

February 16, 2009

Patrick Leung
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Re: ENSC 440, *General Gadgets Functional Specifications: Kitchen Alert*

Dear Mr. Leung:

The attached document describes the functional specifications related to Kitchen Alert, a product of General Gadgets Canada. Kitchen Alert is designed to improve kitchen safety and provide convenience for its users. The system will detect and monitor the stovetop situation and take action to alert the user when there are potential problems on the stove. By monitoring the stovetop condition based on temperature, motion, humidity, and other inputs from the kitchen's environment, Kitchen Alert will help prevent kitchen fires.

The attached functional specifications provide requirements for Kitchen Alert's functionality in prototyping and production phases. These specifications were generated after careful analysis of all factors involved in this field. The management and engineering teams at General Gadgets are using this documentation for research and development as well as to ensure that the project stays on course.

General Gadgets Canada is founded by fifth year Engineering Science students: Rasam Hafezi, Alex Kung, Edward Lee, and Eric Matthews. Should you have any questions or concerns regarding our functional specification, please feel free to contact me by phone at (778) 885-0499 or by e-mail at rhafezi@sfu.ca.

Sincerely,



Rasam Hafezi
Chief Executive Officer
General Gadgets Canada

Enclosure: *General Gadgets Functional Specifications: Kitchen Alert*



General
Gadgets

Functional Specs

Kitchen Alert

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Executive Summary

When there is food cooking and you are not right there watching, is there anything that prevents your food from burning, boiling over, or, even worse, starting a fire? While technology has found its way into households everywhere, the kitchen-stove area is one area where the technology is not really present. Perhaps it is the high heat and high humidity environment that has deterred the implementation of technology in this area, but those factors are the same ones that make the kitchen-stove area a potential safety hazard to the people in the household.

Our product, **Kitchen Alert**, aims to be this piece of technology that makes the kitchen safer, and, at the same time, provides convenient features for its users. The purpose of the product is to be able to accurately identify the stove conditions, determine whether it is safe, and then take appropriate actions. The basis of the system is a series of sensors for heat, humidity and motion sensing.

The development of **Kitchen Alert** will occur in two phases. In the first phase, a prototype system will be developed that demonstrates proof of concept, but will lack in polish in areas that does not directly affect functionality. The final product will be developed in the second phase and will be the market ready version of Kitchen Alert. The first phase of development is targeted for completion by April 2009, and will focus on the following:

- Providing users safety and convenience features.
- Operating under stovetop conditions.
- Being easy for users to understand and use.

The second phase of development, the final product, will build upon the successes from the first phase, so the timeline for it will be determined after the completion of the first phase.

This document details the functional specifications for the first phase and partially for the second phase of development. The details discussed for the second phase are only preliminary and are subject to change from changes in development and further research.

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Glossary

Kitchen Alert	A kitchen stove safety device created by General Gadgets. ii, 1
PSU	Power Supply Unit. 4
RoHS	Restriction of Hazardous Substances Directive. 10
WEEE	Waste Electrical and Electronic Equipment. 10

1 Introduction

General Gadgets' **Kitchen Alert** is a safety device designed for gas and electric stoves. Kitchen Alert monitors the stovetop condition based on temperature, motion, humidity, and various inputs from the cooking environment. When the device senses potential cooking disasters on the rise, it notifies the user through audio and visual means to take appropriate actions. This document outlines in detail the functional specifications for Kitchen Alert.

1.1 Scope

This document provides the functional requirements for Kitchen Alert. The specifications describe the proof-of-concept and the prototype, as well as the production model. The requirements listed will be closely abided by General Gadgets throughout the entire development process.

1.2 Intended Audience

These listed specifications are intended for use by the members of General Gadgets Canada. The document will serve as a guideline through all development phases and will act as an indication of project's progress. Software and Hardware VPs are to refer to the set of requirements to assist them in completing the project milestones, and the project manager will use it to provide feedback and advice on the team's progress. All software and hardware testing will consider these requirements as the baseline for quality assurance.

1.3 Document Conventions

In order to clearly indicate the type of functional requirement the following convention will be used:

Rn **p** A functional requirement,

where **n** is the number of the functional requirement, and **p**, the priority of the functional requirement, is denoted by:

- I For proof-of-concept device
- II For both proof-of-concept and production device
- III For production device only

In addition, for the remainder of this documentation, "the device" refers to General Gadgets' **Kitchen Alert** safety product.

2 System Requirements

Kitchen Alert consists of several independent systems that are integrated together to create a kitchen safety device like no other. The main components of the system are temperature detection, burn detection, humidity detection, motion detection and the user interface. The system will continuously monitor all the different components and use this information to determine the status of the kitchen. A high level graphical representation of the system is shown in Figure 2.1.

If the system determines that there is a risk of fire it will notify the user that immediate attention is required. The system is able to monitor motion within the vicinity to determine if anyone is in the kitchen. If the system determines that stove has not been attended to for a specific period, it will alert the user. Kitchen Alert is able to monitor the temperature of the stovetop and determine food is about to burn. The system also includes some convenience factors such as turning on a fan when there is high humidity in the area and having a built-in kitchen timer. For the prototyping phase the kitchen fan will be replaced by an indicator light, and in the production model the indicator will be replaced by a stovetop fan.

To bring the product together, Kitchen Alert will have an easy to use and easy to clean user interface. It is important for the system to be easy to use as this will promote its continuous use. As the product will be near the stove at all times it will get dirty and greasy. Therefore, the product must be easy to clean and resistant to grease and dirt.

There will be some differences between the prototype and production versions of the product and these differences will be shown in later sections.

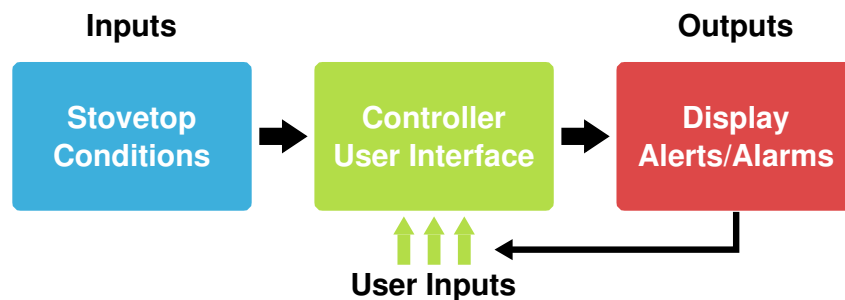


Figure 2.1: Graphical System Overview

3 General Specifications

This section outlines the overall system specifications for the device. These requirements are chosen to accommodate the harsh environment around a standard kitchen stove to maximize power efficiency, and to provide appealing aesthetics, safety, convenience, and enjoyment to the user while keeping the device compact and tidy.

3.1 General Requirements

- R1** **I** The development cost shall not exceed \$750.
- R2** **II** The user interface shall not cause false alarms.
- R3** **III** The device shall function with a single gas burner or electric coil from any commercially available kitchen stove.
- R4** **III** The device shall be able to monitor simultaneously four gas burners or electric coils.

3.2 Normal Operating Conditions

- R5** **II** The device shall have an operating temperature between 0 and 100 degrees C.
- R6** **II** The device shall be able to operate in a high humidity environment, including steam and smoke.
- R7** **II** The device shall be able to adapt to varying lighting conditions.

3.3 Physical Requirements

- R8** **I** The device shall have means to be securely mounted in the stovetop area.
- R9** **I** The dimensions for the main body of the device shall not exceed 30cm x 10cm x 20cm.
- R10** **I** The weight of the device excluding the power adapter shall not exceed 800g.
- R11** **II** The device shall be visually attractive.
- R12** **III** The device shall be integrated into the rangehood of the stove.

3.4 Electrical Requirements

- R13** II The **Power Supply Unit (PSU)** input must meet the North American wall standard of 110V/120V at 60Hz AC.
- R14** II The maximum power consumption of the device shall not exceed 4 Watts.
- R15** II The **PSU** output shall be greater than the maximum power consumption of the device.
- R16** II All electrical circuit elements shall be well protected from user tampering without disassembly.
- R17** II The **PSU** output voltage should be regulated to prevent surges from damaging the device.
- R18** III The heat dissipation shall be less than 2 degrees C.

3.5 Standards

- R19** III All electronics must meet the CSA International standards for electronics [1].

3.6 Reliability

- R20** III The device will require minimal to no maintenance.
- R21** II The device must be able to withstand constant exposure heat and humidity from cooking.
- R22** III The device shall have an operating life of greater than 5 years.

4 Temperature Detection

This section outlines the specifications for detecting stovetop temperature. Temperature around the stove is a critical input to the device. The measurements must provide accurate readings and be able to sense temperatures up to several hundred degrees C. The detector also must be well protected from the cooking environment while retaining the desired performance as outlined below.

4.1 General Requirements

R23 II Temperature measurement must be taken without physical contact.

4.2 Physical Requirements

R24 II The sensor shall fit within the device's housing constraints.

R25 II The sensor must be protected from grease, humidity, and other elements in the cooking environment.

4.3 Electrical Requirements

R26 II Power consumption shall not exceed 500mW.

4.4 Performance/Reliability Requirements

R27 II Detection range must be at least 1m with a 15cm diameter at measurement point.

R28 II Temperature measurement must be accurate to within +/- 2 degrees C.

R29 II Temperature resolution must be at least 1 degree C.

R30 II Temperature changes must be detected within 2s.

R31 II The temperature detector shall sense temperatures ranging between 0-400 degrees C.

5 Fire/Burn Detection

A detection method is required in the device to alert the user in the event of burnt food and/or kitchen fire, or in the case where the risk of burning is imminent. The detector must be reliable but not overly sensitive as to cause false alarms. A high level overview is given in Figure 5.1.

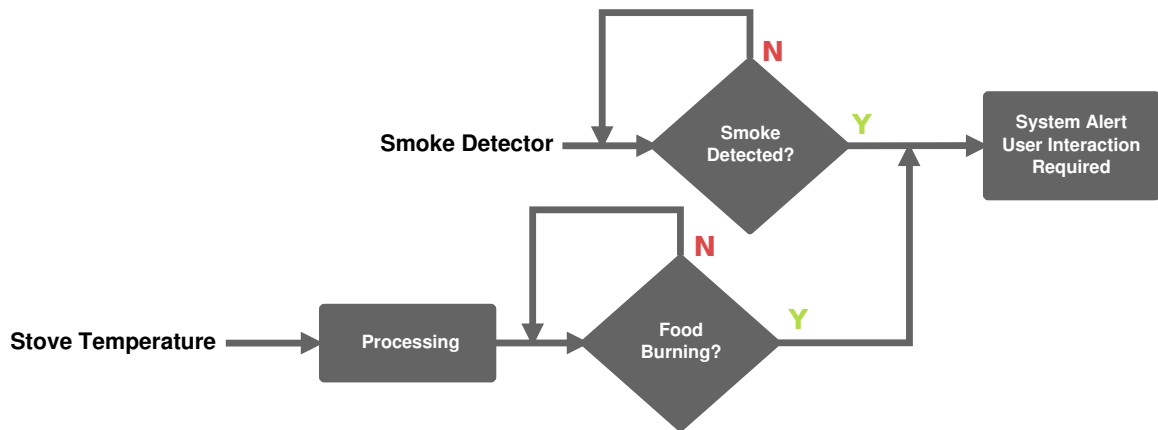


Figure 5.1: Graphical Burn Detection Overview

5.1 General Requirements

- R32** II The burn detector must have adjustable sensitivity to accommodate unique cooking environments.

5.2 Physical Requirements

- R33** III The sensor shall be securely fastened above the stove.

5.3 Electrical Requirements

- R34** III The burn detector shall have a backup power source.
- R35** II The burn detector shall have low power consumption.

5.4 Performance/Reliability Requirements

- R36** II The burn detector's response time must be less than 2s.
- R37** II False detection error rate shall be less than 5%.

6 Humidity Detection

Humidity detection is used along with temperature detection as co-inputs for monitoring the cooking procedure. The detector must be able to detect a wide range of humidity to accommodate diverse foods and recipes. A graphical high level overview is given in Figure 6.1.

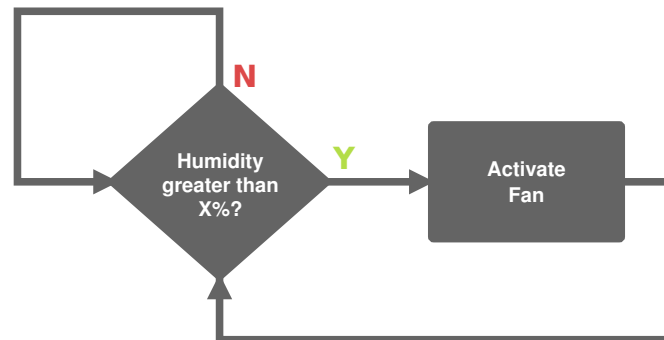


Figure 6.1: Graphical Humidity Detection Overview

6.1 General Requirements

- R38 II The humidity detector shall be able to detect up to 100% humidity.
- R39 II The error rate shall be less than 5%.
- R40 II The operating temperature of the humidity detector shall operate between 0-80 degrees C.
- R41 II The humidity detector shall have adjustable sensitivity.

6.2 Physical Requirements

- R42 II The humidity detector shall be smaller than 2 cm in any dimension.

6.3 Electrical Requirements

- R43 II The humidity detector shall have low power consumption.

6.4 Reliability

- R44 II The humidity detector must be vapor resistant.

7 Motion Detection

This section outlines the specifications for detecting user movement around the stove area. The purpose of motion detection is to alert the user when there is a prolonged absence of human activity in the kitchen. These specifications have been selected for reliability and increased safety. An overview is given in Figure 7.1.

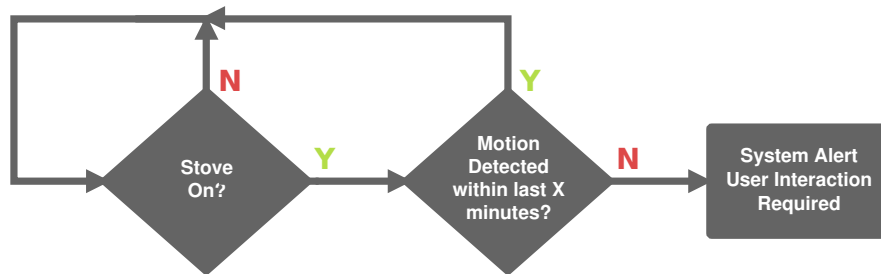


Figure 7.1: Graphical Motion Detection Overview

7.1 General Requirements

- R45** II The detection angle must cover the stove area.
- R46** II The user shall be allowed to adjust the time for which the motion detector determines user absence.
- R47** I The detection range shall be at least 2m.
- R48** III In absence of user motion, the burner shall be shut off.

7.2 Physical Requirements

- R49** II The motion detector shall be smaller than 5cm by 5 cm.

7.3 Electrical Requirements

- R50** III The motion detector shall be able to automatically shutdown an electric stove if no motion is detected for a pre-set amount of time.

7.4 Performance Requirements

- R51** II The motion detector shall have the ability to work in low light and bright situations.
- R52** II The motion detector shall have continuous motion detection.

8 User Interface

The user interface is the most essential element of the device. It must be intuitive and simple to operate. It must also provide adequate feedback and efficiently convey warnings to the user at appropriate times. Additionally, the user interface should support user configurations of the device settings.

8.1 General Requirements

- R53** II User inputs must be easily accessible.
- R54** II The user interface shall inform the user of the status of the device.
- R55** II The user shall be immediately alerted if immediate attention is required.
- R56** II System options must be easy to adjust.
- R57** II The user interface shall be easy to view in bright and dark lighting situations.
- R58** II The user interface shall be easy to clean.
- R59** II Most features must have the option to be disabled.
- R60** II The user interface shall have audible alerts.
- R61** II When a user input is given the system shall give an audible feedback.
- R62** II The user interface must be pleasing to the eye.

8.2 Physical Requirements

- R63** II The instrument panel of the user interface shall be no bigger than 30cm by 10 cm.

8.3 Environment

- R64** II The user interface shall work under normal kitchen environment.
- R65** II The user interface shall work in high humidity.

8.4 Performance Requirements

- R66** II The performance of the input device shall not be hindered with dirty hands.
- R67** II The user interface shall not have false input readings.

9 User Documentation

The user documentation will be written for the production model of the device only. It must be concise and straight-forward, and target the general public. The documentation also must be easy to understand with no ambiguity in its instructions.

- R68** III The user documentation shall be written to an audience with minimal technical background.
- R69** III English and French shall be the primary language of the documentation.
- R70** III The documentation shall include a user manual and technical support information.
- R71** III Detailed technical information for product integration shall be included.
- R72** III The user manual must have clear and precise operating instructions.

10 Environmental Requirements

We have devised following requirements in an effort to make the device environmentally friendly and safe:

- R73** II The device shall be *Restriction of Hazardous Substances Directive (RoHS)* compliant [2].
- R74** III In compliance to *Waste Electrical and Electronic Equipment (WEEE)* [3], a recycling program will be implemented to collect and/or replace the device component(s) at the end of the life cycle.

11 Conclusion

The functional specifications covered in this report have been thoroughly examined and approved by General Gadgets Canada. By carefully investigating the requirements for Kitchen Alert's overall system and sub-components, we will be able to proceed on our project with more clearly defined objectives. These specifications will be frequently referenced by each team member during the development schedule. The prototype for Kitchen Alert is projected for completion in April 2009.

References

- [1] "Canadian Standards Association (CSA)." [Online]. Available: <http://www.csa.ca/standards/electrical/Default.asp?language=english>
- [2] "RoHS Compliance." [Online]. Available: <http://www.rohs.eu/english/index.html>
- [3] "Waste Electrical and Electronic Equipment (WEEE)." [Online]. Available: http://ec.europa.eu/environment/waste/weee/index_en.htm