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Review on VEND IT!- A Smart Vending Machine

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Abstract: Traditional vending machines, though reliable, have often lagged behind in terms of convenience, personalization, and sustainability. As society rely on digital connectivity and automation continues to grow, the need for a smarter, more responsive vending solution has become increasingly evident.
In a world marked by constant technological innovation and evolving consumer preferences, the time has come to reimagine the traditional vending machine.
"Vend It" is a visionary project that aims to reinvent the conventional vending machine, leveraging cutting-edge smart technology to create a seamless, efficient, and user-friendly vending experience. VEND IT! encompasses a comprehensive suite of innovations, ranging from intelligent inventory management to user-centric interface design, and remote monitoring and management capabilities.
Keywords: Vend it, user-centric interface design, mobile application, Raspberry Pi

I. INTRODUCTION

In an era defined by technological advancements and increasing consumer demands, the traditional vending machine has seen limited innovation, often failing to meet the evolving expectations of convenience, personalization, and efficient inventory management. This project seeks to bridge this gap by introducing a smart vending machine solution powered by the Raspberry Pi, a versatile and cost-effective computing platform. By integrating IOT and machine learning technologies, this project aims to revolutionize the vending machine industry, creating a cutting-edge, user-centric experience that not only provides consumers with a wide array of products but also offers real-time monitoring, predictive analytics, and personalized recommendations.

II. PROBLEM STATEMENT

The traditional vending machine, while a ubiquitous presence in our daily lives, is facing a pressing challenge in keeping pace with the rapidly evolving technological landscape and shifting consumer expectations. As we embrace the digital age and the era of smart technology, vending machines have remained largely static, offering limited personalization, inefficient inventory management, and minimal interactivity. This stagnation presents a series of critical issues that need to be addressed:

1) *Limited Consumer Engagement:* Conventional vending machines provide little to no engagement with consumers. They lack the ability to offer personalized recommendations or adapt to changing consumer preferences, resulting in missed opportunities for customer satisfaction and increased sales.
2) *Inventory Management Inefficiencies:* Traditional vending machines often suffer from stock-outs or overstocking issues, leading to revenue loss and customer frustration. Manual restocking processes are labor-intensive and error-prone, contributing to these inefficiencies.
3) *Payment Options:* In an era increasingly characterized by digital payments and contactless transactions, vending machines that only accept cash or traditional payment methods creates vandalism also falling out of step with consumer preferences, limiting their appeal and convenience.
4) *Maintenance and Monitoring Challenges:* Traditional vending machines often require manual inspection and maintenance, leading to downtime and increased operational costs. Remote monitoring and management capabilities are underutilized or nonexistent.

III. LITERATURE REVIEW

1) IOT based Smart Vending Machine for Bangladesh: In 2019, a significant development emerged with the introduction of the "Virtual Vending Machine" in Bangladesh. The Virtual Vending Machine, incorporates a distinctive QR code on its body, serving as a gateway to a web-based system. This QR code enables users in Bangladesh to access a virtual representation of the vending machine through a specific URL. Enhancing user interaction, this approach allows clients to view product lists, make selections, and complete online transactions—all facilitated through the unique QR code embedded on the machine.

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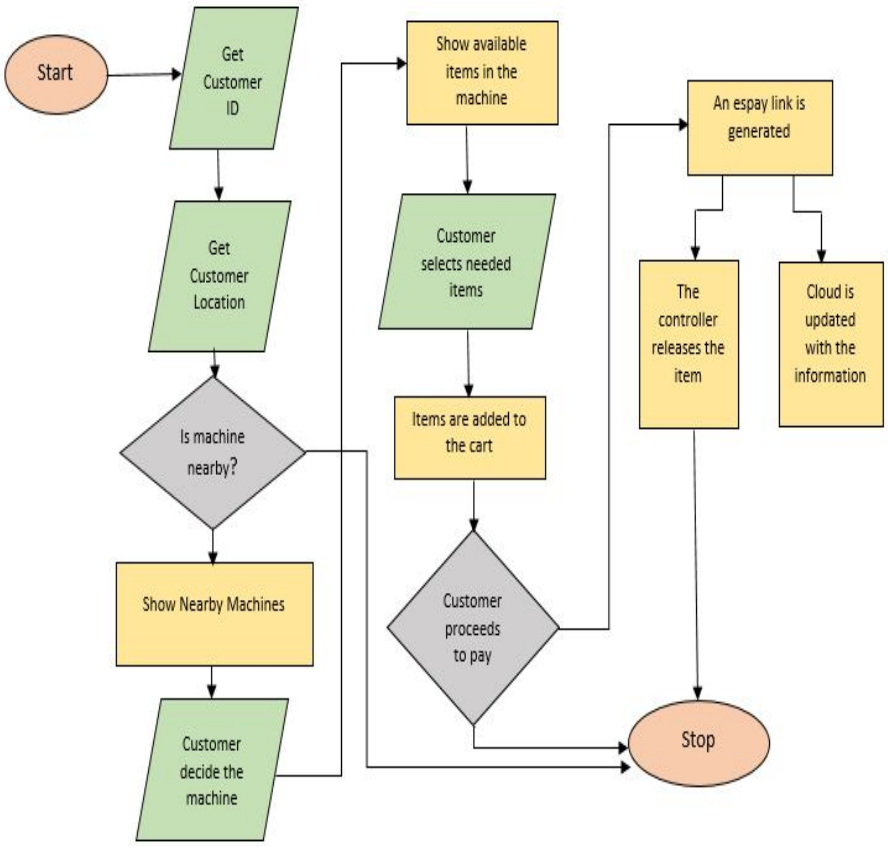
The machine's IOT integration aligns with the broader goal of addressing systemic issues in traditional vending setups, aiming to streamline user engagement and transactions while mitigating challenges related to data analysis and administrative costs. Furthermore, the deployment of GPRS technology enables seamless transmission of sales and supply information to cloud storage, underscoring the commitment to efficient management systems within the context of coffee vending machines in Bangladesh. This case study serves as a testament to the continuous evolution and global applicability of IOT-based solutions in the realm of coffee vending machines [3].

2) Smart Vending Machine for Gym: In 2021, South Korea witnessed a significant breakthrough with the Smart Vending Machine for Gym. Unlike conventional machines, it accommodates various payment methods, enhancing user convenience for seamless transactions by gym-goers in South Korea. A standout feature of this machine is its integration of a BMI checker, emphasizing its commitment to health and wellness promotion within the gym setting. Users can now access and monitor their Body Mass Index directly at the vending machine. This case study underscores the ongoing evolution of vending machine technology, showcasing a shift from conventional functionalities to tailored solutions for specific environments like gyms [4].

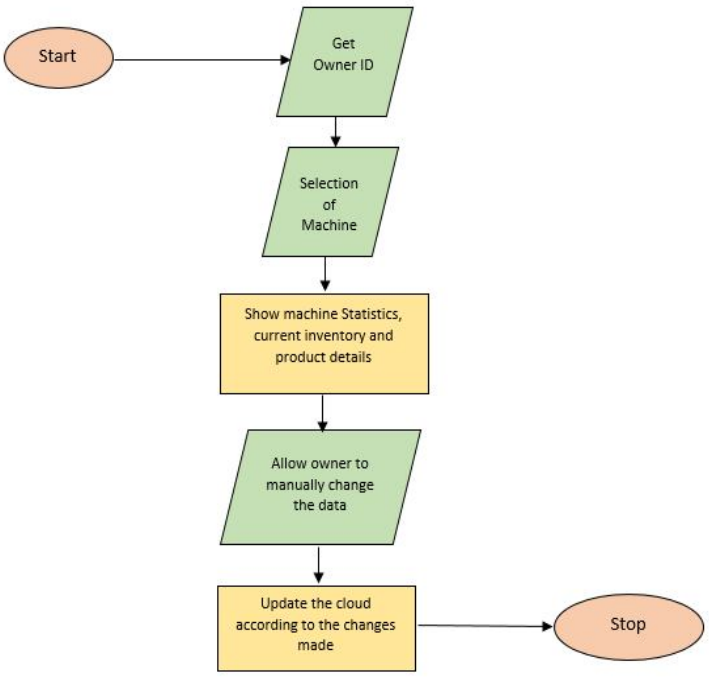
3) In 2020, Taiwan introduced the "Smart Vending Machine with Machine Learning & Deep Learning," marking a significant stride in intelligent vending solutions. This machine incorporates temperature and camera sensors for real-time environmental monitoring. Utilizing face recognition with deep learning, it enables personalized interactions with users. A standout feature is the application of the k nearest neighbors (KNN) machine learning method, allowing dynamic price adjustments in real-time. This responsive pricing mechanism reflects a forward-thinking approach, adapting to consumer preferences and market conditions. This case study showcases the fusion of deep learning and machine learning in vending machine technology, exemplified by the Smart Vending Machine in Taiwan. Experience [5].

IV. METHODOLOGY

A. For User: -



B. For Owner :-



In this project, we are mainly using an android application with MQTT server and raspberry pi as our microprocessor.

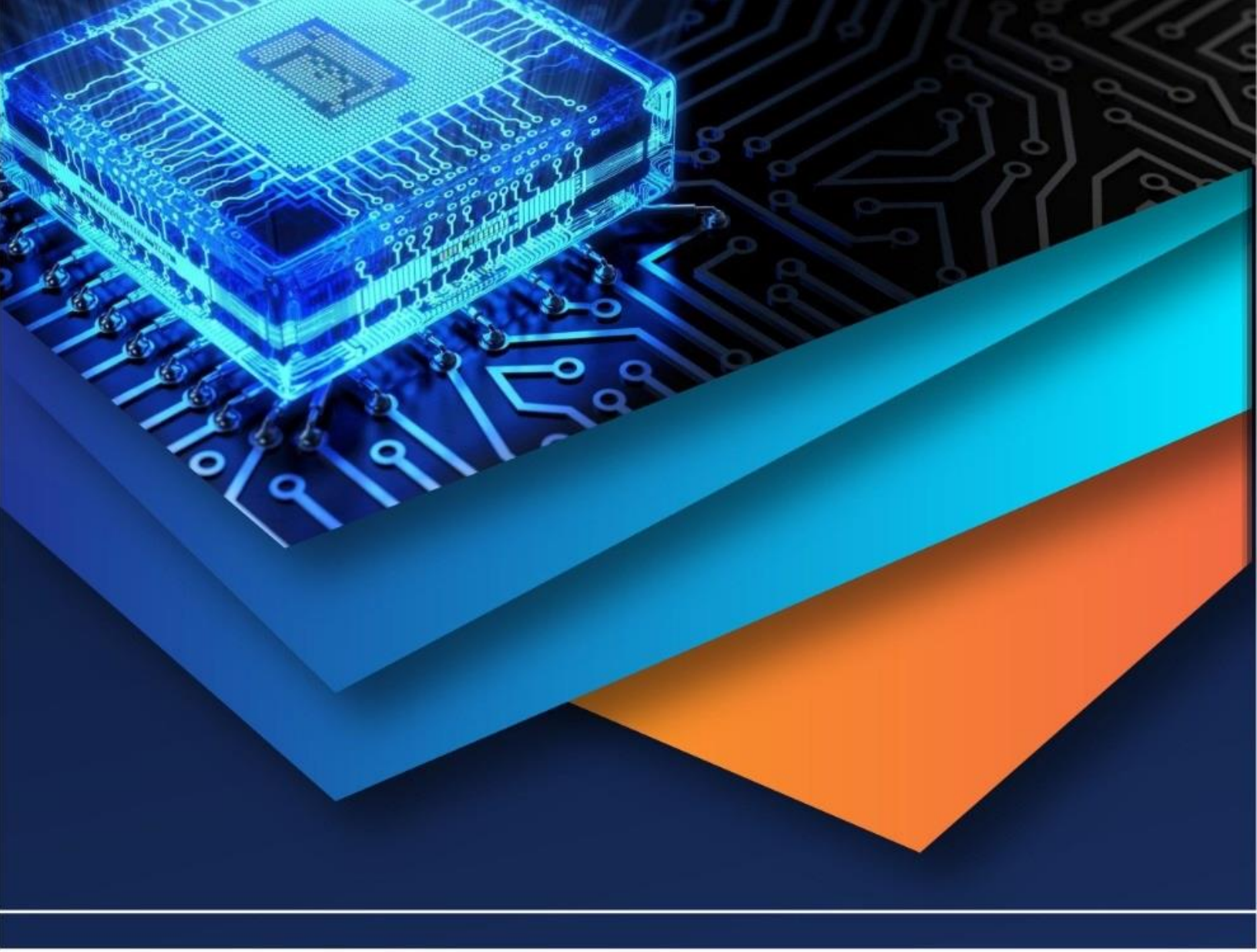
1) *Android Application:-* FOR USER: Users are required to login in the "Vend It!" app so that they can access vending machine products online. After logging in, the user can track the nearest vending machine to them, the app displays the respective machine name, address and distance between the user and the machine. The list of all the items available will be displayed with the price through the app. After selecting, the products go into the cart where users can increase or decrease the quantity of products. After selection the page redirects to espay for online payment through UPI or card. The app further displays order history for keeping track of items with detailed information for the purpose of re-order. The owner of the vending machine receives real-time data of products with quantity, paying details and time of purchasing. FOR OWNER: Owner has its unique username id with password for owner authentication. After logging-in every machine with its respective address is shown in list. Owner can check product details and inventory present in the machine through select a machine. Product details includes the item name vended out from the machine with date, time and price. Inventory includes the items available in the vending machine with expiry date of the item.
2) *MQTT server:-* This Wi-Fi model is the intermediate connection between raspberry pi and android application. The user vending out products from the android app communicates with MQTT which sends a signal to raspberry pi for pushing the respective product out of the machine.
3) *Hardware:-* The proposed project uses raspberry pi (rpi4 model B) as a microprocessor for controlling the vending machine mechanism of vending out products. Motors are used for individual grid of the vending machine so that the spring can rotate and the products can be pushed out. Motor drivers are used for controlling the respective motors of the grid.

V. CONCLUSION

Hence this project aims to design an automated vending machine to reduce the workforce. A multipurpose machine which provides a wide range of products like snacks, chocolates, stationery, medicines etc. The "Vend It" project represents a transformative leap forward in the realm of vending machines by harnessing the power of smart technology to reshape the vending industry. Vend It aims to provide a comprehensive solution to the challenges through a multifaceted approach that encompasses real-time data, intelligent inventory management, personalized user experiences, advanced payment options, sustainability measures, data analytics, and remote management capabilities.

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