Automatic Stationary Vending Machine For Sophisticated Organization With Stock Analysis Report

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Abstract- Automation is a significant part of modern living. Even while handling necessities of existence like food and medicine, people constantly seek convenience. Automation includes time and energy savings in addition to reduced human effort. The study's main goal is to use an Arduino microcontroller to create an automated stationery vending machine. As we all know, a machine is a device that can dispense various goods more like an automated procedure that doesn't require manual handling, which is typically seen in fast-paced cities due to a fastpaced lifestyle. This essay contrasts a variety of vending machine characteristics, including size, timing restrictions, speed, and power use. The product's major objective is to distribute the item into the delivery compartment from the level at which it is positioned, making it easier to hold heavy things as The present vending machines cannot stack heavy items because they drop from a high to the low compartment.

Vending machine plays an important role in human's life for every situation. An automated Stationary vending machine system is introduced to reduce the man power, time and energy. It is similar to an ATM through which we get the required items at vending machine any time & any place. We proposed Stationary vending machine which dispenses stationary items likes as pen, pencil, erasers etc.

Keywords- Rfid, Iot, Sensors, Display, Cion System, Dc Motors

I. INTRODUCTION

A decade ago, vending machine areas of applications were very narrow and technologically limited. Vending machines have been around for many years now. First vending machine was introduced in 1880 in London which was a coin operated vending machine for postcards [1]. After that many vending machines where used for different purposes. But with advancement in technology just not only widened the area of applications but also overcame the limitations providing a way better technologically advanced system which can drive and thrive on its own. Introduction of the Internet of things integrated systems proved to be a new era in the vending machine domain. Lots of other things which changed over time are the accessing methodologies from smart card to fingerprint scanner, from RFID cards to eye retina scanner. Just not the functionality changed but different area of application also surfaces over time. Startingfrom beverage dispenser to electronic gadgets dispenser vending machines, which are in high demand in Japan [2].

Smart PPE machines are useful for live inventory management. Smart PPE vending machine usage means that overstocking items is no longer necessary and can be avoided. Also due to its availability in a high visibility accessible area of the workplace, typically a hallway, those workers are more likely to replace their equipment as per requirement [3]. The smart PPE vending machine helps to avoid overcrowding at market store especially in billing queues. It maintains the data log of stock like mostly unused, dusty or expired material which is automatically moved to back compartment of store room without any human intervention. Some machines are connected to internet network and send messages automatically regarding material stock is either low or about to empty.

The outline of the paper as follows: Section II described development of different types of vending machines. The proposed system development and workflow is explained in Section III. In Section IV, the designed model and experimentation is given. The results of live inventory data are presented in Section V. Finally, paper is concluded in Section VI.

II. RELATED WORKS

The related work on this proposed framework has a striking number of advancements that further makes vending machines operations and management ever more towards perfection and accuracy.

Toshio Yokouchi et al. in [4] studied various advancements taking place in Japan towards betterment of vending machines, it provide good understanding about the evolution on vending machines designed for numerous different sort of products, it also provided a glimpse of futuristic vending machine that will be implemented in next Chih-Chun Hsu et al. proposed few decades. the implementation using integration between Artificial intelligence and IoT in [5]. Mohamad Walid Asyhari et al. implemented a vending machine monitoring system by integrating its vending machine with Web Server with help of which a system with live inventory management can be implemented [6].

Wahidul Alam and Fahima have proposed a mobile operated IoT based vending machine system for countries' advanced vending machine system [7]. Authors in [8] coined the concept of community based wireless Internet of Thing infrastructure using ubiquitous vending machines.

Aneeqa Ramzan et al. in [9] proposed RFID technology beyond cash-based methods in vending machine and system implementation which provides contactless access for end user to vending machine with the help of RFID technology, which further combined with Internet of Thing operation provides inventory accountability to employer/seller.

Researchers in [8] proposed a system to deal with the modalities of the Smart. Automated Health Machine (AHM) using Internet of Things (IoT), a user-friendly health machine with an interactive graphical user interface for medical necessities. Authors in [9] together came up with the idea to design smart unstaffed retail shops using IoT and Artificial Intelligence which remove the possibility of human error and provide more error-free transactions.

Another brilliant idea described in [10] where optical Subsystem for the Empty Containers Recognition and Sorting in a Reverse Vending Machine that provides an eco- friendly way to dispose used vending machine dispensed items. It can be implemented in our PPE vending machine as well in future to provide a disposal for used PPE kits and avoid illegal recycling of PPE kits once used.

In [11], the Universal IoT Vending Machine Management Platform, researchers are proposing a system when vending machine operations can be altered and can be made use specific, certain items can be restricted for some users and is available to only authorised personnel. Thomas Hänel and Team have proposed a very secure way to equip IoT devices with RFID, it enables security with smooth operation in [12]. An Emerging Application Centric RFID Framework Based on New Web Technology is explained in [13] where, the generic scenario of an RFID framework built using latest web technology and demonstrates its ability to customize using an application for tracking of personal user objects.

After reviewing the progress in domain of vending machine, we proposed a novel concept to interface the vending machine with inventory update through Integromat tool.

III. SYSTEM DEVELOPMENT

As shown in Figure 1, we have implemented The PPE vending machine using Raspberry pi 4b [14] which operates on ARM V8 Cortex A72, which is connected with RFID RC522 using SPI protocol for user authentication.



Fig. 1. Basic structure of proposed

The block schematic of proposed work is shown in Figure 2.



Fig. 2. Block Diagram of Proposed System

The main part of system is processor which is faster and more upgraded version and comes with a faster systemon-a- chip. The processor now uses the Cortex-A72 architecture (quad-core 64-bit ARMv8 at 1.5GHz) [15, 16]. It supports H.265 hardware video decoding for instance. The Raspberry Pi has for long time now ignoring performance factor by using same standard 512MB or 1GB of RAM for years.

To communicate with microcontroller and other hardware module, the SPI communication protocol is used. SPI allow the data which can be transferred without interruption. Any number of bits can be sent or received in a continuous stream. With I2C and UART, data is sent in packets, limited to a specific number of bits. Start and stop conditions define the beginning and end of each packet, so the data is interrupted during transmission. Devices communicating via SPI are in a master-slave relationship [17, 18].

The RC522 RFID module [19] used SPI (Serial Peripheral Interface Bus) to interface to the Raspberry Pi.

The proposed system can be explained into two parts viz. Scanning RFID and dispensing required item and Inventory Management using IOT.

A. Scanning RFID and dispensing required item:

Every authorized person has a unique RFID tag issued earlier. Using the unique tag number that person is able to access the PPE vending machine and select desired equipment using options available on display. Once the person selects the required item, the display unit send an input to raspberry-pi unit specifying the item details which needed to be dispensed. Raspberry-pi unit depending upon the data from the display triggers a process with the help of respective motor and desired item is dispensed.

B. Inventory Management using IOT

Once the item is selected the data is programmed to send out one negative counter signal to cloud-based Google sheet and data on Google sheet shows the new real-time inventory's status by reducing the counts by number of items dispensed.

The dataflow of proposed system is shown in Figure 3. It describes step-to-step execution process for proposed system. When system is initiated the very first thing that takes place is initialization of Input/output pins. Once input/output pins are initiated the system waits for end-user's input or we can say item selection. On selection of desired item, the display ask for Authentication, End-user authenticates itself with the help of individually assigned RFID card. Once authentication is done with respect to selected item by end-

user the corresponding motor is triggered that resulted in the displacement of the product. After displacement, the final inventory count is sent to cloud using IOT mechanism. The Inventory agent can see the real time inventory stats on remote system.





Fig. 4. Interfacing Set up of proposed system

IV. IMPLEMENTATION

Here we used total 6 springs with specification of 2mm thickness, springs having the length of 120mm, and the pitch distance is 20mm. It is wounded in lathe machine. All springs are made of steel which are used here for store and release energy. This held the PPEs without slipping and worked manually as required. The distance between two consecutive coils is pitch.

The insulation is provided to the spring to prevent the passage current through it. There are two ends of spring one is free to roasted and second end connected to DC motor. The rotation of springs is depending on DC motors, the spring rotates with respect to the rotation of DC motors. With every complete rotational of cycle desired item is distanced. The CAD model of our implemented design is shown in Fig. 5.



Fig. 5. CAD Model of Vending Machine

The PPE kit vending machine storage box hardware is design in CAD software. After the storage box design modelling then fabricated using laser cutting and powder coating. Now the springs are design and made in different machine i.e. lathe machine and now it is inserted in the vending machine. The DC motors of 12 V are mounted on separate part of machine and motor shaft relate to the spring. The Figure 6 shows the hardware of PPE Vending Machine shows the implemented hardware in vending machine which consists of basic assembly deployed viz. springs, motors and RFID. The springs are connected to DC motors which operate on input from the end-user. After that end user select desired only with valid a RFID card.

V. RESULTS AND DISCUSSIONS

The SPI is enabled on Raspberry Pi through the command line and sudo raspi config. It opens the Menu of configuration. In this menu, sub-menu 5 is selected i.e. "Interfacing Options". After this by clicking "P4 SPI." it enables the SPI Interface, and by clicking on Yes, It shows "The SPI Interface is enabled." now for finishing it, going toward the command line terminal and entering the command line terminal and reboot. After rebooting raspberry Pi the Enabling SPI process is finished.

By using Libraries written in the Python 2, python 2.7 is installed. It completed by entering sudo apt-get install SPI PY library (python2.7-dev.) is used interface with RC522 module. We stored the required library in memory card which going to be installed. Now by typing cd SPI-Py to enter the SPI-Py directory and library, sudo python setup.py is installed.

Integromat is a platform allowing you to connect various third-party services. It is like Zapier, which allows data in a more deliberate way. Integromat offers a fully functional free trial account that allows for up to 1000 operations, which should be sufficient to keep sending your data every few hours, without a need to pay for anything. Once we have the webhook, we need to insert it into the code.

set to execute the script every 1 minute. As a result, the list of items and inventory status for each item, with every transaction the count changes and new inventory status is updated.

In the end, Fig. 12 shows the developed Smart PPE Vending Machine which consist of all proposed benefits promised over traditional system, such as inventory management and touch less system.

VI. CONCLUSION

The development and deployment of different variants of vending machine have been investigated in this paper. The major contribution of the paper is to dispense the PPE items contactless by using smart PPE vending machine and maintain the live inventory management using webhook software. The scope of the work is limited to hospital management / medical organization to access the PPE item using RFID scanning technique. Real-time update of PPE items will be highly benefited to medical staffs and in future the smart phone application will be developed to send the alert for expired or required PPE items. Also, in line with smart PPE vending machine in future we will be emerged with PPE items Incinerator machine for proper disposal of used PPE items effectively to promote Swachh Bharat Abhiyan campaign

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