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Research Article

Designing a Self-cleaning Table and Alcohol Spraying On the Table Automatically in Fast Food Restaurants to Prevent the Spread of Coronavirus

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Abstract: Smart restaurants are being developed today. As an integral part of the restaurant system, designing the table is bound to face a qualitative leap. As people yearn for a better, more comfortable and convenient life, the development of the table in smart restaurants will become more intelligent and humanized. At present, people are in great demand for smart service and cleaning in restaurants, and they hope that the table will be completely clean after eating or before ordering food, and that no food debris will remain on the table. Especially in this period due to the spread of Corona virus while human interactions should be reduced, the lack of table cleaning is intelligently visible. currently, most restaurants and fast foods, whether smart or ordinary, use humans to clean up food waste, which increases the likelihood that restaurant staff will over-treat guests and customers.

In this plan, the moving part (chariot) is mounted on the table, which automatically collects food waste and directs it to the trash can installed next to the table. The Arduino board is used in a closed-loop system to control the moving part and the trash can lid. The moving part of the table collects food waste along the way and disinfects the table on the way back to the original point through alcohol spraying.

Keywords: Self-cleaning table, Coronavirus, Arduino, Close loop, Infrared sensor

1. Introduction

The smart restaurant market has entered a period of rapid development. Therefore, people are looking for more opportunities to use more features such as smart desks to improve the quality of life. But to date, there have been no such products. In most smart restaurants, robots are responsible for cleaning the table. On the other hand, due to long working hours, low wages, unwillingness to work as a cleaner, workforce shortage has been a constant problem for food court cleaning and maintenance tasks in recent times [1]. Recently, many robotic platforms are designed for different cleaning application which include floor cleaning [2,3], facade cleaning [4], staircase cleaning [5], pavement cleaning [6,7] and garden cleaning [8]. However, these robot architectures could not support table cleaning and maintenance tasks. In this context, HSR can be a viable candidate for this task [9,10]. However, configuring HSR for cleanliness inspection and food litter collection is a challenging task [11]. Because, the robots need optimal food litter (food scraps, stains, spillage) detection system and real-time planner algorithm to execute the cleaning and inspection task [12]. Various techniques have been developed for cleaning robots to recognize the different class of litter (garbage, dirt, liquid spillages, and stains) and compute the cleaning strategy. Among them, computer vision-based techniques are widely used in cleaning robots for recognizing the litter and compute the cleaning action [13–17]. Jinhong Dua et al designed an intelligent mechanical table cleaner that mechanically collects dishes on the dining table [18].

The purpose of this study is to design a smart table for collecting food waste and disinfecting the table by spraying alcohol to prevent human interaction and the spread of coronavirus. In this plan, in addition

to saving time, it reduces human interactions and the table is thoroughly cleaned and disinfected to prevent the spread of Coronavirus.

Self-cleaning table design

This table consists of three parts: fixed, movable and alcohol sprayer, and trash. The moving and disinfecting part of the table includes 1- main body, 2- moving system, 3- electronic circuits, and 4- disinfecting part. The body of the table is designed and built in such a way that six infrared sensors are installed under the table and in front of each chair, which detects the presence of the customer and the number of customers. And on the table, two rails are designed and built to guide the wheels of the moving part. The moving system includes the Arduino Nano board and the DC motor driver. The powertrain consists of two DC motors with a gearbox, two 12-volt rechargeable dry batteries, and two round weeds that move on rails on the table and move back and forth (Figure1-2). This automatic self-cleaning table uses Arduino Nano boards for control. The disinfection part is also installed in the upper part of the moving part and includes an alcohol storage tank, pump, transfer hose, and nozzles.

The side bucket of the table is controlled using a DC motor, gearbox, scrubber to close the arm of the bucket door, and the control circuit inside the box under the table. The trash can lid is also connected to the DC motor with four side guide rods.

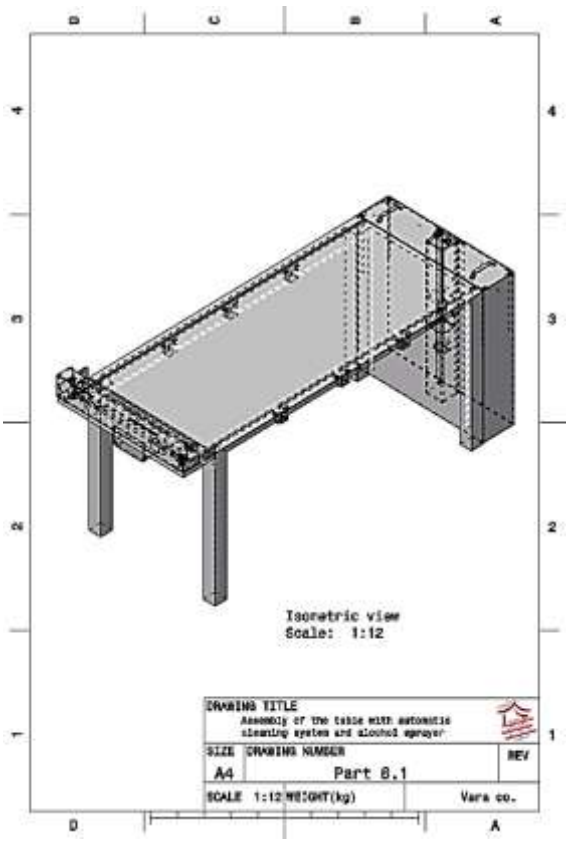

Figure 1. Assembly of the table with automatic cleaning system and alcohol sprayer

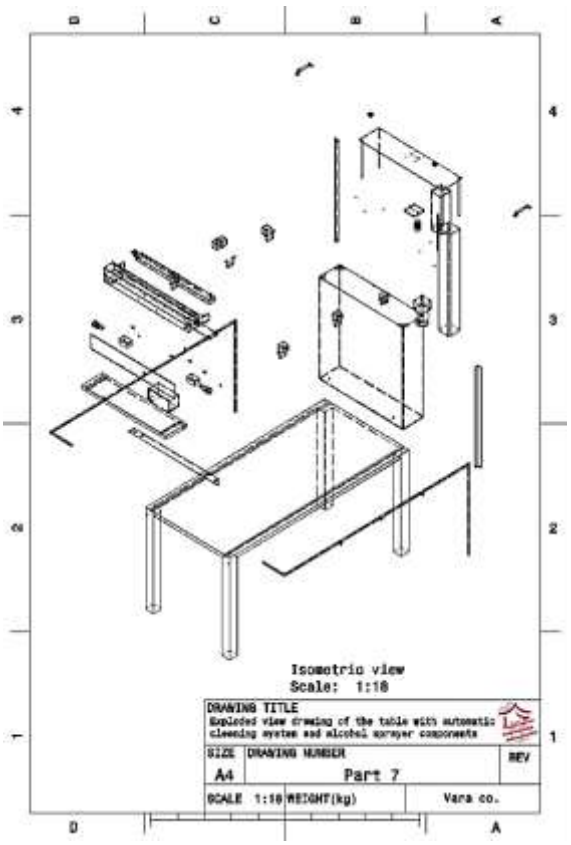

Figure 2. Exploded view drawing of the table with automatic cleaning system and alcohol sprayer components

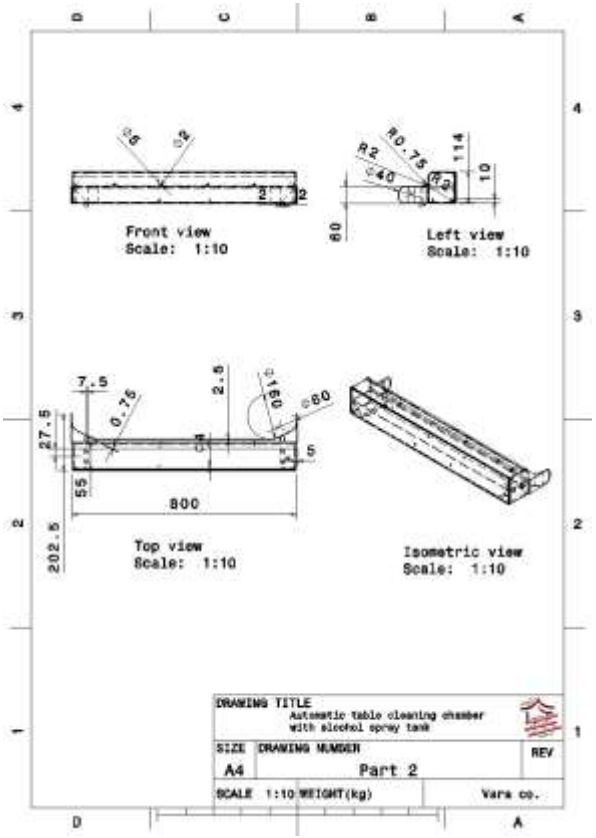

Figure 3. Automatic table cleaning chamber with alcohol spray tank

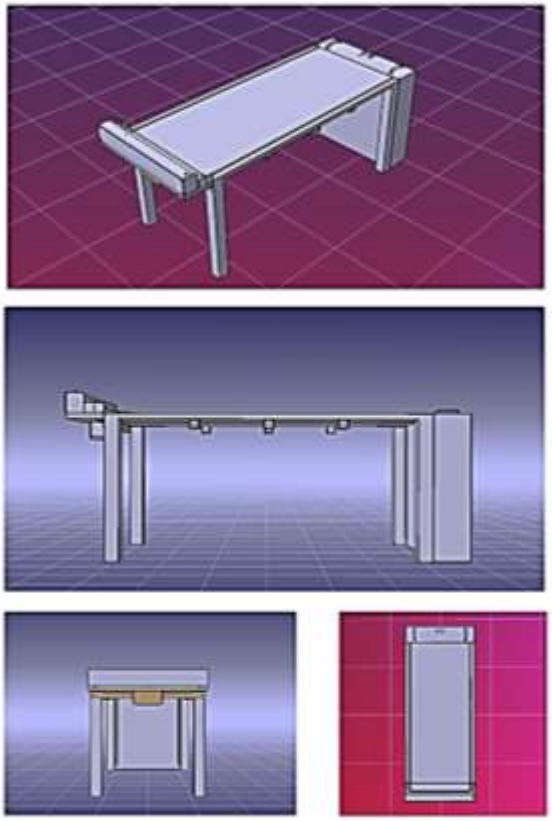

Figure 4. 3D isometric view of the table from four directions

2. Methods smart table

In this design, a moving part (chariot) is installed on the table, which automatically collects food waste and directs it to the trash can installed next to the table (Figure 3). The Arduino board is used in a closed-loop system to control the moving part and the trash can lid. There are 6 infrared sensors in front of each chair under the table to count people and determine whether or not they are used for initial servicing and garbage collection automatically. After each of the six seats is vacated, the cart on the side of the table set begins to move, and parallel to it, the trash can door on the left side of the table begins to open to allow food leftover from the table. The cart moves into the trash can, and when the cart returns to its original point, the disinfectant begins to spray alcohol on the table surface (Figure 5), and the trash can lid begins to close and close. To prevent the chariot from deviating on the table, rails are provided that the chariot moves inside these rails.

The speed of the chariot is adjustable to increase or decrease the cleaning time according to the number of customers and the crowded restaurant. Also, this table has the ability to connect to the image processing system and restaurant cameras, to work with image processing and machine vision. Electricity for the chariot and trash can is provided by dry batteries installed on the table. This table can be connected to the automatic control system of fully mechanized restaurants with image processing and can be connected wirelessly to the control part of mechanized restaurants through the HMTRP wireless board.

Figure5. Self-cleaning table method

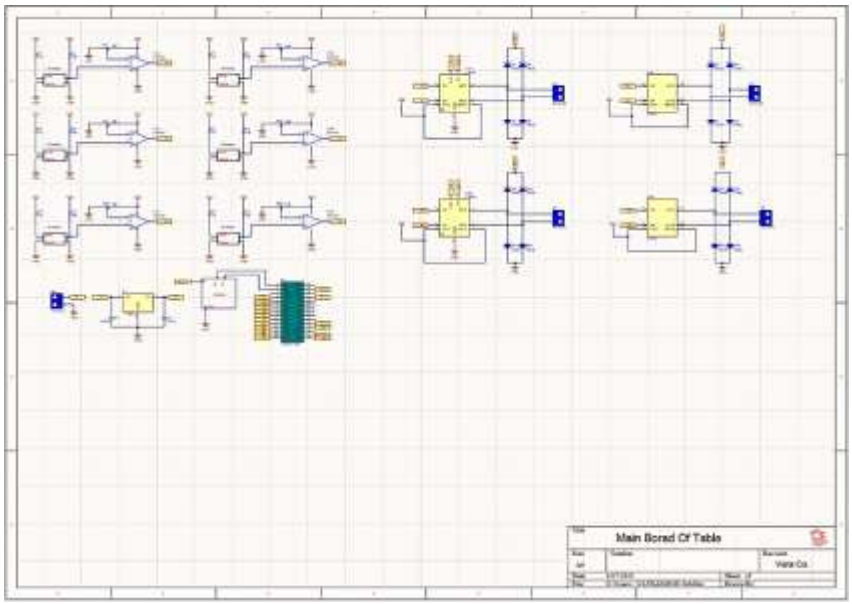

Figure6. Main Board of Table

3. Conclusion

In this design, a self-cleaning table was designed in which the moving part (chariot) was installed on the table in such a way that it automatically collects food waste and directs it to the garbage bin installed next to the table. Six infrared sensors were installed under the table to count the number of customers and confirm the presence of the customer. The moving part of the table, by human intervention, collects food waste and directs it to the trash, and when the moving part is on its way back to the starting point, alcohol is sprayed on the table to prevent the spread of coronavirus.

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