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Pharmacy Automation

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ABSTRACT

Pharmacy automation is used to control every transaction in the pharmacy and to keep accounts registered. Thanks to the system implemented, it is ensured that the records of the drugs are taken and they work without any problems. This system can be used to keep track of the drugs or products in the warehouse. While 80% of the products on the shelves are used actively, 20% are passive at the same time. It allows you to follow the information in detail, as it allows you to take action in accordance with this rule. Drugs, personnel and warehouse products that are entered into the system can be tracked through the programs preferred for pharmacy automation. This system can be used to prevent deficits and to control the profit rate. Using this system in pharmacies, which allows you to get information about the availability of the drug, provides you with quality results. Since it provides automatic processing, it helps to provide control without the need for re-checking.

KEYWORDS: *Arduino, Stepper Motor, Servo Motor, Stepper Motor Drive, C#*

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1. INTRODUCTION

A shelf system has been developed for use in pharmacies. This system is planned to reduce the workforce of pharmacy workers in pharmacies and the number of workers of pharmacy owners (Barrett, Oborn, Orlikowski, & Yates, 2012; Walsh et al., 2011). The automation system ensures that the shelves in the pharmacy go back and forth on the x-y coordinate system in the form of a mechanical system. In this developed system, after the specified drug is entered, it goes to the location where the drug is located and takes the drug. It is designed in a structure that can perform all the operations expected to be performed in the Cartesian coordinate system (x-y). Cartesian motion systems are products made for commercial purposes. It is designed to make products quickly. The C# interface of the implemented system is to read the prescription of the drugs and the drugs are displayed in the interface program, and thanks to the coding applied to the interface, it has the ability to use the system as desired and can be collected in a certain reservoir after collecting it.

Abubaker and Abubaker (2019), implemented a system that enables the placement of drugs in cabinets in pharmacies. In this system, they used the Cartesian robot method.

Sun, Qiu, Lin, and Zhang (2020), created an intelligent logistics storage and handling robot to solve the problems of low work efficiency and high work intensity in traditional pharmacies and other warehouses.

Goundrey-Smith (2013) and Zubia, Parra, and Lopez-de-Ipina created a robot to collect and package products for use in pharmacies.

2. PHARMACY AUTOMATION

The flow chart of the pharmacy automation control system is superficially as in Figure 1.

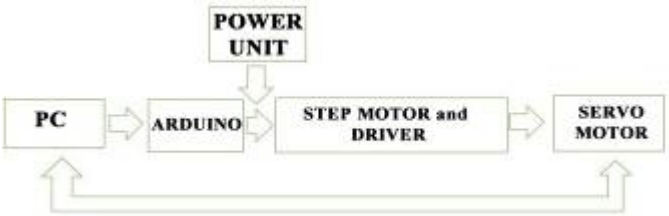

Figure 1. Pharmacy Automation Block Diagram

Arduino, stepper motor drivers, stepper motor and servo motor are connected to each other via computer with the number of the drug to be taken. Algorithm logic is expressed in an easy to use way in this system. At the beginning, the drug number of the desired drug is entered. In the next step, since each drug has a

specific location, the drug goes to that location with the software code on Arduino, rectifier and motor drivers, stepper motors and takes the drug with the help of servo motor. In the last step, the drug taken is brought back to the starting point. The system buys 12 drugs in this way and it is aimed to lighten the workload a little.

In this study, a system that controls pharmacy automation, drug tracking and purchase, whose software is made with Arduino, has been developed. The drug requested from the computer was made by connecting the serial communication with the Arduino on the screen with the C # interface to the system. By using an integrated driver, stepper motors are followed and both visuality and ease of use are provided to the user (Figure 2).

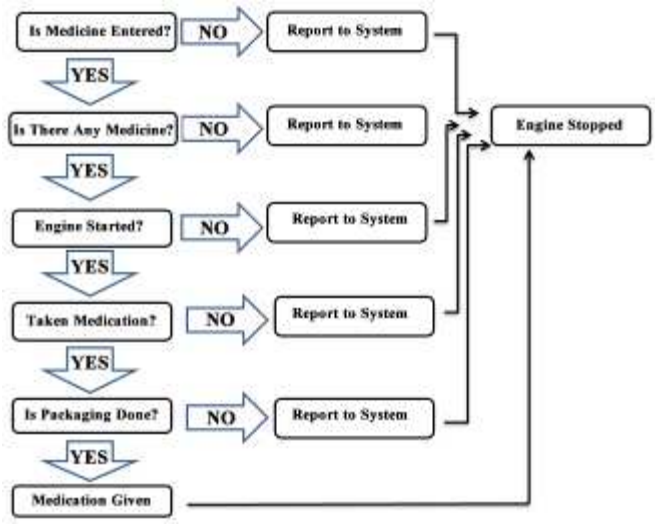

Figure 2. Pharmacy Automation Flow Chart

2.1. SolidWorks Drawing of Rack System

The 3x4 rack system was drawn in a program called SolidWorks. The x-axis horizontal distance on the shelf is 60 cm and the y-axis vertical distance is 80 cm. Its depth is 60 cm. There are sections reserved for each drug for drug intake between the X-axis distances. These sections are spaced 7.5 cm on the x-axis and 10 cm on the y-axis (Figure 3).

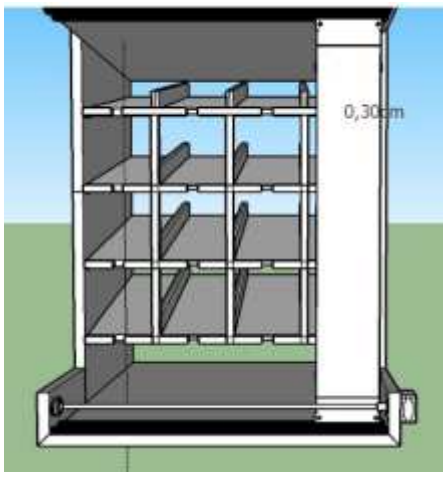

Figure 3. SolidWorks Drawing of 3x4 Rack System

2.2. Drawing of Moving Mechanism Router Part

The movement mechanism of the shelf is provided by two-dimensional axis movement. The drawing of the Router part, which is the necessary x and y axis movement for the shelf we created, has been made. It was decided to use the required 80 cm shaft, salmon, 4 shaft holders, 4 shaft bearings, 1 bearing in this drawing. The design required for these materials to work in harmony with each other was made as shown in Figure 4.

Figure 4. x-y axis Router drawing

After the laser cutting, all the materials we bought were combined and the desired shelf was created. Rail bearings were mounted on the top and bottom of the rack. Shaft, shaft holder all assembled. A coupling is used to connect the worm shaft with the stepper motor (Figure 5).

Figure 5. Rack Mount

2.3. C# Interface

As the screen interface, it is as in figure 6 through the C # program. A number is assigned for each desired drug on the created interface. The drugs can be accessed via Arduino on the shelf designed according to the number of the desired drug. After the button selected on the interface becomes active, the Arduino runs the codes necessary to activate it via serial communication.

Figure 6. Pharmacy Automation C# Interface

2.4. Installation and Operation of the System

The drug determined from the computer was made using a wired serial communication with Arduino. When Arduino data is input, stepper motors start to work together. The Arduino and the driver were powered by 12V 30A DC. Since the stepper motor counts the steps, a certain position step count was made for each drug. By giving energy to the stepper motor via Arduino, the necessary step has been taken. If a drug takes x steps, it takes 2*x steps in the second step and 3*x steps in the third step. All step calculations were made in this way. When the stepper motors reach their position, the servo motor makes a 120 degree step movement. Servo motor waits at this level for about 3 seconds. Since the drug stays on the inclined surface, it falls into the chamber during this time and comes back to the 0 degree angle. After taking the drug, it returns to its starting position (Figure 7).

Figure 7. Pharmacy Shelf Automation

3. CONCLUSIONS

In this study, technical drawings were made using SolidWorks drawing. The drawn SolidWorks drawing was transferred to Autocad, the wood was processed in cnc, and the assembly was done by us. The front mechanism of the shelf was laser cut and the welding process was carried out in the lathe. Considering that the system will be mounted on the existing rack, a quick work on the mechanism rack was not performed. In the project, some problems can be seen in the transition of the mechanism on the rods. These problems are caused by the lack of power of the motors and the low level of the rod screws. Such technical problems will be seen in the prototype construction phase and necessary corrections will be made in case of production. It is seen that the dissemination of academic studies that will enable the benefits of pharmacy automation technology to be introduced to the sector employees is important for the solution of the basic problems related to material management. Arduino and C# communication form the basis of the system.

The working logic of the system is that the drugs on the shelves go back and forth on the rod screws with the help of stepper and servo motor and follow the x-y coordinate system to find the drug and take it. This system can be operated more quickly thanks to a more powerful and expensive motor and rod screws. Since this system is not used in Turkey, many processes and programs can be written and developed on the project. The project can be adapted to many shelf automation systems, not just the pharmacy shelf.

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