scientific committee of the 10th CIRP Conference on Intelligent Computation in Manufacturing Engineering
doi:10.1016/j.procir.2016.07.007

In the 2000s, the restaurant industry introduced a Process Management System (PMS) based on a POS system. The POS indicates order information by an order sheet individually: dish-by-dish. Therefore, kitchen staff members can count the dishes when they cook them simultaneously. PMS calculates the total dishes the staff should cook. Therefore, staff members need not calculate them [6]. Kitchen staff can improve cooking speed and capacity using PMS.

Although the restaurant industry introduced these systems and machines, some difficulties persist. First, conventional studies do not consider specific service characteristics. Service is intangible. Therefore, it cannot be stocked. Consequently, services must be produced simultaneously to meet a customer's request. Moreover, customer demand changes day-by-day. Customer demand fluctuation should be considered if a service provider intends to raise labor productivity [7].

The authors developed a kitchen simulator to design a restaurant kitchen layout to optimize labor input and to meet fluctuating customer demand using POS data. Based on simulation results, a restaurant kitchen was remodeled to improve cooking speeds because waiting time is an important factor underpinning customer satisfaction [8] [9] [10]. Another restaurant kitchen was remodeled to reduce cooking staff work hours and to improve labor productivity [11].

However, neither conventional studies nor studies of kitchen remodeling using simulation examined the workloads of staff members although worker fatigue degrades their performance. The restaurant industry should improve cooking operations not only for labor productivity but also for reduction of the workloads of staff and ES [12].

To resolve these difficulties, the restaurant kitchen was remodeled to reduce the necessary walking distance of cooking staff. The moving distance of the cooking staff was simulated to reduce the number of paces they must take, because walking deeply affects staff fatigue. Based on simulation results, the kitchen layout and cooking machines were remodeled to reduce the moving distance of kitchen staff members. The total number of steps before remodeling, immediately after remodeling, and 2 months after remodeling were recorded to assess the efficacy of the simulation-based improvement of the layout.

2. Restaurant kitchen remodeling using simulation results

This study was conducted at a Japanese restaurant (Osaka, Japan). First, the moving distance in the existing kitchen layout was simulated using a kitchen simulator. Figure 1 portrays the existing kitchen layout of the restaurant. Order data, and work hour data of the restaurant were recorded for a week to simulate the moving distance. A POS system recorded order data (POS record order-received time, kind of dish, and cooking position). An attendant management system recorded work hours: the working position, time going to work, and time leaving work. The cooking machine placement was measured at the kitchen. A placement database was produced to include size, front, position, and cooking capacity data.

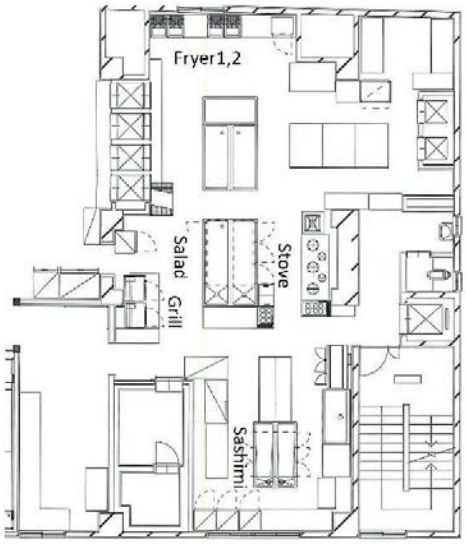

Fig. 1. Layout of the existing restaurant kitchen.

Based on the simulation results, the kitchen designer, store manager, chef, and supervisor discussed the kitchen layout difficulty, number of cooking machines, and cooking position placement. The kitchen designer redesigned the kitchen layout according to the number of cooking machines, the results of

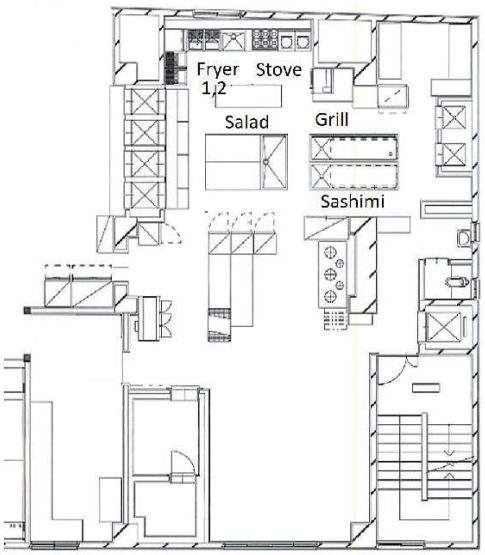

Fig. 2. Layout of the remodeled restaurant kitchen.

the discussion and the simulation. Figure 2 shows the remodeled restaurant kitchen layout. Moving distance of the