**Smart cooker whistle counter with auto shut-off**

**Executive Summary**

The **Smart Cooker Whistle Counter** is an innovative kitchen automation device designed to provide a seamless, safe, and efficient cooking experience. Using a combination of **Arduino**, **microphone sensor**, **buzzer**, and **LCD I2C display**, it automatically counts cooker whistles and notifies the user with visual and audio cues. The system is equipped with **push buttons**, **boost converter**, **relay module**, **3-pin plug**, and **switch** for enhanced control and safety. With a user-friendly design, it enables users to monitor cooking without constant supervision, reducing the risk of overcooking or burning. This solution is ideal for households, hostels, and busy individuals, offering a smart, time-saving upgrade to traditional pressure cooking.

**Introduction**

**Problem Statement**

A Smart Cooker Whistle Counter with Auto Shut-Off faces challenges like accurate whistle detection due to background noise, requiring advanced sensors. Compatibility issues arise with different pressure cookers and stove types, demanding adaptable designs. Safety concerns include false shut-offs, necessitating dual-sensor verification for reliability. Power supply and connectivity limitations may affect performance, so offline functionality and manual override options are essential. Market acceptance depends on user-friendly interfaces and educating consumers about the benefits of automation in cooking.

**Purpose**

The purpose of the **Smart Cooker Whistle Counter** is to automate the process of monitoring pressure cooker whistles using electronic components, thereby improving cooking accuracy and user convenience. It is designed to eliminate the need for constant human supervision by counting whistles precisely and providing real-time alerts. This innovation aims to enhance kitchen safety, prevent overcooking or undercooking, and support efficient cooking practices—especially useful for students, working professionals, and the elderly.

**Scope**

The scope of the **Smart Cooker Whistle Counter with Auto Shut-Off** project includes the design, development, and implementation of an embedded system for automatic whistle counting and stove shut-off. The system utilizes a microphone sensor to detect pressure cooker whistles, a relay to control the stove, and an LCD display for user feedback. It offers adjustable whistle count settings, customizable vibration levels, and provides alerts via a buzzer. The project aims to serve as a cost-effective, safe, and efficient solution for home cooks, with potential for further enhancements such as mobile integration and multi-cooker support.

**GPCU**

**Gap Analysis**

In traditional cooking methods using pressure cookers, users rely on manual whistle counting to determine cooking time. This process is prone to human error, especially when the user is distracted or multitasking, often leading to overcooked or undercooked food. Moreover, forgetting to turn off the stove can pose significant safety risks and result in energy waste. Despite the increasing demand for kitchen automation, there are limited low-cost solutions specifically designed to monitor whistle counts and control cooking duration in real-time.

Existing smart kitchen appliances focus largely on connectivity features like Wi-Fi control or app integration, which may not be practical or affordable for all users, especially in developing regions. There is a clear gap in the market for a **simple, standalone device** that performs a very specific yet vital task—accurately counting whistles and turning off the stove when cooking is done. The **Smart Cooker Whistle Counter with Auto Shut-Off** effectively addresses this gap by offering a **user-friendly**, **cost-effective**, and **safe alternative** to manual monitoring, making it ideal for everyday household use.

**Product Description (Product Overview):**

The **Smart Cooker Whistle Counter with Auto Shut-Off** is a smart kitchen device designed to automate and simplify the pressure cooking process. At its core, the system uses a **microphone sensor** to detect the sound of each whistle produced by a pressure cooker. Each detected whistle is displayed in real time on an **LCD screen**, allowing the user to track progress effortlessly. A preset whistle count can be configured using **PLUS and MINUS buttons**, and the count is locked using a **SET button** to prevent accidental changes during cooking.

Once the actual number of whistles matches the set value, the system automatically activates a **relay module** to simulate turning off the stove (in practice, this could be connected to a smart switch or automatic gas valve). Simultaneously, a **buzzer alert** is triggered to notify the user that cooking is complete. This automatic shut-off mechanism significantly enhances kitchen safety and reduces the risk of overcooking or unattended cooking mishaps.

Designed with user-friendliness in mind, the product includes intuitive controls, a clear digital interface, and a **RESET button** to start a new cooking cycle. Its compact size, energy-efficient operation, and standalone functionality make it a practical addition to any household. By reducing manual monitoring and improving cooking precision, this smart system offers a reliable, affordable solution for today’s busy kitchens.

**Comparison of Product:**

| **Criteria** | **Traditional Pressure Cooker** | **Smart Cooker Whistle Counter with Auto Switch-Off** |
| --- | --- | --- |
| **Whistle Counting** | Manual, prone to errors | Automated and accurate whistle detection |
| **Cooking Monitoring** | Requires constant supervision | Hands-free operation with automatic alerts |
| **Cooking Accuracy** | Inconsistent, due to manual counting | Consistent and precise cooking results |
| **Safety** | Risk of overcooking and overheating | Auto switch-off ensures safe operation |
| **Energy Efficiency** | High energy consumption without control | Energy-efficient with automatic switch-off |
| **User Convenience** | Time-consuming and inconvenient | User-friendly and hassle-free operation |
| **Technology Integration** | No smart features | Advanced whistle counting and automation |
| **Market Availability** | Widely available | Limited availability in smart cooking solutions |

**Uniqueness of the Product**

The **Smart Cooker Whistle Counter with Auto Shut-Off** stands out for its **focused functionality**, offering a dedicated solution to a common cooking challenge—accurate whistle counting. Unlike general-purpose smart kitchen appliances that are often expensive and feature-heavy, this device provides a **low-cost, standalone system** that doesn’t rely on mobile apps or internet connectivity. Its simplicity, ease of use, and precise sound-based automation make it accessible to a wide range of users, including the elderly and busy homemakers. With its **auto shut-off relay**, **user-lockable settings**, and **real-time LCD feedback**, it ensures safer, more consistent cooking without constant supervision—something most conventional kitchen gadgets do not provide.

**DESIGN AND ENGINEERING STANDARDS:**

The development of the **Smart Cooker Whistle Counter with Auto Shut-Off** adheres to established design and engineering practices to ensure safety, efficiency, reliability, and ease of use in domestic kitchen environments.

**ISO (International Organization for Standardization)**

* **ISO 9001**: Quality Management Systems – Ensures consistent product quality and manufacturing processes.
* **ISO 12100**: Safety of Machinery – General principles for risk assessment and risk reduction in embedded systems.
* **ISO 26262**: Functional Safety for Electrical and Electronic Systems (relevant for kitchen appliance safety).

**IEEE (Institute of Electrical and Electronics Engineers)**

* **IEEE 315**: Standard Graphic Symbols for Electrical and Electronics Diagrams – Used for designing the schematic.
* **IEEE 802.3**: Communication and interfacing standards (for potential future integration with IoT or smart home networks).
* **IEEE 1685**: IP-XACT for hardware design interoperability (if expanding to custom PCBs or modular units).

**IEC (International Electrotechnical Commission)**

* **IEC 60335-1**: Safety of Household and Similar Electrical Appliances – Part 1: General Requirements.
* **IEC 61010-1**: Safety requirements for electrical equipment for measurement, control, and laboratory use.
* **IEC 61508**: Functional Safety of Electrical/Electronic/Programmable Electronic Systems.

**ASTM (American Society for Testing and Materials)**

* **ASTM D3359**: Adhesion test for surface coatings (for durable casing finishes).
* **ASTM E1954**: Standard Guide for Fire Prevention for Photographic Materials (applicable to circuit fire safety).
* **ASTM F963**: Consumer Product Safety – Relevant for devices used in household environments.

**ASME (American Society of Mechanical Engineers)**

* **ASME Y14.5**: Dimensioning and Tolerancing – For mechanical housing design and enclosure precision.
* **ASME A17.1**: Safety Code for Electrical Components in Domestic Applications (relay and switch integration).

**BSI (British Standards Institution)**

* **BS EN 60335-2-15**: Safety of Household Electrical Appliances – Particular requirements for cooking and heating appliances.
* **BS EN 60529**: Degrees of Protection by Enclosures (IP Rating for protection against steam and spills).

**DIN (Deutsches Institut für Normung)**

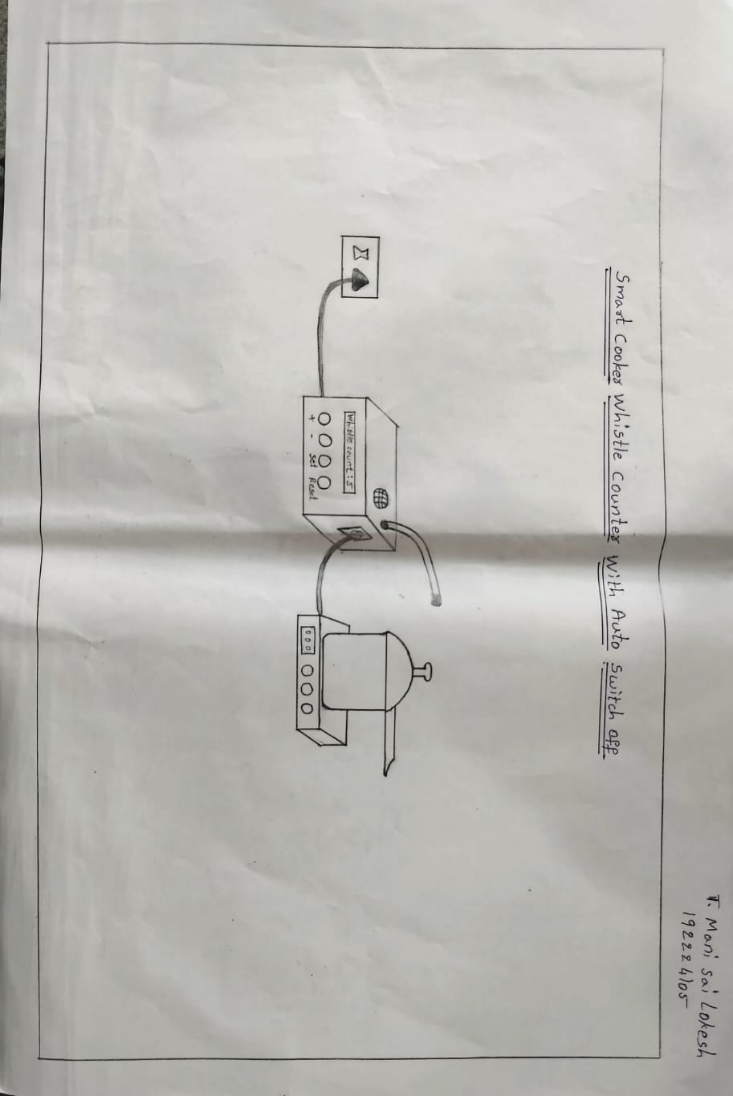
* **DIN EN 60335-2-15**: Safety of Household Appliances – Applicable to devices with heating or cooking control functions.
* **DIN 4102**: Fire Behavior of Building Materials – Ensures flame-retardant materials are used in device housing.

**CEN (European Committee for Standardization)**

* **EN 60335-1**: General safety of household electrical appliances.
* **CEN/TR 15350**: Risk assessment for consumer product use – to ensure the device can be used safely in kitchens.

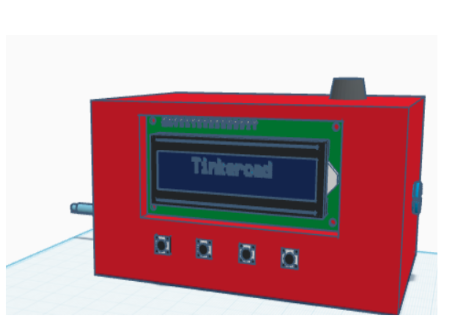
**2D DESIGN:**

**Technical Sketches & Diagrams:**



**3D DESIGN:**

**3D Model of the Product:**



**Product Image :**

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**FUNCTIONAL PROTOTYPE**

The functional prototype of the **Smart Cooker Whistle Counter with Auto Shut-Off** has been successfully developed and tested to validate its core functionality. The device integrates sound detection technology, embedded control systems, and actuation mechanisms to provide automated cooking management with enhanced safety and convenience.

**Key Features of the Prototype:**

* **Whistle Detection System:** The prototype uses a microphone module to detect pressure cooker whistles. The sound signal is processed by a microcontroller (e.g., Arduino Uno) which accurately counts the number of whistles.
* **Auto Shut-Off Mechanism:** Once the preset whistle count is reached, the system activates a servo motor to physically rotate and shut off the gas stove knob, ensuring safe and precise cooking without user intervention.
* **Preset Button Functionality:** The device includes a user-settable button to select the desired whistle count before cooking begins. This feature allows flexibility based on the type of food being prepared.
* **Compact and Durable Build:** The prototype is housed in a compact casing that accommodates all electronic components securely. The design is suitable for typical Indian kitchen conditions with considerations for heat and moisture resistance.
* **Standalone Power Supply:** Powered by a rechargeable battery, the device can operate independently without requiring a constant power source, allowing for safe and uninterrupted operation even during power fluctuations.

**Conclusion and Future Work**

The **Smart Cooker Whistle Counter with Auto Shut-Off** is a practical and innovative solution to a common household challenge—monitoring and managing cooking time with pressure cookers. By automatically counting whistles and turning off the stove when the preset limit is reached, the device enhances cooking safety, prevents overcooking, and provides convenience for users of all ages. Its cost-effective design, ease of use, and independence from internet connectivity make it highly accessible, especially in regions where smart kitchen technologies are still emerging. This project not only promotes energy efficiency and food consistency but also contributes to the broader goal of smart home automation with a focused, user-centric approach. With further refinement, the system holds strong potential for real-world application and market deployment.

**Future Improvements**

1. IoT Integration

Add Wi-Fi or Bluetooth connectivity to allow remote monitoring and control using a mobile app. Users can receive alerts, set whistle limits, or view cooking logs in real time.

2. Voice Assistant Compatibility

Integrate with smart assistants like Alexa or Google Assistant so users can set or reset the whistle count using voice commands.

3. Multi-Sensor Detection

Combine microphone input with temperature or pressure sensors for more accurate whistle detection and cooking status monitoring.

4. Custom Recipe Modes

Include programmable modes for different dishes (e.g., rice, dal, biryani) with preset whistle counts and shut-off timings.

5. Battery Backup or Solar Power Option

Add a rechargeable battery or small solar panel to maintain functionality during power outages or for outdoor cooking scenarios.

6. Mobile App with Cooking Analytics

Build an app that stores whistle logs, cooking durations, and user preferences to help optimize future cooking tasks.

7. Advanced Safety Features

Integrate gas leak detection or emergency shutdown if abnormal conditions are detected, improving household safety.

8. Display Upgrade

Use an OLED or touchscreen display to show more cooking info, timer, or safety alerts in a more user-friendly way.

9. Servo Motor for Auto Stove Turn-Off

A servo motor can be implemented to automatically rotate and shut off the gas stove knob once the preset whistle count is reached. This provides a physical, hands-free shut-off mechanism, boosting safety and full automation. The addition of this servo-driven action would transform the device into a fully autonomous cooking assistant, ideal for modern kitchens.

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