Project Description

Kitchen Sentinel is a simple, user-friendly, and accessible Android application created by Macabenta, Morden, and Pilapil of Team MPM. It is designed to assist an IoT system, also named Kitchen Sentinel, that detects gas leaks, temperature changes, and motion in the kitchen. The system alerts users and caregivers to prevent accidents. The target population for this app includes elderly individuals who face challenges due to old age, especially those living alone. The application's intended task is to display the sensor readings from the IoT system and alert users when the sensors detect any issues.

Requirement Summary

Minimum Requirements	Processor	Dual-Core
	OS	Android 5.0 (Lollipop)
	RAM	2 GB
	Connectivity	Wi-Fi or Mobile Data
Recommended Requirements	Processor	Quad-Core
	OS	Android 8.0 (Oreo)
	RAM	4 GB
	Connectivity	Wi-Fi or Mobile Data
Other Requirements	Permissions	Notification Access, Internet

Table 1. System Requirements

The application targets devices running at least Android 5.0, with a dual-core processor and 2 GB of RAM. It remains lightweight to support lower-end models. For optimal performance, Android 8.0, a quad-core processor, and 4 GB of RAM are recommended. Internet access and notification permissions are required.

Overview

To ensure the prototype met its intended usability goals, a system evaluation was conducted, focusing on the core features and user experience of the Kitchen Sentinel application. Due to ongoing academic commitments and the lack of physical access to testing environments, the evaluation was performed using remote methods. Participants joined online sessions via platforms such as Discord, Microsoft Teams, or Messenger, where they shared their screens while completing a set of tasks.

The evaluation was structured around three main techniques and the following usability metrics:
1. **Efficiency** – How quickly participants could complete each task.
2. **Effectiveness** – Whether participants were able to correctly complete the task without confusion.
3. **Satisfaction** – How comfortable and confident users felt when using the system.

Technique Used

Technique	Description
Usability Specifications	Measuring how effectively and efficiently users could complete key tasks.
Heuristic Evaluation	Assessing the interface using Nielsen's 10 Usability Heuristics.
System Usability Scale (SUS)	A post-test survey capturing users' perceived satisfaction and ease of use.

Table 2: Usability Evaluation Techniques and Their Descriptions

The following are tasks to be performed by the participants in order to evaluate the effectiveness, efficiency, and overall satisfaction of the Kitchen Sentinel prototype. These tasks reflect the core features of the application and its focus on elderly users.

1. Hazard Detection and Alert Handling
- Task 1: Open the app and view the current sensor readings (Gas, Temperature, Motion) on the Dashboard.
- Task 2: Identify which sensor triggered the alert using the icon or visual indicator.

2. Activity Log Review
- Task 1: Navigate to the Activity Log section.
- Task 2: Review the most recent alert and identify its timestamp and type.

3. Settings
- Task 1: Open the Settings page from the main Dashboard.
- Task 2: Enable Dark Mode and increase the font size for better readability.
- Task 3: Add or update an emergency contact or caregiver phone number.
- Task 4: Access the Help Center and locate information about handling gas alerts.

4. General Use and Navigation
- Task 1: Launch the application and explore each section (Dashboard, Activity Log, Settings).
- Task 2: Interpret the overall kitchen safety status based on the sensor data.

Method of conducting Online Tests:

　　　Social media platforms were used in conducting the online tests for this evaluation. Below are screenshots showing how the evaluation underwent.
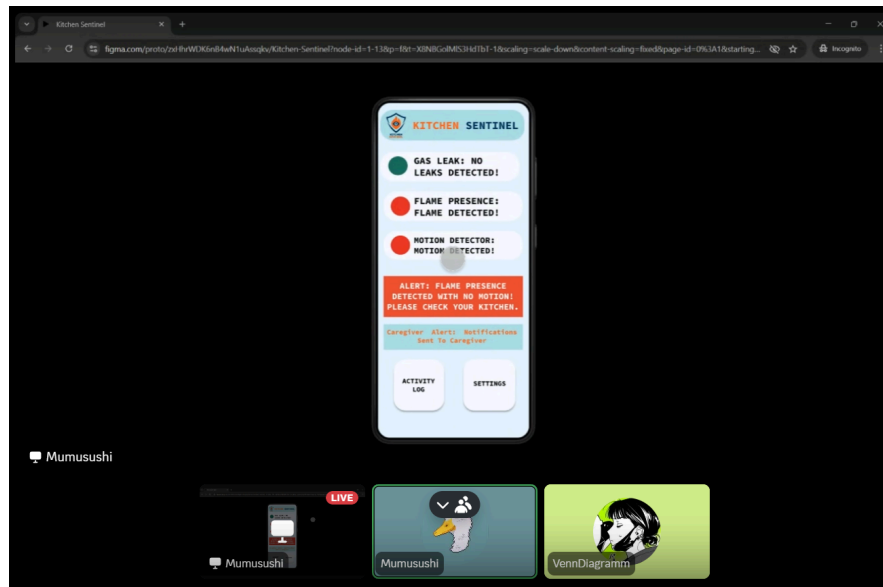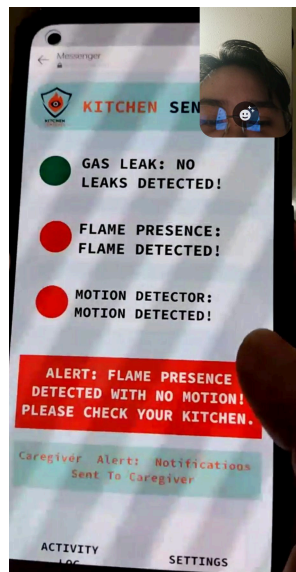

Figure 1: Discord

Figure 2: Messenger

Data Presentation

Data Analysis

During the online usability testing sessions, Team MPM observed that participants interacted well with the Kitchen Sentinel prototype and were able to complete all assigned tasks, including viewing sensor data; reviewing alert logs; updating settings; and navigating between sections, with minimal instruction. The interface was found to be intuitive and well-suited for its target users, particularly the elderly.

Participants praised the Dashboard for its simplicity and clarity in displaying alerts, and found navigation across the app smooth and easy to learn. A minor suggestion from one participant involved the Activity Log, where the text size could be increased for better readability, especially for elderly users who may prefer larger fonts—even if it requires more scrolling. Overall, the prototype delivered a positive, accessible experience with only minor adjustments recommended.

Task Category	Average Completion Time	Interpretation	Classification
Hazard Detection and Alert Handling	0.6 minutes	Highly Acceptable	Very Successful
Activity Log Review	1.1 minutes	Acceptable	Successful
Settings	1.5 minutes	Acceptable	Successful
General Use and Navigation	0.9 minutes	Acceptable	Successful

Table 3: Task Completion Times

The table above shows that all task categories were completed within acceptable timeframes. Hazard Detection and Alert Handling had the fastest completion time, suggesting that users found it easy to recognize and understand sensor statuses. Activity Log Review also performed well, though feedback regarding the font size indicates a potential improvement area for visibility.

Heuristic Evaluation

The heuristic evaluation for the Kitchen Sentinel will be conducted using the following Jakob Nielsen's 10 Usability Heuristics.

Visibility of System Status
The Dashboard was able to give clear real-time feedback by presenting current sensor data such as Gas, Temperature, Motion and alarm indicators.

Match Between System and the Real World
The application makes use of commonly used terms and icons like "Gas" and "Activity Log." In order to accommodate elderly users', the design avoids the use of technical jargon.

User Control and Freedom
The application allows users to easily navigate between app sections and perform actions like updating emergency contacts.

Consistency and Standards
All of the pages in the interface have the same layout, icons, and interaction and users rely on common mobile norms, which ensures easier navigation and lowers the learning curve.

Error Prevention
The design minimizes user error through input validation and simple interfaces such as contact number validation and toggle switches for settings.

Recognition Rather Than Recall
The dashboard displays all relevant data, including alerts and sensor statuses allowing users to no longer need to commit actions or content locations to memory thanks to the usage of clear icons and labeled buttons.

Flexibility and Efficiency of Use
Features like dark mode and text size modifications are included in the program to accommodate users of all levels. These choices improve usability for older or visually impaired users and let users customize their experience.

Aesthetic and Minimalist Design
The application's UI is clear and straightforward. Users are able to concentrate on important information without being distracted by other features.

Help Users Recognize, Diagnose, and Recover from Errors
Clear and detailed error messages and a Help Center allows users to resolve issues with the application.

Help and Documentation
The system has a Help Center, which offers solutions to commonly asked questions and fundamental troubleshooting techniques and offers easily accessible documentation for the program.

Participant Survey and Feedback

Results

SECTION 1: EFFECTIVENESS			
Question	**Mean**	**Interpretation**	**Classification**
I was able to view sensor readings clearly on the Dashboard.	3.8	Highly Acceptable	Very Successful
I was able to identify which sensor triggered an alert using the icons or visual indicators.	3.7	Highly Acceptable	Very Successful
I was able to locate and read past events in the Activity Log.	3.6	Acceptable	Very Successful
I was able to access and understand information from the Help Center.	3.5	Acceptable	Successful
SECTION 2: EFFICIENCY			
I was able to navigate between the Dashboard, Activity Log, and Settings without difficulty.	3.8	Highly Acceptable	Very Successful
I was able to enable Dark Mode and adjust the font size easily.	3.6	Acceptable	Very Successful
I was able to quickly add or update emergency contact information.	3.4	Acceptable	Successful
SECTION 3: OVERALL SATISFACTION			
Overall, I found the Kitchen Sentinel app easy to use.	3.7	Highly Acceptable	Very Successful
The app's design and layout are appropriate for elderly users.	3.8	Highly Acceptable	Very Successful
I would feel confident using this app or recommending it to someone elderly.	3.6	Acceptable	Very Successful

Average Scores Summary

Category	Average Score	Interpretation	Classification
Effectiveness	3.65	Highly Acceptable	Very Successful
Efficiency	3.6	Highly Acceptable	Very Successful
Overall Satisfaction	3.7	Highly Acceptable	Very Successful

Overall Average	3.65	Highly Acceptable	Very Successful

       The tables above summarize the users' evaluation of the Kitchen Sentinel prototype across three key categories: effectiveness (3.65), efficiency (3.6), and overall satisfaction (3.7). Each of these scores falls under the interpretation of Highly Acceptable and is classified as Very Successful. The overall average score is 3.65, which maintains the same interpretation and classification. This suggests that users found the prototype effective, efficient, and generally satisfying to use.

Survey (System Usability Scale (SUS))
After answering the questionnaire earlier the participants are then asked to complete the following questionnaire, the following are the SUS scores of each participant

Results

Participant	Score	Interpretation
P1	95	
P2	92.5	
P3	97.5	
P4	95	
P5	92.4	
P6	90	**A**
P7	95	
P8	95	
P9	92.5	
P10	95	
SUS Mean Score	**93.9**	

       The table above shows the usability scores of all 10 participants, ranging from 90 to 97.5, with a total mean score of 93.99. Based on the SUS evaluation scale, this is considered an A, indicating excellent usability. According to the standard scale, the average benchmark score is 68, and scores above this threshold suggest good usability. The system's score of 93.99 suggests that users found the Kitchen Sentinel prototype to be highly usable and something they would likely recommend to others.

Designs Implication

Based on the different usability analysis tests that were done using various techniques namely, usability specifications, heuristic evaluation, and surveys (System Usability Scale), the Kitchen Sentinel Prototype does not require a major change, as the results of various tests suggest it has high acceptability and usability. It has an average SUS score of 93.99 (Grade A), and high ratings in usability (effectiveness, efficiency, and satisfaction). This indicates the prototype performs satisfactorily as intended.

However, minor design improvements could further improve and enhance its usability:

- **Increase Font Size**: A participant mentioned that the small text was difficult to read. Larger fonts or a font-size toggle could improve readability and give users more control over the application.
- **Improve Help Center Accessibility**: The Help Center received an acceptable rating, but it had the lowest score among the effectiveness metrics. Its effectiveness could be improved by making it more prominent and visually engaging.
- **Streamline Settings**: Although users were able to complete tasks in the Settings section, it had the highest completion time. The layout and elements could be simplified or grouped more clearly to reduce the time required to complete tasks.
- **Improve Visuals**: While users praised the simplicity of the interface, they suggested enhancing the visual design, such as improving the icons and other elements, to make the application more accessible, visually comfortable, and appealing for elderly users.

There were no major flaws identified that would suggest a complete redesign of the prototype. The system appears to align well with the needs of its target users. However, minor revisions should be made to further refine the prototype and enhance its overall usability and acceptability.

Critique and Summary
Advantages of the Evaluation:

- The use of the Usability Specifications Survey, System Usability Scale (SUS) and heuristic evaluation provided both quantitative and qualitative data, giving us more comprehensive insights into our prototype's usability.
- Participants were observed in natural usage conditions (i.e., online sessions), allowing us to gather real-time and authentic feedback.
- The evaluation focused on metrics relevant to the needs of our target audience, the elderly. Efficiency, effectiveness, and heuristic evaluation were standard and appropriate measures that helped us assess whether the design met the specific needs of this demographic.

Disadvantages of the Evaluation:
- The sample size was limited to 10 participants, which may not fully represent the broader diversity of our target demographic or capture edge cases.
- Due to time constraints, some features were not thoroughly explored, and potentially helpful functionality may have been overlooked.
- The Help Center feature was not properly tested, as most participants completed tasks without needing additional assistance.

What We Would Do Differently:
- Design Changes: Based on feedback about text readability, we would prioritize adjustable font sizes earlier in the design process, especially knowing its importance for elderly users. Also improve the aesthetics of the website to make it more visually appealing.

With More Resources:
- We would conduct usability testing with a larger and more diverse sample group, including longitudinal studies to observe performance over time.
- We would also conduct in-person testing to gain deeper insights into user behavior, especially non-verbal cues that are often missed in remote sessions.