TEAM MPM
Members: Macabenta, Morden, Pilapil

Overview:

Kitchen incidents are among the most frequent and potentially dangerous problems in different households due to the variety of hazards present in the environment. From sharp utensils and slippery floors to hot surfaces and flammable materials, the kitchen has numerous risks that can lead to anything from minor accidents to serious injuries. Common issues such as gas leaks, unattended stoves, and forgotten cooking remain as prevalent safety concerns in homes across many countries.

One of the most vulnerable and common demographics that are exposed to these dangers are the elderly, especially those living by themselves. Elderly individuals face numerous challenges in their daily lives due to the effects of aging, like memory loss and slow reaction time. These issues are particularly problematic when dealing with stuff in the kitchen, as they significantly increase the risk of accidents occurring.

Although plenty of advancements and innovations have been developed to address these problems, most are either expensive, overly complex, or not user-friendly for the elderly. In response to this challenge, the developers identified the need to create a system capable of providing real-time safety monitoring, using IoT technologies in conjunction with a mobile application.

The Kitchen Sentinel mobile app plays a central role in the system by serving as the user-facing interface for caregivers and family members. It allows remote monitoring of kitchen safety data in real time, such as gas levels, temperature, and user motion, through an intuitive, user-friendly, and accessible interface built with elderly and caregiver needs in mind. The app is lightweight, cross-platform, and designed to be simple enough for non-technical users to navigate. It includes features like a real-time dashboard, alert history, and remote notification settings, ensuring that even if the elderly user is unaware of danger, someone else can be notified promptly.

User Profile and Characteristics: (A description of the important characteristics of the users of the system.)

The primary users are elderly individuals, especially those living alone or with limited supervision. Important characteristics of these users include:

Characteristic	Description
Cognitive and physical limitations	Memory issues and reduced mobility are common.
Low technology familiarity	Users may not be comfortable using smartphones or navigating complex apps.

High vulnerability	They are at higher risk of kitchen-related incidents like gas leaks and fires.
Need for passive safety mechanisms	Systems must operate with minimal input required from the user.
Family or caregiver reliance	Caregivers often play an indirect but crucial role in monitoring safety, supported through the mobile application.

Task Analysis

The primary tasks performed by users of the Kitchen Sentinel involve minimal active engagement because of the system's automated nature. User activities include monitoring stove usage, detecting gas leaks, and responding to alerts. The system handles these tasks automatically through sensors, ensuring users do not need to manually check appliances. A manual override button allows users to control the device when necessary.

Caregivers or family members use the mobile application to receive remote alerts and review kitchen status, enabling indirect but crucial support. The app also helps them monitor ongoing sensor data with minimal intrusion into the user's daily life.

These tasks occur in a typical kitchen environment, where hazards like gas and heat require a reliable and easy-to-use monitoring solution. The system is designed to function efficiently without requiring frequent interaction, making it suitable for elderly users with cognitive or physical limitations.

Analysis of the Existing System

Application Name: Kitchen Sentinel
What is it:

Kitchen Sentinel is a smart, low-cost safety system designed for household kitchens, specifically to protect elderly individuals from gas leaks and unattended stove usage. It continuously monitors gas levels, stove activity, and user presence using various sensors. When a potential hazard is detected, it triggers local alerts and sends remote notifications to caregivers or family members in real time through the mobile application.

Features:

The team designed the Kitchen Sentinel to deliver essential safety functions through the integration of smart yet affordable components.

- **Gas Leak Detecting (MQ-2 Sensor):** Monitors LPG levels and identifies leaks.
- **Stove Activity Monitoring (Temperature Sensor):** Detects whether the stove is active.
- **Motion Detection (PIR Sensor):** Determine user presence near the stove.
- **Local Alerts (Buzzer and LED):** Indicators used to notify users of possible dangers.
- **Remote Alerts (Wi-Fi Module):** Sends alerts to caregivers or family members in real-time.

- **Manual Override (Reset Button):** Silences alarms when necessary and acknowledges alerts.

Strengths	Limitations
Affordable and replicable	No automatic gas shutoff (only alerts, no control)
Real-time safety monitoring	Limited to indoor kitchens
Simple hardware-based design	Sensor inaccuracies may lead to false positives
Alerts users even in the absence of caregivers (through buzzers and LED)	Relies on network availability for remote alerts
User-Friendly (easy for non-technical individuals).	No fire suppression or emergency call system
Mobile app allows caregivers to receive real-time alerts remotely	App usage require basic smartphone access and internet connectivity

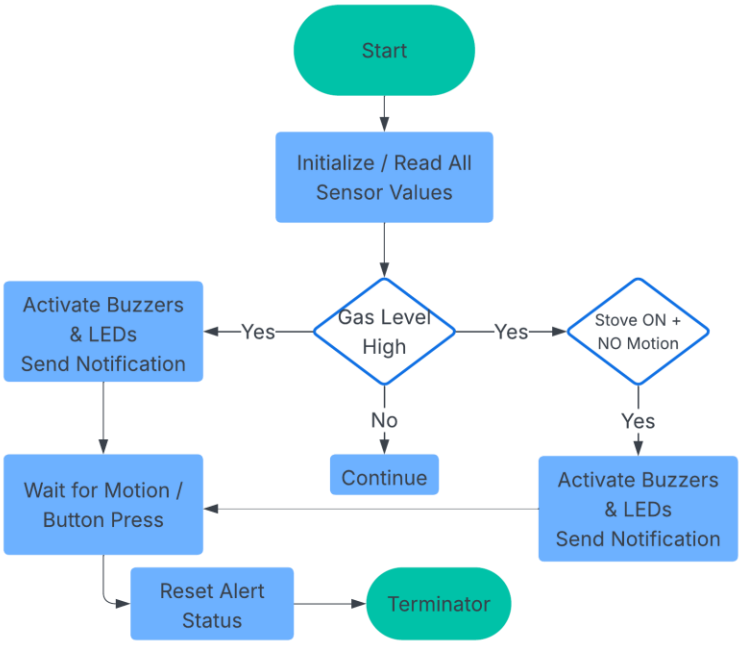
Questions about the system:

- **Who are the potential users?**
  The primary users of the Kitchen Sentinel system are elderly individuals, particularly those who live alone or require minimal supervision in their homes. Secondary users include family members, caregivers, and staff at elder care facilities who are responsible for ensuring the safety and well-being of these individuals
- **What tasks do they seek to perform?**
  Users aim to maintain a safe cooking environment by ensuring that stoves are not left unattended and that gas leaks are promptly identified. They also rely on the system to alert them or their caregivers to any potential hazards in real time, so appropriate action can be taken quickly.
- **What functionality should any system provide to these users?**
  The system must be capable of detecting gas leaks, monitoring stove activity, and identifying user presence or absence. It should provide both local alerts (like buzzers and LEDs) and remote notifications through GSM or Wi-Fi, all while requiring minimal input or interaction from the user. A manual override or reset button should also be included to silence alarms when necessary.
- **What constraints will be placed on your eventual design?**
  Several design constraints exist, including the need to use affordable components, maintain a simple interface suitable for elderly users, and rely on consistent network availability for remote alerts. Additionally, the system is intended for indoor domestic use only and does not include automated gas shutoff or fire suppression features due to cost and complexity.
- **What criteria should be used to judge if your design is a success or not?**
  The success of the Kitchen Sentinel will be evaluated based on the accuracy and responsiveness of its detection system, the reliability of its alert mechanisms, and its ease

of use for elderly individuals. Other criteria include user satisfaction, minimal false alarms, and positive feedback from both users and caregivers regarding the system's overall effectiveness and dependability.

Approach:

The design illustrates the logic followed by the system to detect hazards and trigger appropriate alerts based on sensor readings. These alerts are communicated both locally (via buzzer and LED) and remotely (via the mobile application) to ensure timely response.



Design Implications and Broader Insights

The analysis of user attributes and task environments showed important design implications beyond basic usability. The elderly, as primary users, frequently suffer from memory loss, limited mobility, and unfamiliarity with modern technologies. These constraints need a system that functions passively, with minimum involvement. As a result, Kitchen Sentinel was created to automate hazard identification and rely on clear audiovisual notifications, eliminating the need for user intervention.

Additionally, caregiver involvement influenced the inclusion of remote alert features via a mobile application, ensuring support even when users are alone. Environmental factors, such as the inherent risks in kitchen settings, further emphasized the need for real-time, reliable monitoring over complex manual systems. These insights shaped a design that prioritizes simplicity, safety, and affordability, which are essential for real-world use among elderly individuals.

These system designs not only accommodate the needs of elderly users but also reflect a broader understanding of how assistive technology can empower independent living while being reliant on complex digital tools.