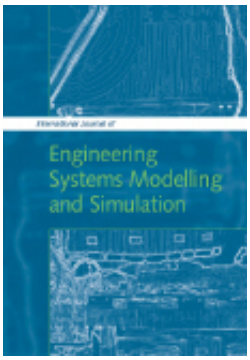

International Journal of Engineering Systems Modelling and Simulation

ISSN online: 1755-9766 - ISSN print: 1755-9758
https://www.inderscience.com/ijesms

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DOI: 10.1504/IJESMS.2022.10045314

Article History:

Received:	23 July 2021
Accepted:	02 September 2021
Published online:	03 December 2022

Automatic refilling vending machine using Amazon DRS AWS

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Abstract: Presently, the existing replenishment device may be handiest when systematically reviewing the inventories. Whereas, there are ongoing vending machines that may not be able to provide or discover whether the substances are doing nicely to be replenished or no longer be replenished. This effect is an inefficient replenishment policy and there will be regular inventory-out among the products. This undertaking intends to provide the automatic replenishment of smart merchandising gadget with the intention to provide and support inventories to the administrator. Amazon sprint replenishment service (Amazon DRS) permits, while the vending device is about to run out of the stock/product, it to automatically locate orders on Amazon, administering which of the supplies may be due for replenishment. By executing this venture, inventory-out of the vending machines may be prevented and a green manner of the replenishment system can be carried out.

Keywords: vending machine; Amazon dash replenishment service; Amazon DRS; ESP32; internet of things.

Reference to this paper should be made as follows: Kumar, R.S., Manimegalai, P., Abishak, S., Hariharan, N.K.S. and Pamela, D. (2023) 'Automatic refilling vending machine using Amazon DRS AWS', *Int. J. Engineering Systems Modelling and Simulation*, Vol. 14, No. 1, pp.24–29.

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1 Introduction

Vending machines gave consumers convenience, and they have become an integral part of the consumer lifestyle. Service functions, on the other hand, continue to exist as a method aimed towards society and the general public, and research is being performed to improve their operation and performance. In the vending machine market, more innovation has been given to the collaboration with the supply chain, specialising in the development of replenishment strategy, due to an increase in the competitive market and short product life cycle. To suit in with frequency, internal control, and satisfactory manage, extra replenishment functions are critical. The traditional replenishment focuses on solving estimations primarily based on historical stock records. When using an ancient evaluation technique or system to top off the gadgets of vending machines, a trouble develops, and it is far only appropriate when demand is extremely stable and as a result the replenishment price is excessive; the call for merchandise fluctuates in an excessively vending system. The task's use of Amazon dash replenishment service (Amazon DRS) provides value by allowing vending machines to mechanically replenish inventory through placing orders on Amazon thru the DRS provider.

Smart vending machine using Amazon DRS can be used in many ways as follows:

a Main objective of the method is to design low-cost smart vending machine by utilising ESP32.

b To demonstrate end to end use cases of Amazon DRS service with easy and interactive end user interaction.

c It will automatically replenish the product of vending machines easily form Amazon.com through Amazon DRS service.

d It will be best suited for the small-scale vending machines such as snacks vending machine, beverage vending machine, sanitary needs vending machine.

e Reduces the relationship between the admin/owner of the vending machine and supplier to the minimal level.

Nowadays the utilisation of vending machine has increased drastically which is making it easy for consumers and providers. Existing replenishment services of vending machines are high cost, not easy to implement and use by laymen. Having better replenishment functions is a key to fit in with frequency, internal control and quality control. A vending machine generates an average of Rs. 6,000 in revenue every week for the person who owns and operates it. This equates to more than Rs. 25,000 each month. As a result, we can see how a few machines producing an average might start bringing in good earnings and in desirable places. Around the world, the cost of setting up an entry-level vending machine can range from Rs. 2 Lakhs to Rs. 3 Lakhs. However, we cannot imagine automatic replenishment service for this price in this form of vending. To suit in with frequency, internal control, and satisfactory manage, extra replenishment functions are critical.

2 Literature review

When the vending machine's stock inventory/product is ready to run out, *Amazon DRS* automatically puts orders on Amazon, alerting the administrator to which supplies need to be replenished. Stock-outs among vending machines will be avoided as a result of the implementation of this method, and an effective replenishment mechanism will be created (Kaushik, 2016). In this proposed method, we are going to make a vending machine with three slots for each inventory. Simple notification service (SNS) Topics are used by the dash replenishment service (DRS) to alert you (the device maker) of changes to device status, order status, subscription status, and more. And login with Amazon (LWA) allows you to safeguard your customers' information by utilising Amazon.com user authentication mechanism. Amazon's login is based on OAuth 2.0, which

is widely used for user-authorised exchange sites. Inventory listings with unique Amazon standard identification numbers (ASINs) will be linked to each slot in the DRS API (Arifin et al., 2017).

A clever system is managed with the aid of a fuzzy machine that outputs crisp values which are represented by way of the resupply alert index (RAI), a decimal wide variety representation that stages from zero to 3, with zero representing 'pressing' popularity and 3 representing 'good enough' repute; this tells the operator which substances want to be replenished (Liu et al., 2021). By implementing this check, stock-outs of vending machines may be avoided, and a green replenishment system might be implemented (Dela et al., 2015; Markkandan and Venkateswaran, 2016). The software used to construct this device is a paper allocating device that covers the call for at the University of Santo Tomas' School of Engineering and compares it to other digital simulations. The RAI was able to demonstrate to the supplier that it can provide statistics on which merchandising machine and which of its goods has the highest replenishment urgency through simulations (Humco et al., 2020).

The layout and experimental investigations of merchandising machines for workplace stationery transactions are offered in this observe. The proposed vending machine has the following advantages: transactions may be done using short message system (SMS), all transactions can be monitored on line through the proprietor the use of android, the vending device has an early caution gadget (EWS) while the machine is in problem, and it additionally has a battery backup whilst the power goes out, and there's no want to make special agreements with banks or telecommunication providers.

The model was prepared with RFID equipment for verification and administration mechanism (Malge et al., 2019). In this method the customer will be allotted with a card in which the particulars will be stored in the record. First, the customer swipes the card, if he/she is a legal customer permission will be allowed and list of the medications will be showed on the console.

Radio frequency Identification was used along with Arduino, to overwhelm the coin depended vending machine that will not return the remaining cash when no change is presented (Kanagasabapathi et al., 2019; Suresh et al., 2021). The user shall choose the material before the radio frequency Identification is read, then card will scan the material that will be get at collector of the chocolate.

3 Proposed method

The working procedure is illustrated in a block diagram as shown in Figure 5. It breaks down the system into different chunks to make it easier to visualise and interpret. It outlines the systems various blocks and illustrates which components receive output from the ESP32 and which provide input to the ESP32. In our task ESP32 acts as a microcontroller. The vending machine will have three slots each for slot1, slot2 and slot3. Listed with *ASINs* of slot1 product will be mapped with slot1, list with ASINs of slot2 will be mapped with slot2 and list with ASINs of slot3 product will be mapped with slot3. Webpage that is linked with Amazon DRS service, so users of the vending box can register and select products for each slot based on their preference using product ID and serial number of vending machines. The Reed switch is connected to each of the slots with Neodymium magnet, which is used as a slot counting indicator. When the slot reaches the minimum threshold value (for example five count in slot), then it will send a message/token to Amazon DRS for product replenishment in slots. DRS use SNS topics to notify you (the device owner) of changes to device status, order state, subscription status, and more. End admin/owner facing web page for product registration is done separately for the authorisation code. All current information, (i.e., tokens, AP credential, and slot status) stored in EEPROM of ESP32 every time it changes. So, on every power cycle, the vending machine retains the latest information.

Then a successful trigger of the Amazon DRS powered Vending machine enables the admin/owner to check out the product and acknowledgement of the product through the registered mail-id. Then products from vending machines will be delivered by Amazon.

The block diagram of smart vending machine using Amazon DRS is shown in Figure 1, which depicts the overall functioning of the module and proposed system that incorporates IoT-based automated system.

3.1 ESP32

ESP32 is a series of low-value, low-strength microcontrollers with built-in Wi-Fi and twin-mode Bluetooth as shown in Figure 2.

The ESP32 own family consists of integrated antenna switches, RF, energy amplifiers, low-noise acquire amplifiers, filters, and electricity manage modules, in addition to a ten silica Tensas lx6 microprocessor in both dual-core and single-centre versions. Expressive structures, a shanghai-based totally Chinese start-up, designed and evolved the ESP32, that's produced through TSMC the usage of their 40 nm era.

Reed switch and Neodymium magnet consists of a hermetically sealed glass envelope with a pair of contacts on ferrous metal reeds as shown in Figure 3. The contacts might be typically open and close when a magnetic field is applied, or normally closed and open when one is applied. A coil may be used to activate the switch, or a Neodymium magnet may be brought close to the switch to create a reed relay. The reed switch will return to its original position after the magnet is removed from the switch.

Figure 1 Block diagram of the proposed system (see online version for colours)

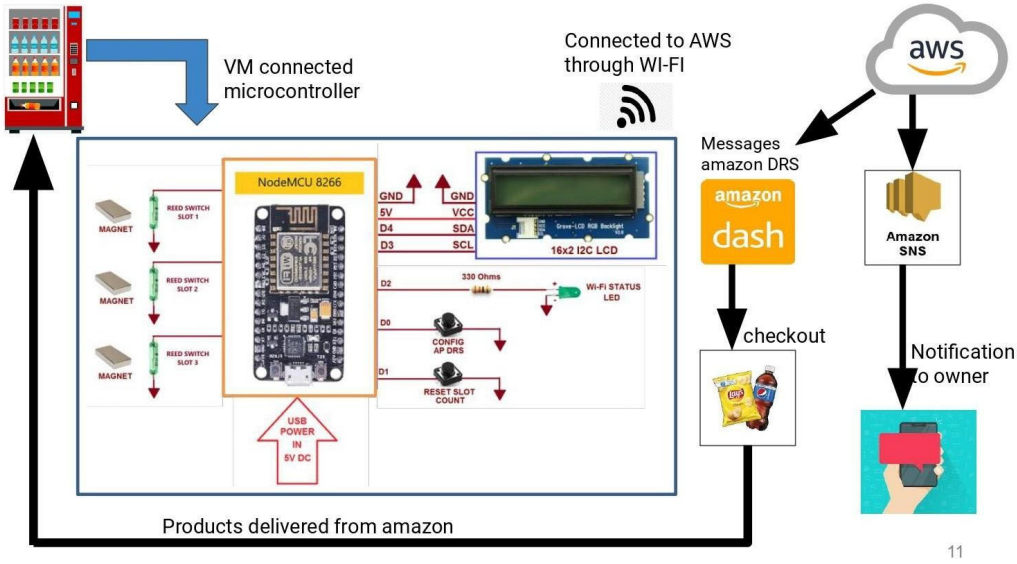
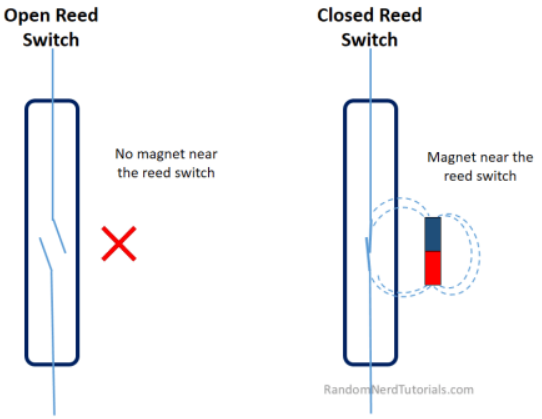


Figure 2 ESP32 (see online version for colours)

Figure 3 Reed switch and neodymium magnet (see online version for colours)



A multiplatform (Windows, MAC OS, Linux) application is created in a C programming functionality in the Arduino Integrated Design Environment (ADE). For programmer coding, we utilise Arduino software. This is a useful tool in the software industry.

Amazon Simple Notification Service (Amazon SNS) is a fully managed messaging service, which may be used to communicate applications to applications (A2A) or applications to people (A2P).

SNS topics are used by the DRS to alert you (the device creator) of changes to device status, order state, subscription status, and more.

Figure 4 Amazon dash replenishment service (see online version for colours)

Figure 4 shows the Amazon dash refill (DRS) service which allows linked products, like a printer that requests higher inks, to reserve actual things from the Amazon while compounds run low. You may utilise Amazon dash filling systems, customer service and the completion community by using the Amazon authentication and payment systems, providing your clients affordable costs, excellent options, and dependable conveyance.

Figure 5 Login with Amazon (see online version for colours)

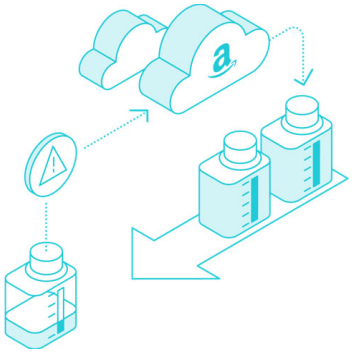


Figure 5 explains the LWA that shield the customer data by way of leveraging the consumer authentication device utilised by amazon.com. LWA is based on oaths 2.0, which has been widely adopted for consumer authorised exchanges across websites.

Some of the limitations of this method is:

a cannot ensure the quality of the snacks offered

b no provision for bargaining

c care should be taken about the replenishing the items.

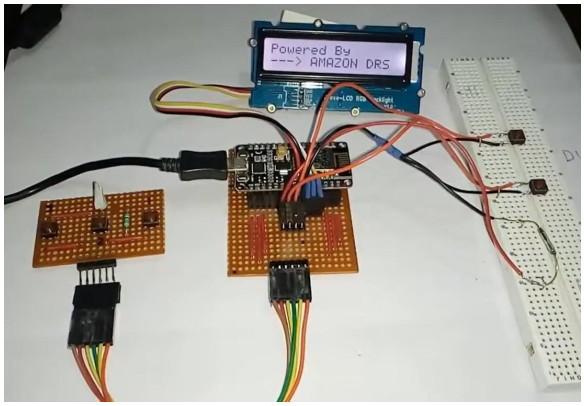
4 Result and discussion

Since the end customer must register the product with Amazon DRS and generate a 20-character authorisation code, we have built a web page for registering the product with Amazon DRS from the customer's end as shown in Figure 6. Once a 20-character authorisation number has been created during the registration procedure, it will be utilised to set up the vending machine to allow for automatic product reordering without the need for human interference.

Figure 6 Product registration web page (see online version for colours)

When the ESP32's config button is pushed, it becomes an access point (AP) that broadcasts its SSID (SVM). End users can connect to this AP via their mobile phone or computer, and the information is sent to the browser.

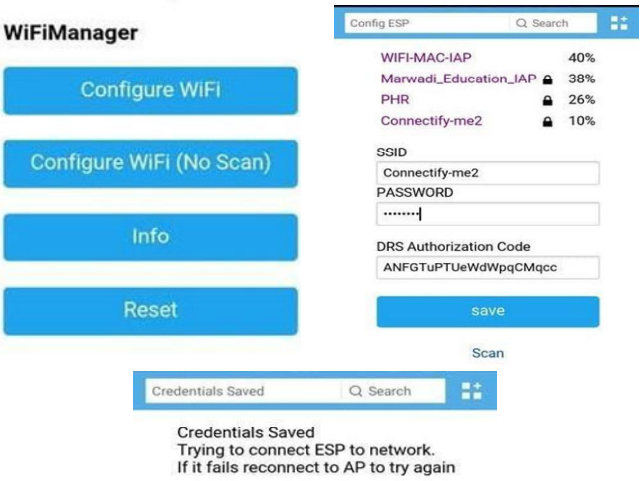
Figure 7 Experimental setup (see online version for colours)



Chosen network SSID, Password, and Authorisation code are established using the save option in the browser, and the ESP32 connects to the preferred network automatically as shown in Figures 7 and 8.

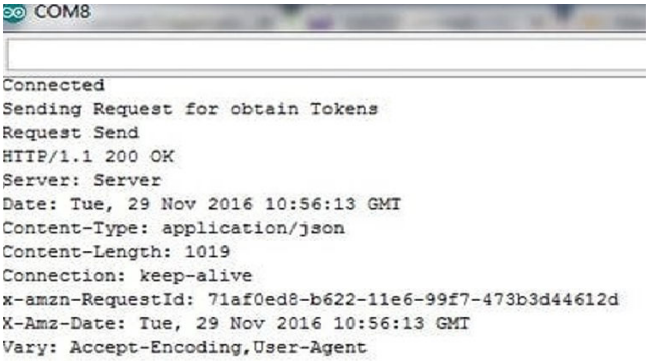
The authorisation code can only be used once. And it is good for around 15 minutes. This duration is not specified in the Amazon DRS documentation, but it is not more than 15 minutes in our experimental setup. Figure 8 shows the configuration of the method hosted by ESP32. By choosing all the authorisation codes the ESP32 connects to the preferred network automatically.

Figure 8 Config hosted by ESP32 (see online version for colours)



So it needs to be given to ESP32 within 15 minutes to produce a valid refresh token, which is then saved in EEPROM for future access token generation. The authorisation code does not have to pass every time, and if ESP32 receives a response from Amazon stating that the authorisation code is incorrect, ESP32 will utilise an old refresh token saved in EEPROM which is executed as shown in Figure 9.

Figure 9 ESP32 terminal showing successful replenishment process on trigger of reed switch (see online version for colours)



5 Conclusions

This automatic refilling using Amazon DRS using IoT has been implemented successfully and has applications in many ways especially in vending machines. This is a very advantageous technique when compared to the existing methods which is useful in many ways. *Amazon DRS* enables when the vending machine is about to run out of the stock inventory/product, it automatically places orders on Amazon, this gives the administrator which of the supplies needed replenishment. Easy to implement in existing vending machines. Reduction of admin/owner and provider gap relation and it is useful for existing low-cost entry-level vending machine. The design of this method enables the existing vending machine into an automatic smart replenishment vending machine with the cost effective.

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