



# Smart Kiosk: An automated multi-purpose vending machine

Sujan Shashikant Pisal<sup>1</sup>, Utkarsh Uday Ambre<sup>2</sup>, Shantanu S. Shukla<sup>3</sup>, Dr. Saniya Ansari<sup>4</sup>

<sup>1,2,3</sup>Department of Electronics and Telecommunication, Ajeenkya DY Patil School of Engineering, Lohegaon, Pune, India.

<sup>4</sup>Head of Department of Electronics and Telecommunication, Ajeenkya DY Patil School of Engineering, Lohegaon, Pune, India.

## 1. Abstract:

This project presents the development of a multipurpose stationary vending machine designed to address the growing need for accessible and on-demand of stationary supplies, document printing, and device charging. The proposed vending machine offers an all-in-one solution for students, professionals, and on-the-go users by integrating three key services as a range of essential stationary items (such as pens, notebooks, paper, and other office supplies), a wireless printer for easy and quick document printing, and 3-4 charging points compatible with various devices such as smartphones, tablets, and laptops.

The proposed vending machine will utilize an intuitive interface, allowing users to select and purchase items effortlessly. It will feature a variety of stationery products, such as pens, notebooks, and art supplies, along with options for wireless printing from smartphones and laptops. Users can send documents to print via a secure connection, eliminating the need for traditional printing setups. Additionally, charging booths will provide quick power boosts for mobile devices, ensuring users remain connected and productive throughout the day. This multifunctional design significantly enhances the overall user experience and promotes a

seamless integration of technology into daily routines.

## 2. Introduction:

In recent years, the advancement of automation and wireless technology has transformed various industries, leading to the emergence of innovative solutions aimed at improving convenience and efficiency. One such solution is the automated vending machine, which is widely used for dispensing a range of stationary products. This paper explores the design and development of a stationary vending machine integrated with wireless printing and charging booths, aimed at enhancing user experience by offering additional functionalities. The system seeks to combine modern automation with wireless technologies to create a seamless, smart service interface for everyday users.

The core concept behind our project revolves around automating the product dispensing process in a stationary vending machine, making it more efficient and user-friendly. Unlike traditional machines, which require manual interaction, this system will feature sensors and control mechanisms that detect product selection and automatically deliver the chosen item to the customer. The inclusion of wireless printing and charging booths further enriches the vending experience, as users can charge their electronic devices or print

documents without needing additional infrastructure or resources. This multifunctional setup is designed to cater to the increasing need for convenience in public spaces, such as airports, campuses, and shopping malls.

In addition to providing product dispensing capabilities, the system aims to integrate wireless technology for enhanced usability. The wireless printing booth allows users to print documents from their smartphones or laptops without the need for physical cables or connections. Similarly, the wireless charging station provides a much-needed service, enabling users to power up their devices on the go, which is increasingly essential in today's digital age. The project focuses on the development of these features in a single, integrated platform that can cater to a wide range of everyday requirements in public and commercial spaces.

The overall objective of this project is to design a cost-effective, reliable, and user-friendly system that improves accessibility, convenience, and efficiency. By combining cutting-edge technology, such as wireless communication, automation, and user-centric interfaces, our system intends to provide solutions that meet the demands of modern consumers. This research paper will explore the key design considerations, technology choices, and implementation strategies involved in the development of this stationary vending machine with wireless printing and charging booths while discussing its potential applications in real-world environments.

### **3. Literature Survey:**

We chose the research paper "Development of Smart Vending Machines with Printing and Charging Capabilities" by J. T. Mith and L. A. Johnson because it offers a comprehensive exploration of innovative features that enhance the functionality of traditional vending machines. The authors present valuable insights into integrating printing and charging capabilities, which are essential for meeting modern consumer demands for convenience and efficiency[1].

The primary purpose of the paper is to review the design of Automatic stationery vending machine. The Primary goal is to dispatch new Innovation applications in the public eye. Here we use a servo motor to dispense the item along with Raspberry Pi. To overcome the physical cash we are building a digital payment based on QR code (paytm UPI).The customer can select the product before scanning the QR code. After the successful payment customer will receive the Email from paytm Application and Cloud Servers receive confirmation Email and matches the pattern. After all this payment process the particular servo motor will rotate and dispense the item.[2]

This research proposed an IoT-enabled cashless vending machine that incorporates both cloud computing and payment gateway for ordering and purchasing items through digital payment systems by using a mobile application. The system enables a pre-installed mobile application to scan the Quick Response (QR) code attached to the body of a vending machine, opens the portal of a web-based virtual machine through the code, allows user to choose and order items from the virtual vending, initiates and authorizes a digital payment through an IoT gateway installed inside the physical vending machine by establishing a connection between user's and vendor's financial entities, and finally, dispenses the ordered items by unlocking the shelves of the vending machine after the successful payment transaction. [3]

This paper proposes an intelligent self-service vending system embedded with a single camera to detect multiple products in real-time performance without any labels, and the system realizes the integration of weighing, identification, and online settlement in the process of non-barcode items. The system includes a self-service vending device and a multi-device data management platform. The flexible configuration of the structure gives the system the possibility of identifying fruits from multiple angles. The height of the system can be adjusted to provide self-service for people of different heights; then, deep learning skill is applied. [4]

This topic relates to the integration of smart technology within vending machines, which includes advanced functionalities like

charging ports, potentially for mobile devices or electric vehicles, and on-demand printing services. These advancements in vending technology aim to provide added convenience, foster customer engagement, and support operational efficiency by leveraging the Internet of Things (IoT) and real-time data analytics. [5]

This outlines how interactive, multi-function kiosks are designed to improve city life by offering essential services and data access in public spaces. These kiosks serve multiple roles, from providing real-time information and transactional services to enhancing public safety through integrated alert systems. They can support city sustainability efforts by gathering environmental data and promote local businesses via digital advertising. The focus is on making urban spaces more accessible, connected, and engaging for citizens through modular and customizable designs suited to evolving urban needs.[6]

This paper explores the application of IoT technology to create an advanced vending machine that improves the efficiency and convenience of product dispensing. In this design, IoT sensors monitor inventory levels, machine temperature, and operational status, sending this data to the cloud for real-time analysis and management. The system supports cashless transactions through a QR-based payment method and utilizes a robust microcontroller (STM32 or ESP32) for control and interface management, which includes a touch-screen or mobile app interface. This approach provides vending operators with enhanced monitoring, enabling them to optimize stock levels and operational efficiency, while customers enjoy a streamlined purchasing experience through cashless payments and app-based interactions. [7]

This paper discusses the creation of a kiosk designed to offer various public services efficiently. In brief, the abstract probably outlines the need for a multi-functional kiosk that can provide government, utility, and general public services in one unit. Such kiosks aim to improve accessibility, reduce wait times, and streamline processes for users by integrating multiple services, like bill payments, information dissemination, and document processing, into a single platform.

The study may cover the design, functionality, and potential impact of these kiosks on public service delivery. [8]

This outlines the rapid growth and evolution of smart medical vending machines, which are increasingly used to provide convenient, 24/7 access to medications and medical supplies. These machines, equipped with advanced features like inventory tracking, remote monitoring, and secure dispensing mechanisms, are particularly beneficial in regions with limited healthcare access or during emergency situations. The study likely reviews current applications, including hospital settings and remote locations, as well as the technology's benefits for improving healthcare access and reducing dispensing errors. Future directions may include advancements in AI integration, personalized medicine, and enhanced cybersecurity measures to prevent unauthorized access and misuse. [9]

This review explores the potential of medicine vending machines in India, addressing both the opportunities and challenges associated with their implementation. The concept of medicine vending machines promises to improve accessibility to essential medications, particularly in remote and underserved regions. The study examines regulatory requirements, technological advancements, and public health benefits. Key challenges include adherence to pharmaceutical standards, preventing misuse, and ensuring proper maintenance. The paper concludes that while medicine vending machines could enhance healthcare accessibility in India, careful planning, policy development, and technological support are essential for their successful deployment. [10]

The research paper titled "Machine Learning Based Medicine Distribution System" by Lingyu Yan, Chunzhi Wang, Huiling Xia, Xinhua Dong, and Yichao Wang explores a system for automating medicine distribution using machine learning techniques. The proposed system aims to enhance efficiency and accuracy in medicine dispensing, particularly within automated medicine vending machines. A significant focus is on recognizing the correct medicine based on visual characteristics, using methods like Support Vector Machines (SVM) and

Connected Component analysis. This approach is beneficial for correctly identifying and distributing medicines in environments with high demand and requires minimal human intervention, thereby improving service delivery in healthcare settings. [11]

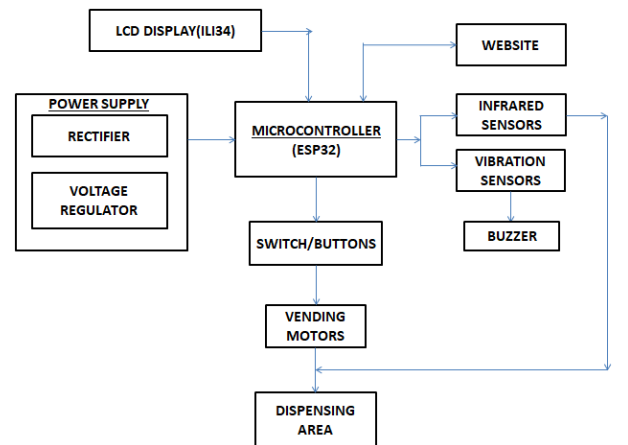
The paper "An IoT Based Smart Medicine Dispenser Model for Healthcare" by C.H. Patil, Nakiya Lightwala, and Mehul Sherdiwala presents an IoT-based solution to assist patients, particularly seniors, with medication adherence. This smart dispenser uses a fingerprint authentication system and dispenses medicines at scheduled times, reducing dosage errors. Connected to a mobile app, it notifies caregivers if a dose is missed. The system aims to improve medication accuracy and adherence, benefiting those with complex medication regimens or limited healthcare access. [12]

This research paper titled "Development of Automated Vending Machine for the Application of Dispensing of Medicines" explores the creation of an automated medicine vending machine that minimizes human intervention, ensuring 24/7 accessibility to essential medicines. It is designed to improve convenience, especially in public spaces, with features like user authentication through RFID, a payment system, and medication inventory management. This system aims to improve healthcare access by providing a reliable, user-friendly, and secure platform for medicine dispensing. [13]

The research paper "Implementation of Autonomous Medication Dispensing Units in European Pharmacies" by J. Müller et al. is focused on how automation can improve medication management in pharmacy settings, particularly in European contexts. The paper likely discusses the integration of autonomous dispensing units, which utilize robotics and intelligent systems to improve the accuracy, efficiency, and safety of medication dispensing. These systems can reduce errors, optimize inventory management, and enhance overall patient care by providing faster, more reliable services. [14]

The paper focus on automation technologies like robotic drug dispensing, prescription verification, and stock management. These systems aim to reduce medication errors, improve operational efficiency, and enhance patient safety by integrating automated features with existing healthcare frameworks such as electronic health records (EHR). [15]

#### 4. Block Diagram:



#### ➤ **Power Supply Unit:**

1. **Rectifier** : A **rectifier** in a power supply converts alternating current (AC) to direct current (DC), enabling the power supply to provide a stable voltage output for electronic devices.
2. **Voltage Regulator** : A **voltage regulator** in a power supply maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable and reliable operation for connected devices.

#### ➤ **Microcontroller unit:**

The **ESP32** is a powerful, low-cost microcontroller with built-in Wi-Fi and Bluetooth capabilities, making it ideal for IoT (Internet of Things) applications. It features a dual-core processor that operates up to 240 MHz, along with multiple GPIO pins, ADC, and DAC channels for versatile interfacing. The ESP32 supports various communication protocols, allowing seamless integration with sensors, actuators, and other devices in smart projects.

## ➤ Vending Machine Motor:

1. **Spring:** The core element that stores mechanical energy when wound. When released, it provides the necessary force to turn the motor and drive the mechanism that dispenses the product.
2. **Gear Mechanism:** This includes gears that help translate the rotational motion of the spring into the desired output, often reducing speed while increasing torque for effective product dispensing.
3. **Clutch System:** This component allows for engagement and disengagement of the motor from the dispensing mechanism, preventing continuous operation and allowing controlled dispensing.

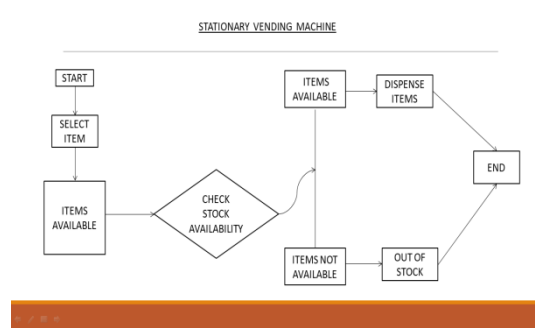
## ➤ Switches/Buttons:

**Switches and buttons** in vending machines serve as critical user interfaces that enable customers to interact with the machine and select products. These components are designed to provide a straightforward and intuitive way for users to initiate actions, such as selecting a specific item, canceling a transaction, or making a payment

## ➤ Infrared sensors:

Infrared sensors are utilized in vending machines for several critical functions that enhance user experience and operational efficiency. These sensors detect the presence of objects and measure distances using infrared light, making them valuable for various applications within vending machines.

## 5. Flowchart:



**Figure (1): Stationary vending machine**

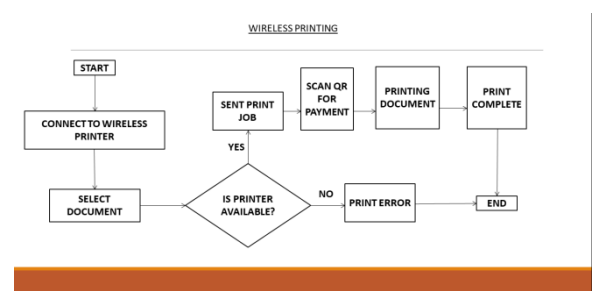
The flowchart represents the working process of a Stationery Vending Machine designed to dispense stationery items based on user selection. It starts with the user interacting

with the machine, where they select their desired item. The system then checks the availability of the chosen product in its inventory. This step ensures that users can only purchase items that are in stock, preventing unnecessary transactions and errors.

Once the stock availability is verified, the system follows two possible paths. If the item is available, the vending machine proceeds to dispense the product, allowing the user to collect it, and then the process ends. On the other hand, if the item is out of stock, the machine notifies the user, preventing further processing. This simple yet effective decision-making process ensures smooth operation and an efficient stock management system.

However, to make the system more functional, an important addition would be a payment verification step. Before dispensing an item, the machine should prompt the user to complete a payment, preferably via a QR code-based payment system integrated with a GSM module. Only after confirming a successful transaction should the machine proceed to the dispensing phase. Additionally, incorporating a feedback system can inform users about stock shortages or errors in real-time, enhancing the overall user experience.

To further improve reliability, the system should include error-handling mechanisms for potential hardware failures, such as motor or relay malfunctions. Implementing an alert system for administrators can help in quick restocking and maintenance, ensuring the machine remains operational. With these enhancements, the Stationery Vending Machine can function as an efficient, user-friendly, and technologically advanced solution for dispensing essential stationery items.



**Figure (2): Wireless printing**

The flowchart represents the Wireless Printing process in the Stationery Vending Machine system. It begins with the user connecting to the wireless printer, which is essential for sending print commands. Once connected, the user selects the document they wish to print. At this stage, the system checks the availability of the printer before proceeding further, ensuring that the printer is operational and ready for use.

If the printer is available, the system proceeds to send the print job after the user completes the payment by scanning a QR code. This payment verification step ensures that the service is only used after a successful transaction. Once the payment is confirmed, the printer starts processing the document, leading to a successful print completion. The process then ends, allowing the user to collect their printed document.

On the other hand, if the printer is unavailable or encounters an issue, the system detects the error and displays a Print Error message. This prevents users from being charged for an incomplete or failed print job. A potential improvement to this system could include an error reporting mechanism to notify administrators of printer malfunctions. Additionally, an option to queue print jobs for automatic printing when the printer becomes available could enhance the user experience.

## 6. Result and Discussion:

```

1 <DOCTYPE html>
2 <html lang="en">
3 <head>
4 <meta charset="UTF-8">
5 <meta name="viewport" content="width=device-width, initial-scale=1.0">
6 <title>Stationery Vending Machine</title>
7 <style>
8 body {
9 font-family: Arial, sans-serif;
10 text-align: center;
11 margin: 0;
12 padding: 0;
13 background-color: #f4f4f4;
14 }
15 .container {
16 width: 300px;
17 max-width: 400px;
18 margin: 20px auto;
19 padding: 10px;
20 background: white;
21 box-shadow: 0 0 10px 0 rgba(0, 0, 0, 0.3);
22 border-radius: 10px;
23 }
24 h2 {
25 color: #333;

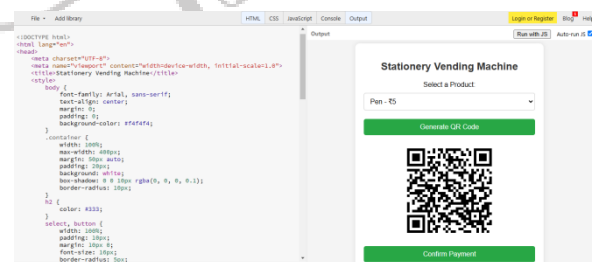
```

This image shows a **Stationery Vending Machine Payment Interface** built using HTML, CSS, and JavaScript. Users can select a product from a dropdown, generate a **QR code** for payment, and confirm the transaction. If the payment is successful, the system dispenses the product. The interface is styled with a clean design and runs on an online code editor for testing.

This image showcases a **Stationery Vending Machine Payment System** interface, which is developed using **HTML, CSS, and JavaScript**. The system allows users to select a product, generate a **QR code** for payment, and confirm the transaction before dispensing the product. The interface is well-structured and provides a smooth user experience. Below is a detailed breakdown of its functionality:

1. **Product Selection:** The dropdown menu allows users to choose a product from the available stationery items. Each product has a predefined price, which is displayed alongside the item name.
2. **QR Code Generation:** Once the user selects a product, clicking the "Generate QR Code" button creates a unique QR code containing the payment details, such as the selected product and its price. This QR code can be scanned using a mobile payment application.
3. **Payment Confirmation:** After making the payment via the QR code, users can click the "Confirm Payment" button. If the payment is verified successfully, the system processes the request and dispenses the selected product. If the payment fails, an error message is displayed, prompting the user to retry the transaction.

The interface is designed with a simple and user-friendly layout, utilizing **CSS for styling** to enhance readability and accessibility



## 7. Future Scope:

The ESP32-based Stationery Vending Machine has significant potential for future advancements in technology, usability, and scalability. With the increasing demand for automation and contactless transactions, this project can be expanded in various ways to improve efficiency, convenience, and user experience.

One of the key enhancements is the integration of advanced payment methods. While QR code-based payment is effective, adding support for NFC, RFID, and biometric authentication can make transactions faster and more secure. A built-in wallet system could also be introduced, allowing users to pre-load money and make purchases seamlessly.

Another important area of improvement is smart inventory management. By integrating IoT-based sensors, the machine can automatically monitor stock levels and notify the owner when refilling is needed. Additionally, AI-driven demand analytics can help predict popular products, ensuring better stock availability and reducing wastage.

To further enhance usability, cloud-based monitoring and analytics can be implemented. A mobile app or web dashboard can be developed for real-time tracking of sales, inventory, and machine performance. Owners can receive automated reports, helping them optimize business operations. AI-driven analytics can also suggest pricing strategies based on demand trends.

For improved sustainability, the vending machine can be powered using solar panels, making it an eco-friendly and energy-efficient solution. Additionally, optimizing the ESP32's power consumption through low-power components and sleep modes can further enhance energy efficiency, reducing operational costs.

