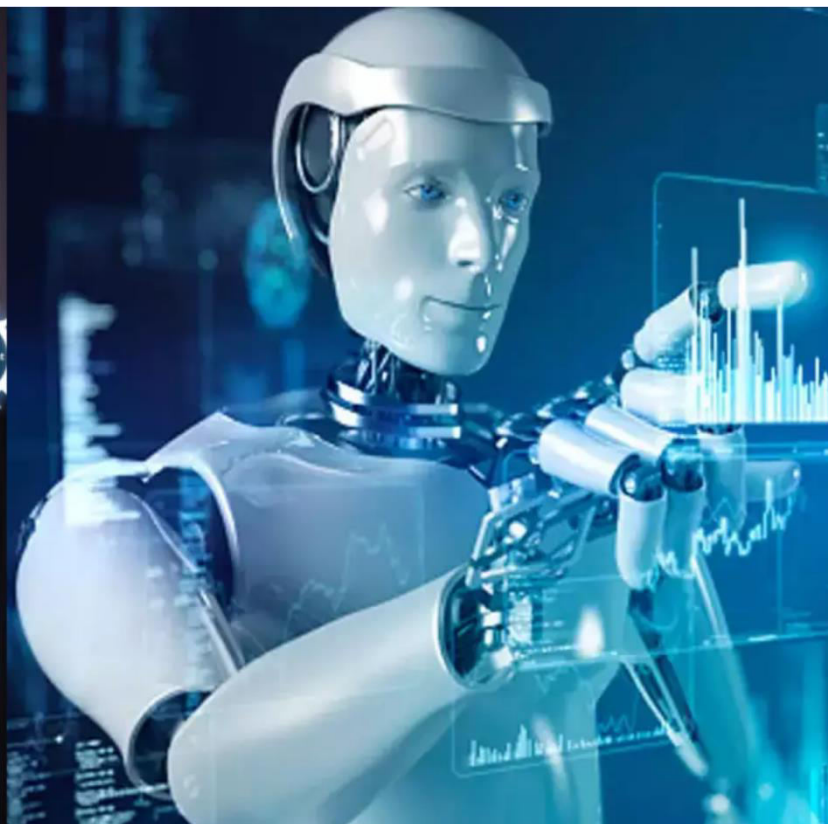




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# Automatic Lemon Juice Vending Machine

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**ABSTRACT:** An automatic lemon juice vending machine is an innovative solution designed to provide fresh, hygienic, and ready-to-serve lemon juice with minimal human intervention. The system integrates mechanical, electrical, and electronic components to automate the entire process, from selecting lemons to extracting juice and dispensing it into a cup. Equipped with sensors and a microcontroller, the machine ensures precise control over operations such as lemon cutting, squeezing, and filtration. Users can easily operate the machine through a simple interface, selecting options like sugar level, salt, or additional flavoring based on preference.

The vending machine emphasizes cleanliness and efficiency by reducing direct human contact, thereby maintaining better hygiene standards. It also incorporates a refrigeration unit to store lemons and maintain freshness, along with an automated cleaning mechanism to ensure consistent quality. Payment integration, such as coin-based or digital methods, enhances user convenience and accessibility.

This system is particularly useful in public places such as railway stations, malls, and educational institutions, where demand for quick and refreshing beverages is high. By combining automation with user customization, the automatic lemon juice vending machine not only improves service speed but also promotes healthy beverage choices. Overall, it represents a cost-effective, time-saving, and scalable solution for modern beverage dispensing needs.

**KEYWORDS:** hygienic, Intervention, vending machine, sensors, microcontroller

## I. INTRODUCTION

The automated lemon juice vending machine is a cutting-edge technology that minimizes human interaction while offering clean, fresh, and conveniently accessible refreshments. The demand for quick and healthful drink options that are easily accessible in locations like train stations, retail malls, hospitals, offices, and educational institutions is rising due to today's hectic lifestyle. Many people enjoy lemon juice as a cool beverage because of its high vitamin C content and health advantages. However, standard cooking methods mostly depend on manual procedures, which can result in hygienic problems, uneven flavor, and more lengthy preparation times. By guaranteeing quicker service, better cleanliness, and constant quality, the implementation of an automated system helps get beyond these restrictions.

## II. RELATED WORK

### LITERATURE SURVEY

Fresh lemon juice can be automatically taken out, mixed, and supplied by an automatic lemon juice vending machine. For speedy and hygienic serving, it combines mechanical, electronic, and control technological advances.

1. Mechanical System: Lemon juice is obtained by machines via cutters, squeezers, or crushers. For clean output, filtration devices eliminate pulp and seeds.
2. Dispensing Method: To make lemonade in the appropriate amounts, valves or pumps regulate the flow of sugar syrup, water, and lemon juice.
3. Control Mechanism: Motors, sensors, and valves are controlled by microcontrollers, such as Arduino or PLC. Temperature, liquid level, and cup position are all detected by sensors.
4. IoT and Payment: IoT for remote monitoring and cashless payment (QR/Rfid) are examples of modern systems.
5. Maintenance & Hygiene: In order to ensure safety, designs focus on easy cleanup, automatic waste disposal, and the use of food-safe materials.
6. Research and Commercial Trends: The orange/lemon juice machines that are now in use are expensive yet effective. Automated low-cost prototypes are the main focus of student projects.
7. Research Gap: Enhancements in flavoring control, energy management, automatic sterilization, and fruit-size adjustments are required.

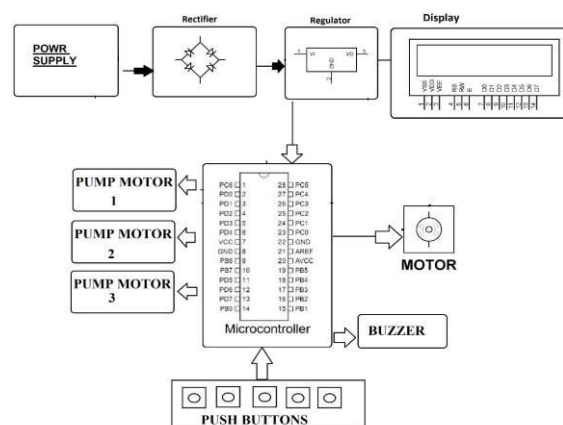
## III. METHODOLOGY

### Existing System:

The reliability and efficiency of the present lemon juice preparation system are affected by a range of problems. It is less feasible for general use since it often involves high start-up costs and complex maintenance. Inconsistencies in taste and quality can result from the process's heavy dependence on manual ingredient mixing. Additionally, direct human engagement limits hygiene control, raising the risk of contamination. The lack of smart features and real-time monitoring, which limits automation, performance tracking, and overall system optimization, is another major drawback.

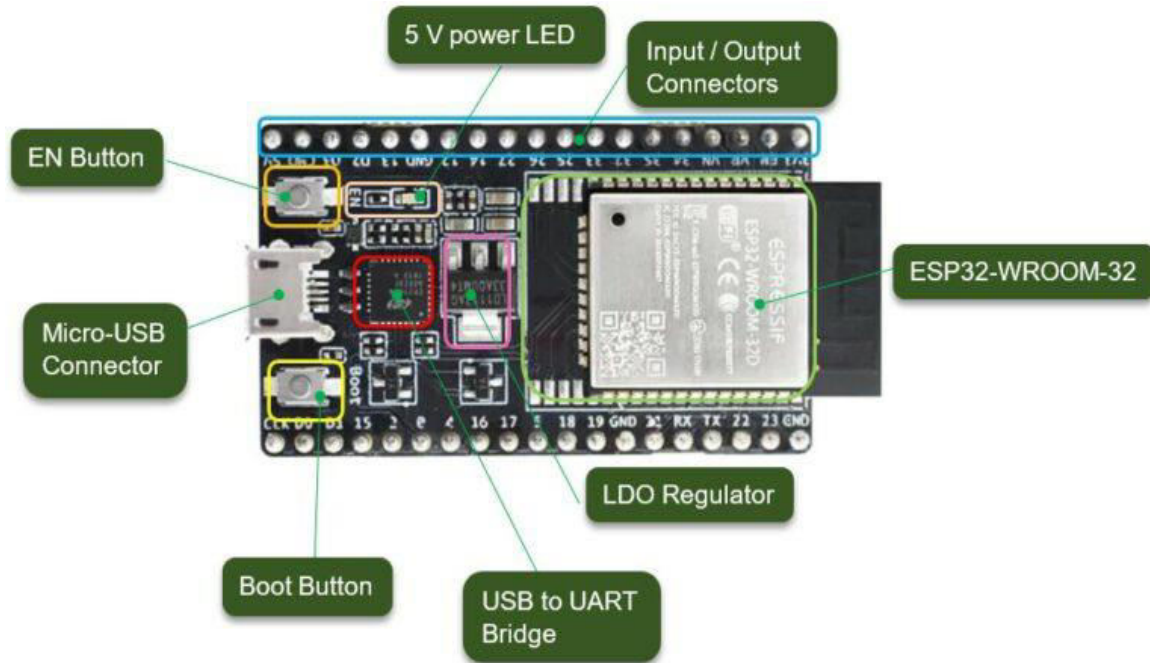
### Proposed System:

By offering a fully automated process for juice preparation and dispensing, the proposed approach for the automatic lemon juice vending machine aims to eliminate limitations of modern methods. Through the use of sensors and actuators, it ensures precise control over ingredient ratios, creating consistent flavour and quality. By running contactless, the technology lowers the danger of infection and increases hygiene. It also includes IoT-enabled function for system status updates and real-time monitoring. Additionally, the design is affordable and easy to use, which makes it suitable for extensive use in a variety of public settings



a.

ESP328



1. Module ESP32-WROOM-32: The primary microcontroller that manages the entire system is this one. Because of its integrated Bluetooth and Wi-Fi, it is perfect for real-time monitoring and Internet of things applications.
2. Micro-USB Plug: used to upload code from a computer and provide power to the board. EN (Enable) button functions as a reset button. The ESP32 is restarted by pressing it. Boot button: used when uploading code to switch the ESP32 into programming mode.
3. Bridge from USB to UART: allows the ESP32 to interface with the computer by converting USB signals into UART (serial communication).
4. LDO Control: controls voltage to guarantee a steady power supply for the board.
5. LED powered by 5V: shows that the board is powered on.
6. GPIO (Input/Output) Pins: Sensors, motors, relays, and other project components are connected using these pins.

#### IV. CONCLUSION

The automatic lemon juice vending machine project successfully demonstrates how automation can improve convenience, hygiene, and efficiency in beverage preparation. The system provides fresh, consistent, and customizable juice while minimizing human intervention and reducing the risk of contamination. By integrating sensors, actuators, and IoT-enabled components like the ESP32, the machine ensures precise operation, real-time monitoring, and user-friendly interaction. This project highlights a cost-effective and sustainable approach to modern vending solutions, offering a practical and scalable model for delivering healthy refreshments in public spaces. Overall, it reflects the potential of combining technology and innovation to meet everyday needs in a fast-paced world.

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