

UNATTENDED COOKING ALARM SYSTEM

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BACKGROUND

Statistics according to the U.S Fire Administration on **residential** fires:

- ✓ 356,200 fires
- ✓ 2,480 deaths
- ✓ 12,600 injuries
- ✓ \approx 7.250 billion dollars in losses

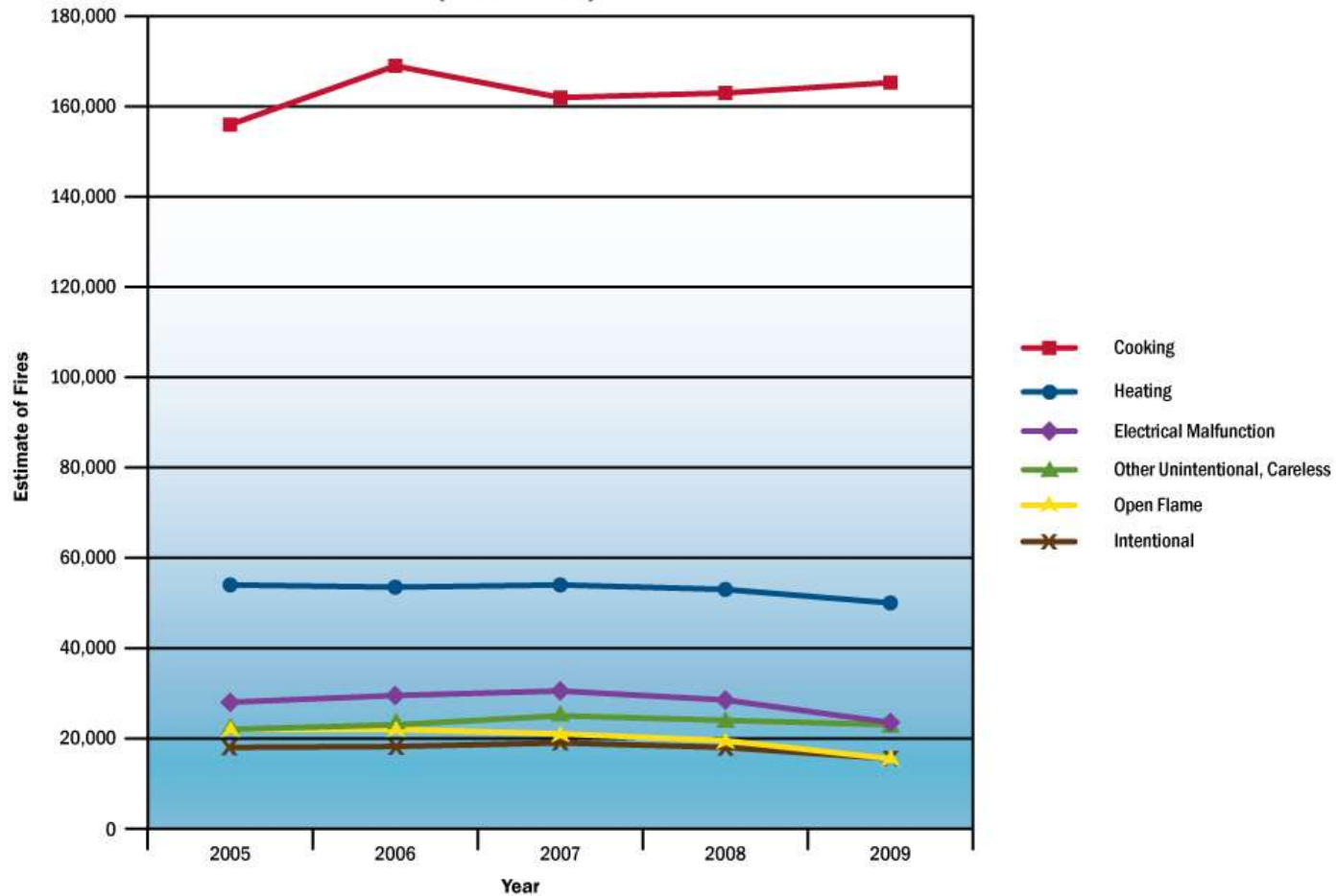
Possible causes of fires in residential areas:

- ✓ Cooking
- ✓ Heating
- ✓ Electrical malfunctions



THE REAL PICTURE

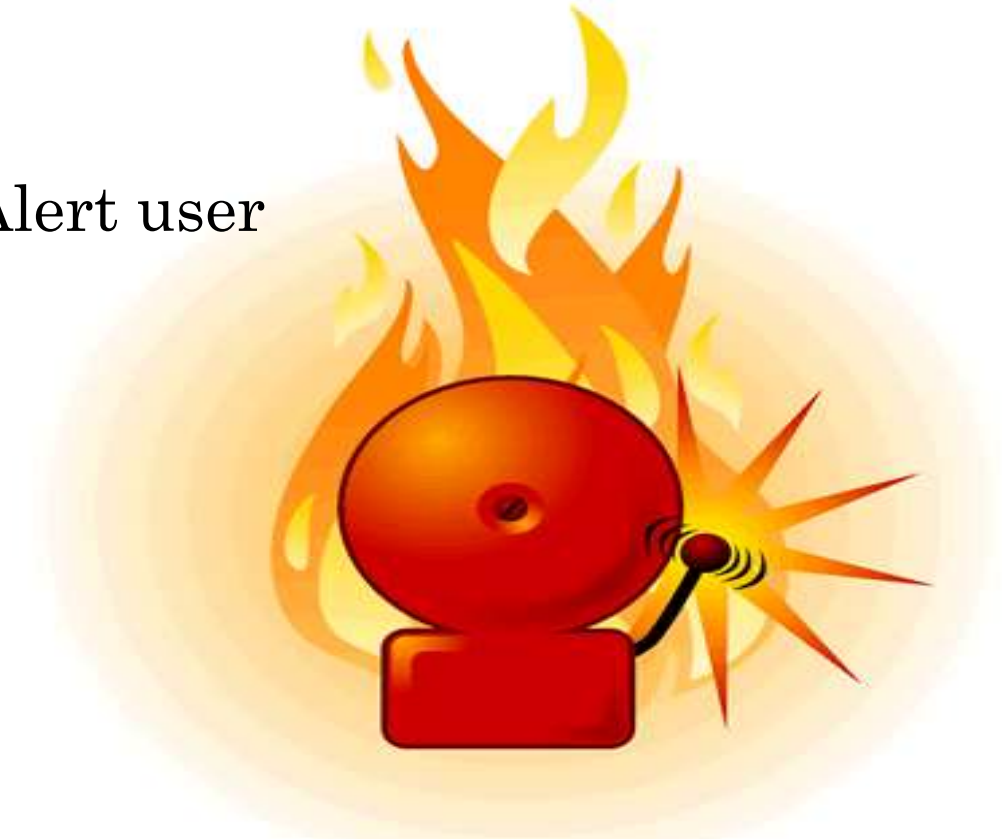
**Leading Causes of Residential Building Fires
(2005-2009)**



WHAT'S BEEN DONE ABOUT THIS ISSUE?

- ✓ Smoke detectors (CO₂ and CO)
- ✓ Inbuilt timers in cookers
- ✓ Heat detectors

Common feature: Alert user



IDEAL SYSTEM

- ✓ Tell when something is on the cooktop
- ✓ Intelligence to tell if children are around
- ✓ Alert user when cooker has been on for too long
- ✓ More visible lights
- ✓ Sense a spill
- ❖ Alert user if they have not been paying attention (if desired)
- ❖ Sense smoke
- ✓ e.t.c.



OBJECTIVES

Objective: to develop a working model of an after market safety device that will interface the wall outlet and cooker plug that will have the following features:

1. Determine when the cooker is on
2. Determine if there is someone in the kitchen and if so, how far are they from the cooker
3. Sense when there is smoke in the kitchen

Based on the above conditions, the system will be able to take action accordingly to reduce the risk of a potential fire



DESIGNING

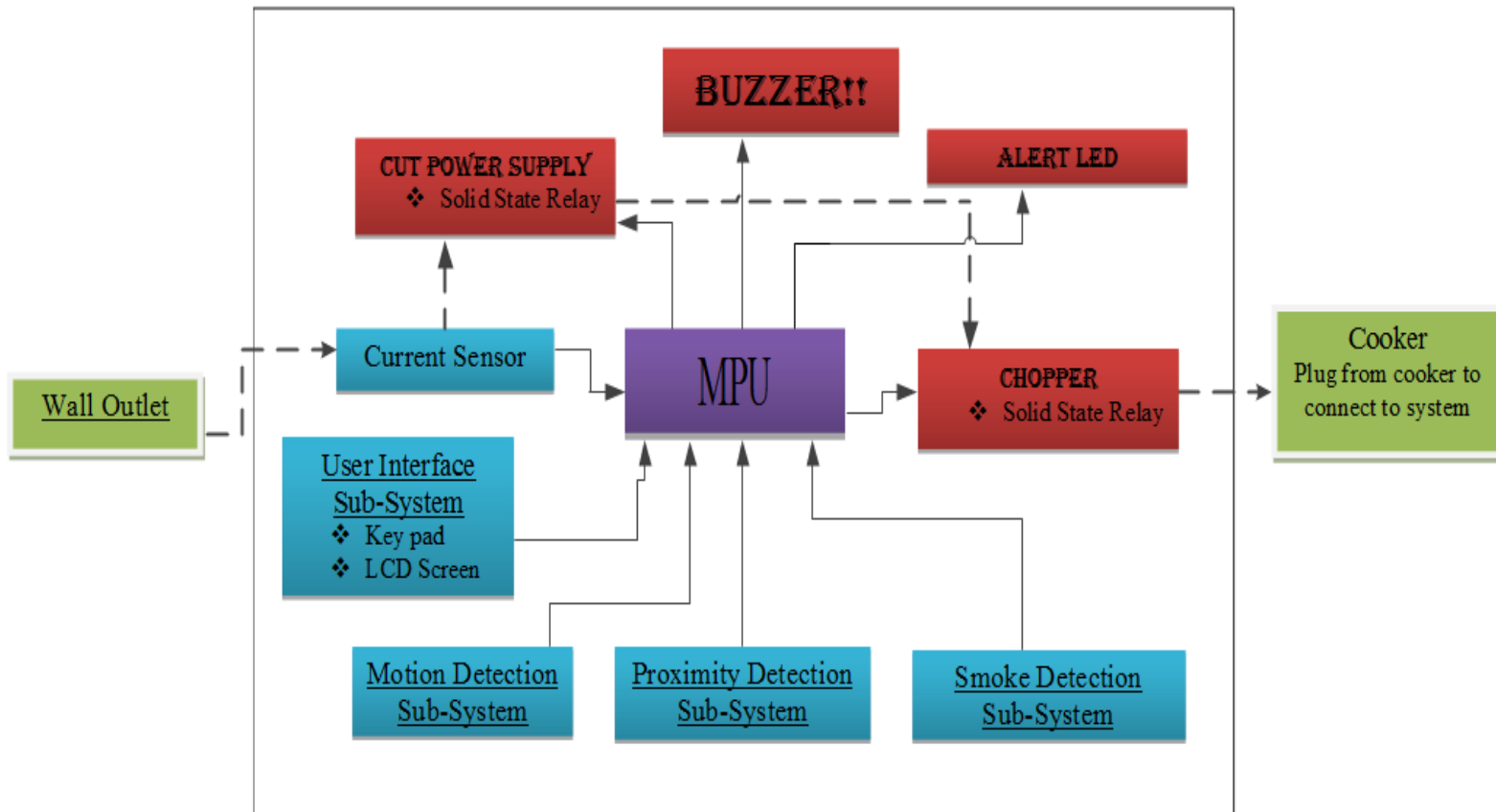
Two main parts

1. Hardware
2. Software

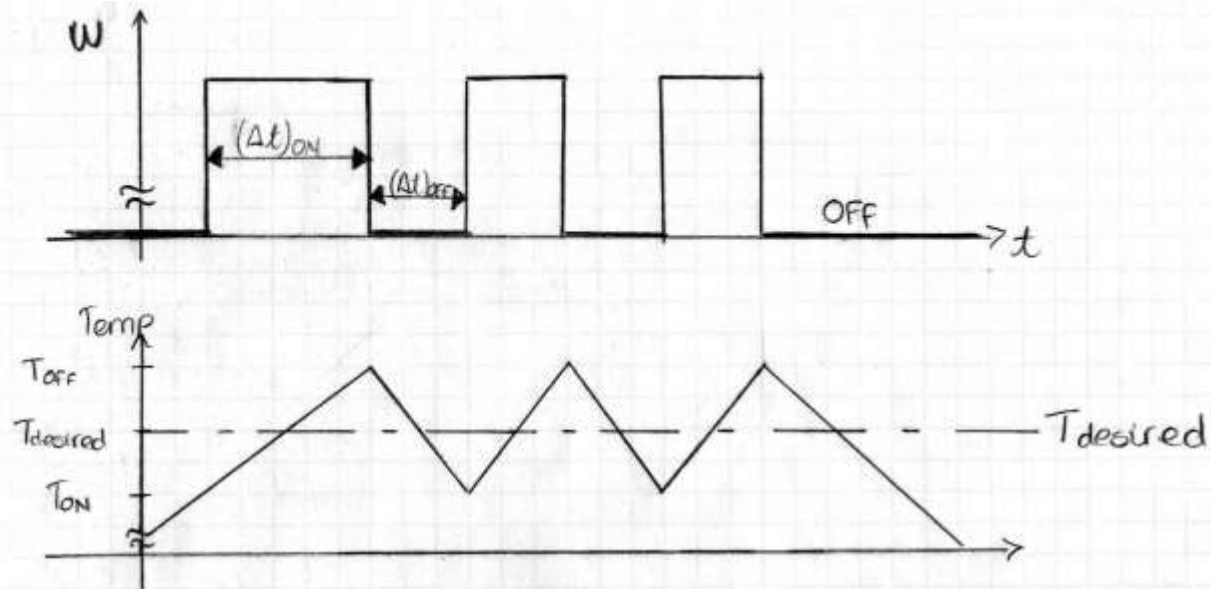


HARDWARE DESIGN

UNATTENDED COOKING ALARM SYSTEM



OVEN PROTOTYPE



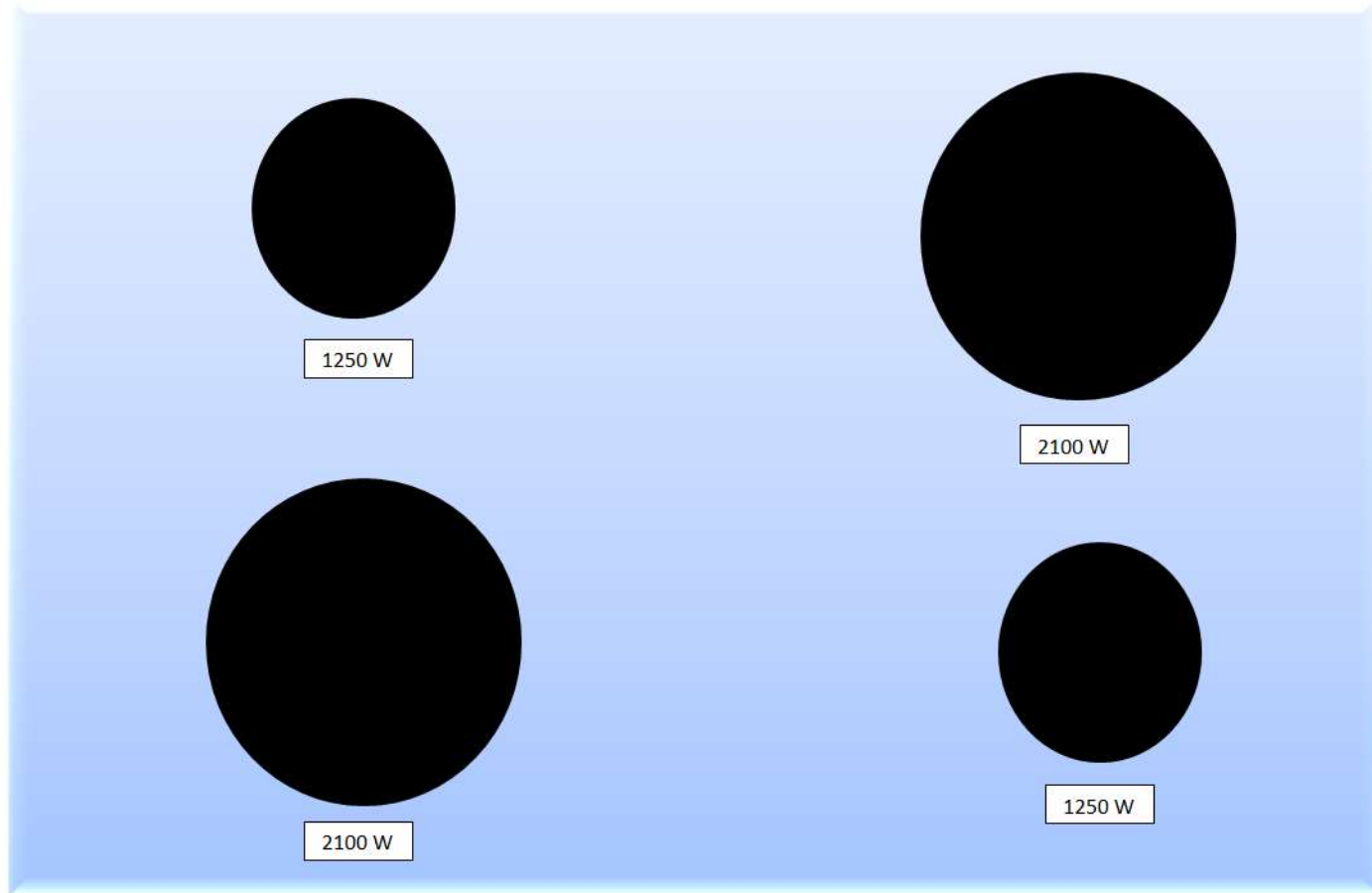
T_{off} → Highest temperature before cooker STOPS drawing power

T_{on} → lowest temperature before cooker STARTS drawing power again



OVEN PROTOTYPE

Maytag Cooktop Ratings



CURRENT SENSING SUBSYSTEM

Purpose:

- ✓ Be able to tell when load is connected to system
- ✓ Know exactly when system is on

Part:

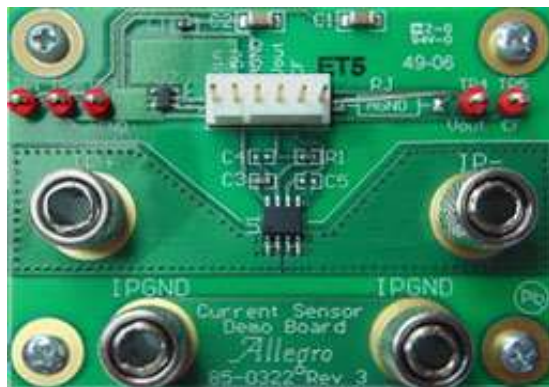
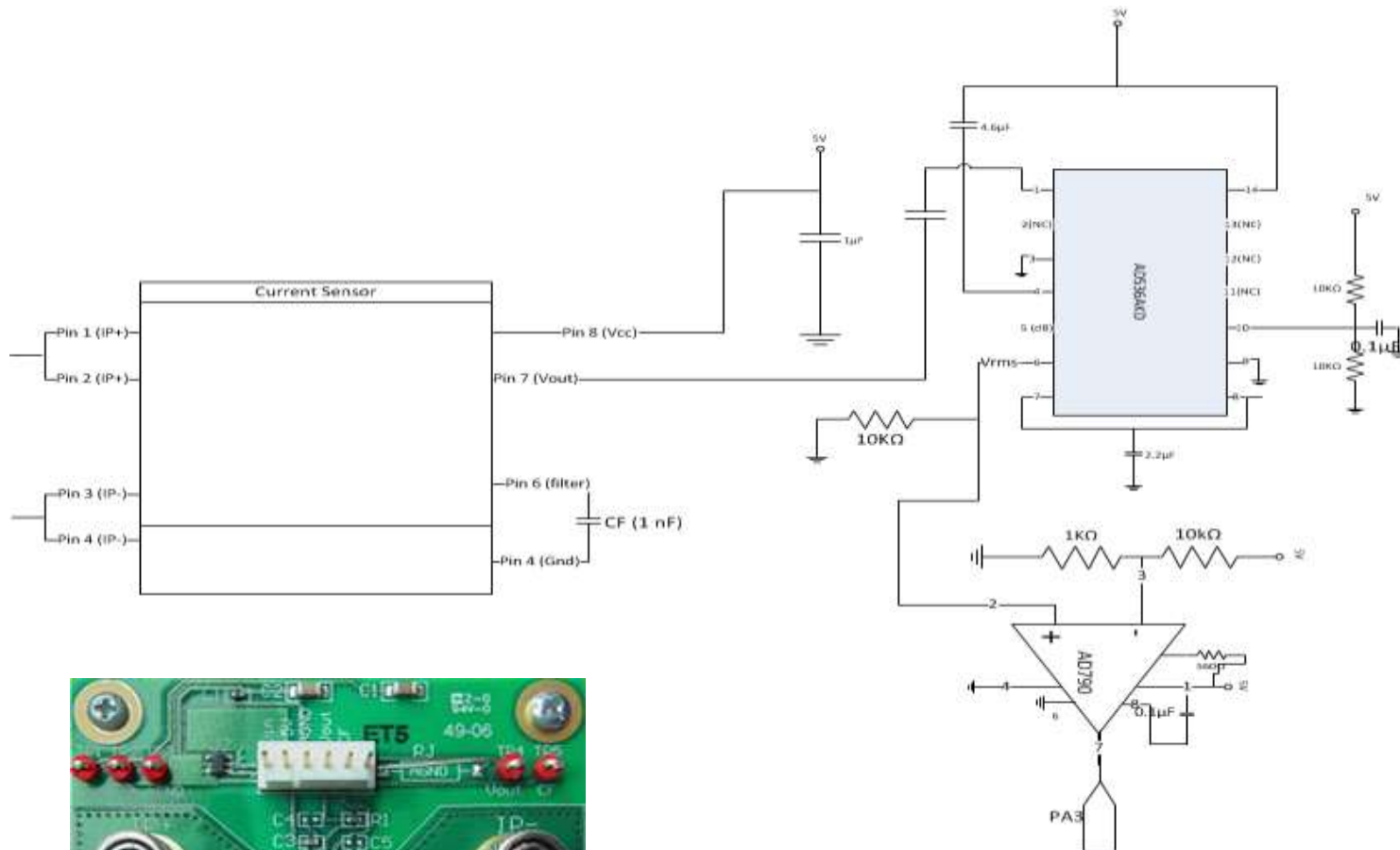
- ✓ ACS712ELC-05

Features:

- ✓ Output proportional to input (AC/DC)
- ✓ Stable output offset voltage
- ✓ Rated for 5A
- ✓ 5V operating voltage



CURRENT SENSING SUBSYSTEM



MOTION SENSING SUBSYSTEM

Purpose:

- ✓ Monitor motion around cooking area

Part:

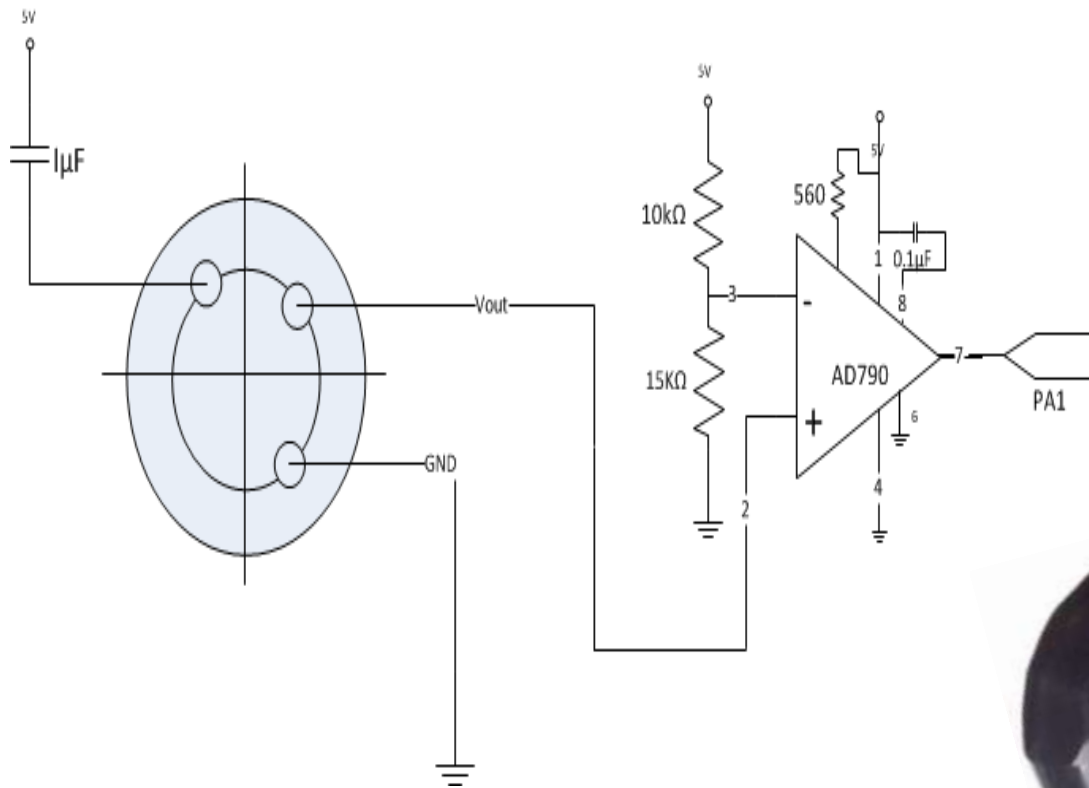
- ✓ AMN24111

Features:

- ✓ High performance infrared human motion
- ✓ Detection range: Horizontal - 110° Vertical - 93°
- ✓ Excellent noise resistance (radiation power supply)
- ✓ Analog output
- ✓ 5V operating voltage



MOTION SENSING SUBSYSTEM



PROXIMITY SENSING SUBSYSTEM

Purpose:

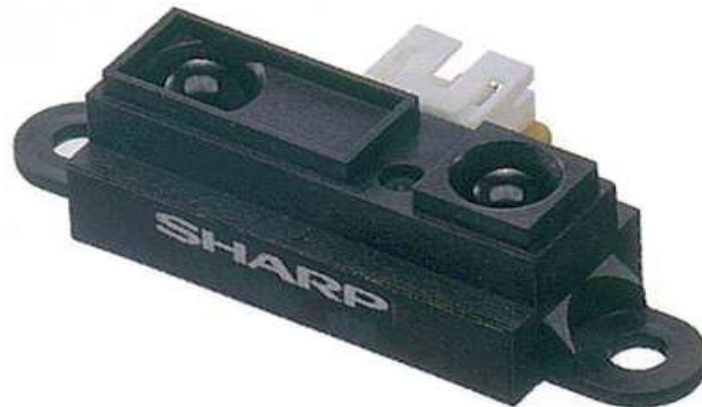
- ✓ Monitor how far motion is from cooktop

Part:

- ✓ GP2Y0A21YK0F

Features:

- ✓ Combination of infrared and position sensing detection signal processing circuits
- ✓ Range: 10 – 80cm
- ✓ Analog output
- ✓ 5V operating voltage



SMOKE DETECTING SUBSYSTEM

Purpose:

- ✓ Monitor smoke conditions

Part:

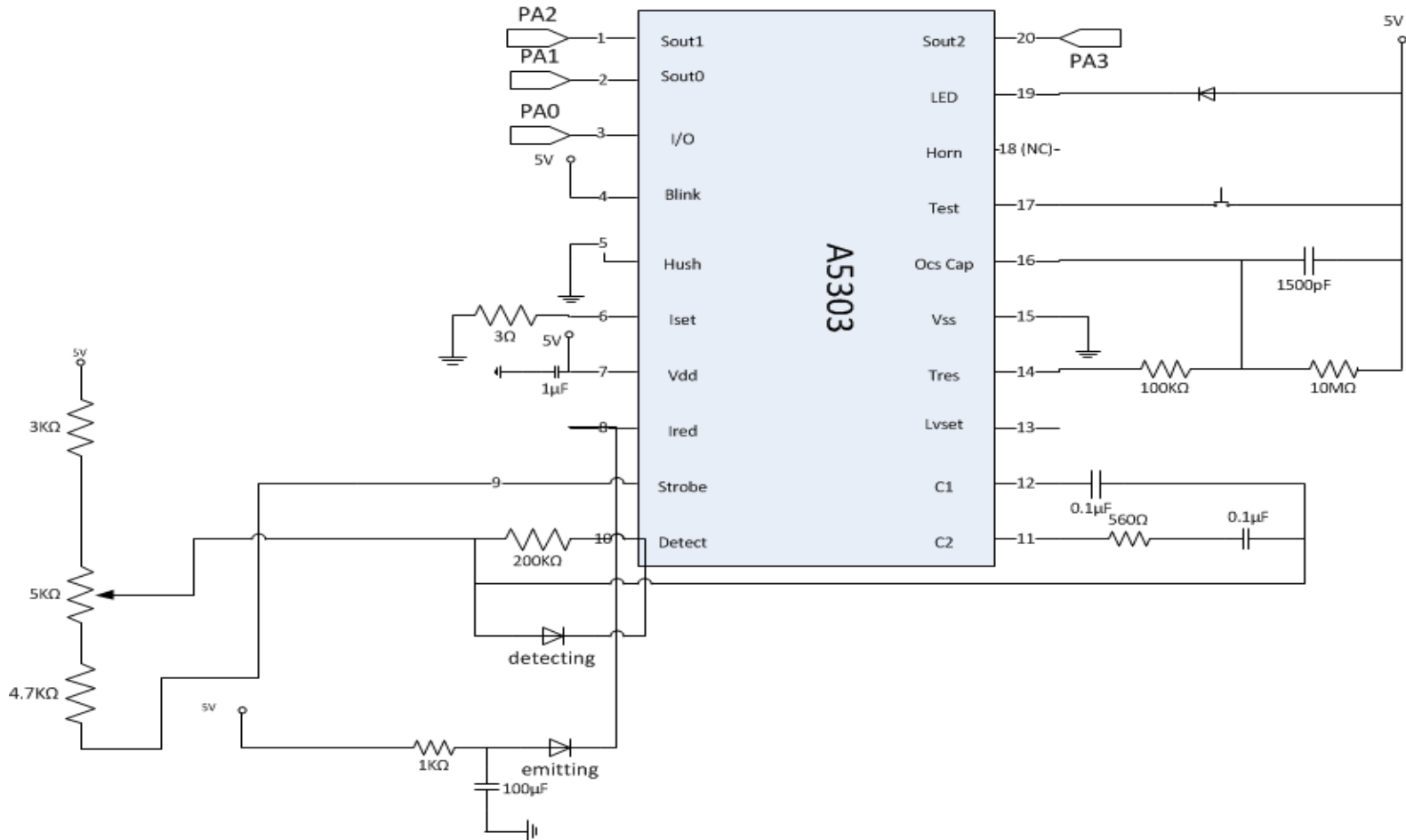
- ✓ A5303

Features:

- ✓ Photoelectric chamber
- ✓ Chamber sensitivity test
- ✓ Built in circuit to reduce false triggering
- ✓ Digital filter on I/O for noise immunity
- ✓ Test chamber conditions
- ✓ Logic outputs
- ✓ 2.3 – 5V operating voltage



SMOKE DETECTING SUBSYSTEM



USER INTERFACE SUBSYSTEM

Purpose:

- ✓ Obtain operating instructions from user
- ✓ Display current state of system
- ✓ Alert user of causes of alarms and system shutdown

Parts:



MICROPROCESSOR UNIT

Purpose:

- ✓ “Brain” of system

Part:

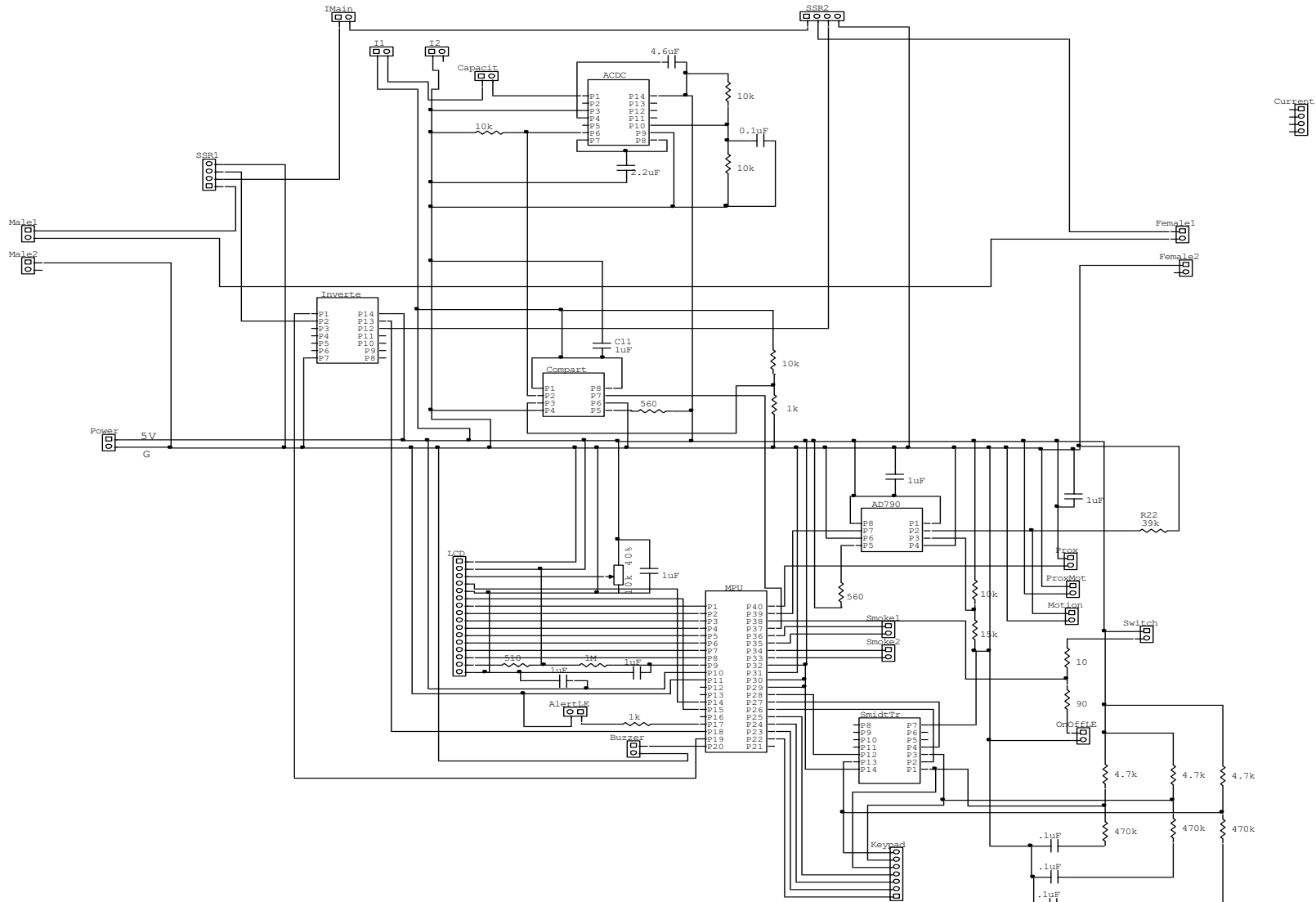
- ✓ ATMEGA644P

Features:

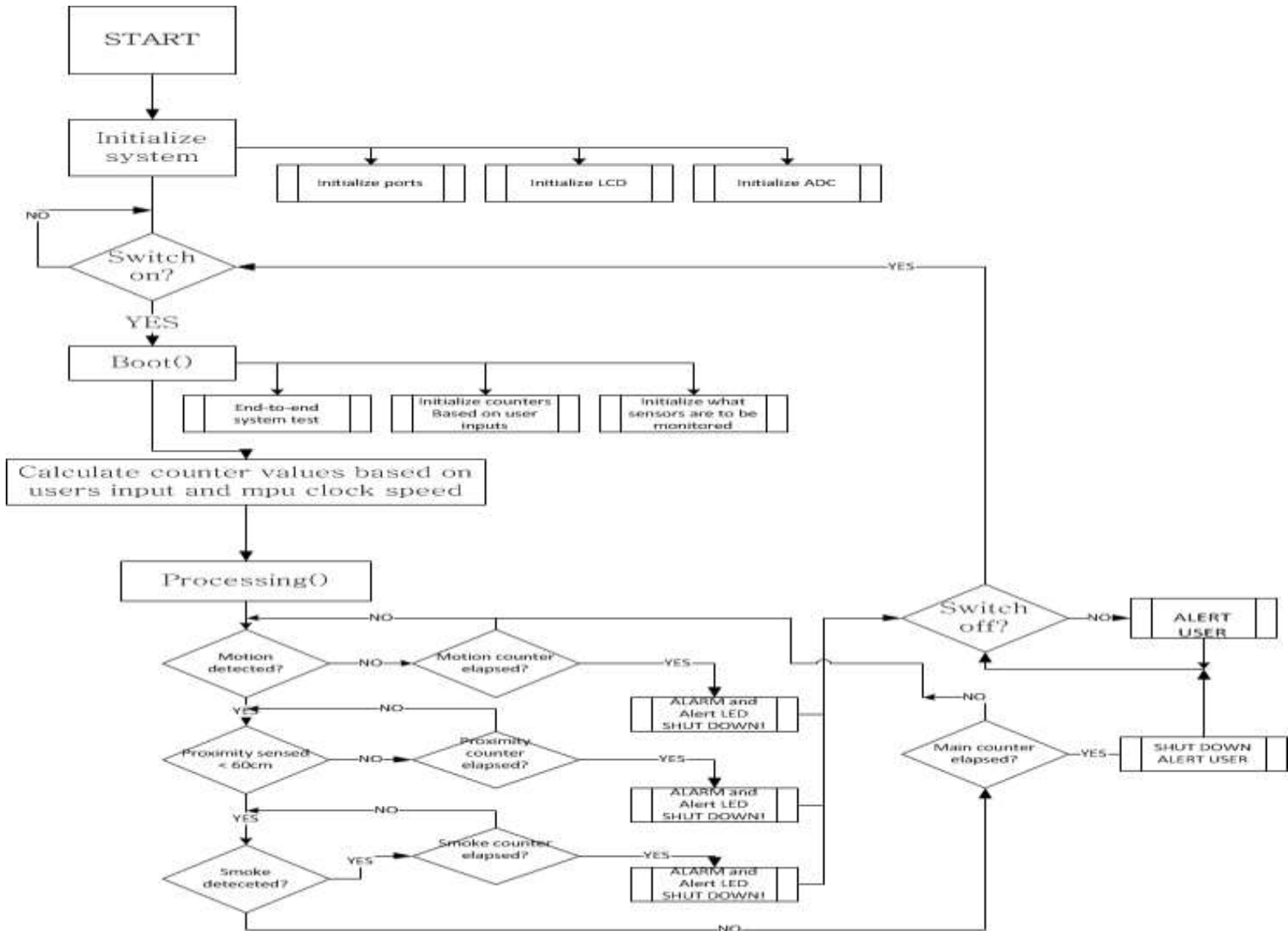
- ✓ 10 bit AD
- ✓ 2.7 – 5.5V Operating voltage



ENTIRE CIRCUIT DIAGRAM



SOFTWARE DESIGN



RESULTS

- ❖ Met design requirements

The design is as good as the testing goes...

- ✓ Limited testing time
- ✓ Reduce hardware by debouncing keypad switches only in software
- ✓ Compress system design to fit industry standards
- ✓ Use “cop watchdog” timer on mpu to avoid logic from “hanging” in a loop
- ✓ Use standby feature in mpu to reduce power consumption
- ✓ Use more defensive programming to account for potential noise issues



CONCLUSION

Who can use this system?

ANYBODY!

Interesting facts on things to come:

✓ National building code – install sprinklers

Disadvantages of sprinklers

✓ Bath houses and cause damage

✓ Extra maintenance costs

✓ Inevitably fail

✓ Cost per square ft. \$1.61 (x 2135)

❖ May not be the answer but definitely an option worth considering.





QUESTIONS?

Thank you!