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Water Filling Pro

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Abstract: Customers always want fast service. However, restaurants always face the challenge of providing fast service, especially if there are many customers during peak time. Using up-to-date and automated machines could help expedite workers' pace to prepare meals ordered by customers. Thus, Water Filling Pro was created to improvised the water filling function to make it more efficient. This project aims to make the machine move automatically and be more effective in the time required to prepare a cup of water. Three main parts need attention, which are the cup machine, conveyor and water pump. As a result, this improvised system managed to create the machine and achieve the objective where the cup will drop on the conveyor and move until a sensor detects the cup, at which point it will halt for a short time to allow the water pump to fill the water. Then, the conveyor with the cup on it will move again to the worker at the end of the line. The best time this system can achieve is 22 seconds, while a sample taken from a fast-food chain performance time is 45 seconds, demonstrating that the machine is faster than the current system. With this improvisation, the system has good potential to be in the market and adding Bluetooth to this system is an advantage since this project was unable to add it to the current system.

Keywords: Cup Machine, Conveyor, Water Pump, Adjustable IR Sensor, Arduino

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1. Introduction

Automation can be defined as a technology concerned with applying mechanical, electronic and computer-based systems to operate and control production. A filling is one of the methods used in the process of packaging liquid products. Packaging this liquid Product is usually done by the beverage packaging industry and fast-food industry. In the packaging industry, all operations are done by robots and machines, and it is automatic. In the past, humans were involved in the process of production [1]. More recently, devices have taken over medicines, vaccines, and chemical plants.

Customers' satisfaction is important to ensure that they will come back to the same restaurant. Customers always want to go to a restaurant where they can get their meal in a short period of time. Most customers do not like to wait long to get what they ordered. If the waiting time is longer, customers can become annoyed [2] and might not want to come back to that restaurant. And it could be worse if they share this bad experience with other people. This will have a negative effect on the restaurant if other people do not go to this restaurant because they are influenced by the bad review.

The method of filling water manually is still used by fast-food restaurants. Such methods are no longer efficient at present because customers want fast food preparation. Surely such a method poses various problems to the employees of the restaurant. Among the problems that are always encountered is not being able to prepare many orders in a short period of time. This is because the restaurant will experience peak times such as breakfast time, lunch, dinner, or promotion time, many customers come to the restaurant. Of course, when employees are in a rush to complete the order as soon as possible, mistakes such as giving the wrong order or completing the order slowly will happen. When such problems arise, customers will feel unhappy and might give a bad review about the restaurants to their friends

Automation used to fill water has not yet been applied by fast-food restaurants. For this study, the automatic water filling method was introduced to solve the problems faced by fast-food restaurants. This study also includes the designing and a control system for an automated cup filling system that can be used by the fast-food industry and can be purchased at a lower price. The control system used to control this operation is an Arduino. Arduino is an open-source electronics platform based on easy-to-use hardware and software [3]. The use of Arduino is more manageable than other types of control systems. A conveyor system is used to carry cups from one station to another. The entire system for this operation is controlled by an Arduino. This designed model has 3 main parts, namely Cup Dispenser Machine, Conveyor and water pump. This model also has two infrared sensors. the sensor is placed in the middle and end of the conveyor.

2. Materials and Methods

The methodology is the process of research, design, and decision to obtain the presented objectives. The purpose of this methodology is to help understand in more detail the model that we will be building. In addition, it is used to achieve the aims and objectives of the study systematically.

2.1 Materials

The model consists of three main parts. Its parts are conveyor, automatic cup dispenser and water pump. These three parts have components that are interrelated with each other. For the conveyor, TT DC gear motor is used to move and stop the conveyor roller. Adjustable infrared sensors are placed at the beginning of the middle and end of the conveyor. This is intended to track the cups on the conveyor. To connect infrared sensors, diodes and NPN type transistors are used. 9v batteries are used to move this conveyor. Two TT DC gear motors are used to move the cup up to drop for the automatic cup dispenser. This automatic cup dispenser uses an AA type battery and is placed on a 4x battery holder. A 12 V relay module is used to connect Arduino with the water pump for the water pump.

2.2 Methods

For this project, we proposed building a Water Filling Pro model after identifying the problems that fast-food restaurant employees faced in areas related to customers' expectations, employees performances, restaurant environment, process flow and quality of machines and equipment used [4]–

[8]. We have also explored several types of service failure strategies [4]–[7] from which we analyzed to decide what types of solution is the most appropriate for us to recommend. After that, we set some objectives that need to be achieved at the end of this project. Based on the issues analyzed, we plan to build an automatic beverage filling machine with a conveyor, dispenser cup, and water pump.

Then, we have made a study, analysis, and comparison to buying each of the components that want to be done to build the model. After we compiled the final list of materials and components to make the model, we bought those components and materials. We used two methods of purchase, namely physical purchase, and online purchase. When all components and materials are complete, we start the assembly session of the model according to what has been discussed.

Next, we create the coding based on the operation we want using the Arduino IDE. Once everything is ready to be tested, the first test session is conducted to identify problems and shortcomings in this model. After placing all the deficiencies and issues that arise, troubleshooting sessions are undertaken to resolve those problems. Subsequently, a final test is made to ensure that this built model can operate as prescribed while achieving our objectives. We made our final test to compete with one fast-food restaurant to make sure it reached our target. The construction process of this project can be demonstrated through the flow chart in Figure 1 below.

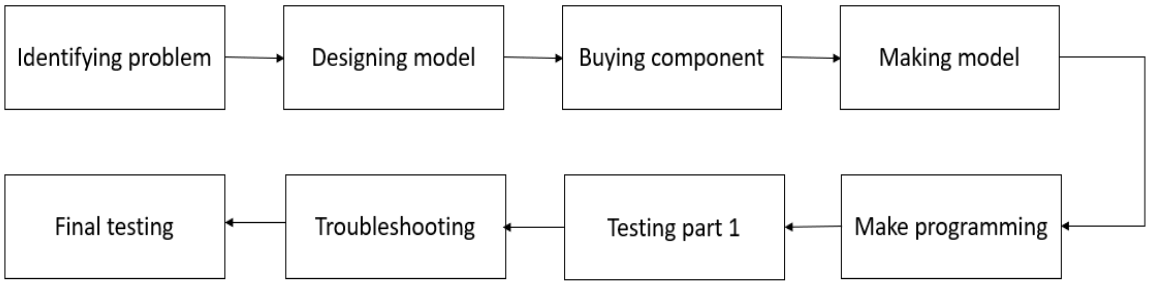

Figure 1: Flow chart for project construction

3. Results and Discussion

Based on what we have done on this project. We obtain the result and most of them meet our expectations and some of them do not meet our expectations. So in this section we will discuss the result and discussion.

3.1 Results

Based on our project, we measured the time that the machine can prepare a cup of water. But the time is not accurate because the cups sometimes take time to drop. The machine has already been tested with one fast food restaurant. The restaurant is ready to help for our final test about this machine. The project testing shows a successful outcome.

Table 1: Time result

No	Type of part	Time Recorded (s)
1	Cup machine drop a cup to conveyor	8
2	Time from the cup drop to the middle conveyor	5
3	Water pump fill the cup	6
4	Continue moving until end of conveyor	7
5	Total	26*

*depends on the situation.

After we tested the machine, we tried to compare it with one of the restaurants that were ready for cooperation. Based on time recorded, they take around 45 seconds to go to the filling water machine and fill the water which is quite far from the cashier. They lose much time for that which makes our project successful.

3.2 Discussions

We evaluate the performance of our machine to determine the efficiency of the machine compared to human labour, especially fast-food restaurants' workers. The three main parts in this project will be discussed to make analysis and review about this machine.

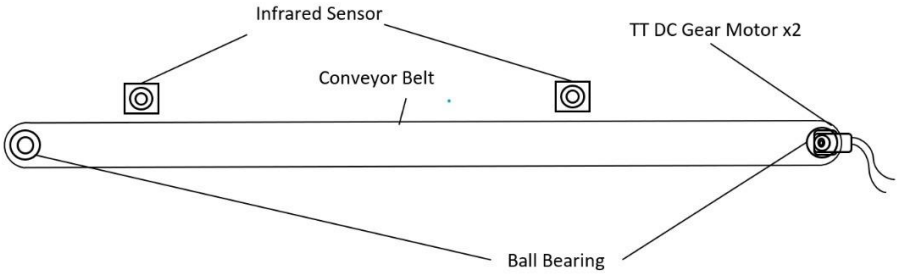

Figure 2(a): The setup of the conveyor part

Figure 2(b): The projection view of the conveyor

Figure 2: Conveyor part

The conveyor (Figure 2) is the one of the main parts that moves the cup from end to end. We use two motor gears, so that it can carry the roller to roll to make the recycled wallpaper moving. The conveyor takes around 10 seconds to reach the end of the conveyor. But before it arrives at the end of the conveyor, the motor must stop for a few seconds in the middle, which has an Infrared Sensor to give time for the water pump to fill the cup with water.

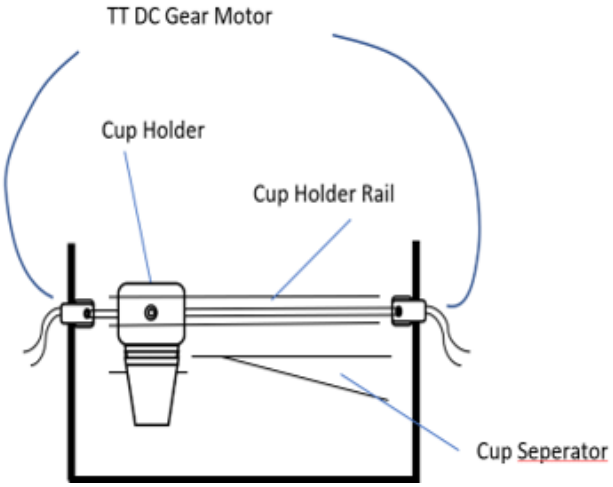

Figure 3(a): The setup of the Cup Dispenser Machine part

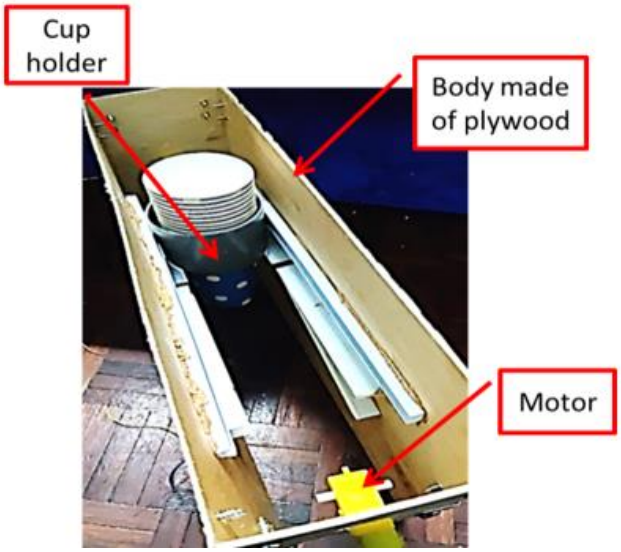

Figure 3(b): The projection view of the Cup Dispenser Machine part

Figure 3: Cup Dispenser Machine part

Figure 3 shows a cup machine whose function is to hold and drop the cup when we start the program. The motor will pull the cup holder and drag it into the middle of it and the cup will activate the conveyor. The cup dispenser machine performs well but sometimes it takes time but the result still does not affect the whole system and time recorded.

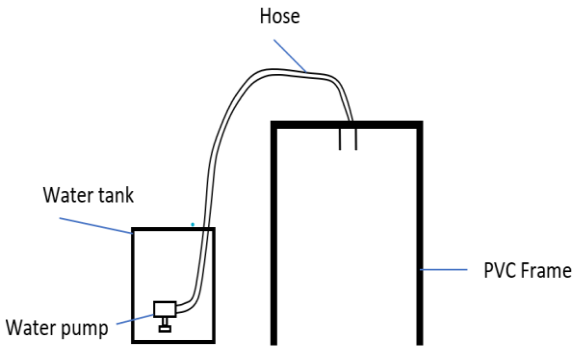

Figure 4(a): The setup of the Water Pump part

Figure 4(b): The projection view of the Water Pump part

Figure 4: Water pump part

Based on Figure 4, this water pump is used to suck the water from the jug into the cup. The timer to pour the water has been set for 4 seconds to fill the cup with water. With the help of the relay, we managed to make the water pump work for 4 seconds.

The project actually planned to add Bluetooth in order to make it easier to control just using a device and don't need to control the machine. But due to time constraints, the project is unable to add Bluetooth and has to use a push button. Fortunately by using Arduino which can programme the system, it makes it easier to control by programme it to push the button to start the system.

4. Conclusion

In conclusion, we managed to produce a model of automatic water filling machine that can be used by fast food restaurants. We managed to use push button and timer. With more time, we would upgrade it using Bluetooth. however, it still fulfills one of our objectives is to make the machine more efficient because the time recorded is lower than that of the workers. Based on the tests performed, our machine model is 15.6 seconds faster than the existing model. In a nutshell, our project to build an automated system was successful because our objective was to run the machine automatically and discover the effectiveness of our machine, Water Filling Pro compared to employees in fast food restaurants

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