

S.M.A.R.T. Alarm:

Smoke Monitoring and Reactive Tasking Alarm

Senior Design 1

Initial Project Identification Document

February 2017

Group A

**Carlos Castro**, Computer Engineering

**Courtnie Coleman**, Electrical Engineering

**Lucas Plager**, Computer Engineering

**Patrick Schexnayder**, Electrical Engineering

**Motivation**

In today’s day and age, technology advancements are occurring at a rapid pace. There are new inventions being created every minute improving people’s lives and making the world a better and safer place. Our group saw that while technology is advancing and becoming a bigger part of our everyday lives, one piece of technology that has not seen a major improvement in decades is the smoke and fire alarm. This device is a standard in everyone’s homes, offices, hotels and all other major buildings that we spend time in every single day but has been neglected as far as engineering advancement and innovation is concerned. The smoke and fire alarm that you have inside your house is essentially the same one your parents had inside theirs. We think we can do better. When looking at the average use case of a smoke detector, it was discovered that while they are useful, these devices do not provide the user with an abundance of information. Frequently, someone would hear the alarm go off and just frantically run to wherever they believe to be the nearest and safest exit without much of a plan. This scenario has the potential for disaster when you consider that there could be multiple people inside the building who do not know their way around and could be endangering themselves. Individuals could be wasting valuable time or be heading in a direction that is dangerous. We believe that a smoke alarm with improved functionality can help to eliminate this scenario and make everyone’s lives easier, and most importantly, safer. This can be achieved by creating a more connected fire alarm system. When the location of a fire is a factor in directing evacuation of a building, communication between the detection system and alarm system can provide crucial, life-saving information.

**Goals, Objectives, and Function**

The goals for the smart smoke and fire alarm are to make an affordable, customizable, connected system of smoke alarms that alert employees and residents of the safest and fastest exit of the building in the case of a fire emergency. We would like this system to not be that much more expensive than existing options to convince the market to adopt our system. In the event of an emergency, these smoke alarms would sound off in an order that would lead people to the closest and safest exit. Users would just have to follow the sound that is projected from these alarms until they reach the exit to the building. These smoke alarms would be dynamic in the sense that they adapt to where the fire is located. This means that if a smoke alarm that is in the middle of a hallway goes off, people on the left of that area would be directed to the exit that is closest on their side of the fire while people on the right of that area would be directed to the exit that is closest on the other side of the fire while nobody is directed though the dangerous area. The system would also be able to handle hallway intersections and other confusing areas. This allows for residents to know where the fire is and what areas to avoid. For people that have hearing issues, these alarms will also have a visual display using light-up arrows that will point individuals in the direction they should go to exit the building. This also allows for better handling of confusing areas where sound alone could be confusing. This system should be achieved by mapping the building layout using a custom-made application during set up of these alarms, creating spatial awareness for each of the fire alarms, while using an algorithm to signal each alarm which is the best exit direction relative to its position. Our final goal is to focus on the ease of installation of our system. This system needs to be simple enough to install so that specialists are not required to configure, set up, and install these fire alarms. An effective ease of installation would ensure that almost anyone would be able to adapt our system into their building plans.

**Engineering Requirements/Specifications**

The fire alarm that will be designed will give a clearer indication as to where to go during a fire. For this system to work each alarm will be connected to each other and will be able to send and receive signals. This system will be mapped to the floor plan of the building, so that when a fire breaks out the alarm system will recognize where the fire is coming from and send out a signal to each alarm to light the LEDs in the direction people should go to get away from the fire.

**1.) Smoke sensors**

Smoke sensor will be used to detect smoke within the building, there are different types of smoke sensors to detect fast flaming fires and slow smoldering fires. Upon more research we will be decided which would be best for us to use within our fire alarm. We want to make sure that we have the most cost-effective sensor that are also very efficient, to provide the costumer with the best product.

**2.) Transmitter and receiver**

For this fire alarm system, we want to make sure to direct the people away from the fire and to the closest exit. For this to work we will need each alarm device to be connected to each other. So each separate alarm will have a transmitter and a receiver so that way each alarm would be able to communicate to each other, and send the correct signal.

**3.) Software**

For the fire alarm system to be successful we will be using a script language to program the devices to recognize the layout of the building, and to be able to set off the sequence as to where to go when one of the smoke sensors go off. It has not yet been determined which script language will be use yet, we want to make sure you use the one that would be the most efficient and easy to implement.

**4.) Battery**

For the fire alarm system, it will be using a 9v battery with 1200 mAh current, due to some research on current fire alarm systems and the profession grade batteries they use. We are also researching the different types of batteries that would provide us with the best life expectancy. We would want the battery to have a life expectancy that will last between 5 to 10 years. This way the alarm system requires minimal maintenance as possible, on top of annual inspections.

**5.) Lights, Direction Indicator, Sound**

To help with the indication of a fire, and to help direct people in the right direction away from the fire there will be two LEDS in the shape of arrows on the fire alarm. Depending on the signal that is sent out, one of the arrows would illuminate in the direction to go. This will help give a clearer indication as to where the fire maybe and where to go. In addition to the lights and the direction indicators, there will also be an echoing sound that will sound when the alarm goes off. This echoing sound will follow the sequence of the signal that was sent out, and the sound will go towards the closest exit, just like the lights.

**House of Quality**



**Block Diagram (Hardware/Software)**



**Budget**

|  |  |
| --- | --- |
| Wireless Adapters | $10 x 5 = $50 |
| Battery Harness / Power Supply | $3 x 5 = $15 |
| Speaker/Alarm | $1 x 5 = $5 |
| Various Electrical Components | $10 x 5 = $50 |
| Microcontroller for Hub | $30 x 1 = $30 |
| PCB boards | $10 x 5 = $50 |
| Smoke Sensors | $7 x 5 = $35 |
| Boot flasher | $15 x 1 = $15 |
| Estimated Total | $250 |

The initial estimated cost for this smart smoke detector project is $250. We will add an additional $50 to this budget to account for broken parts, errors, and items that are unaccounted for. This brings the total cost of our project to $300.

**Financing Plan**

While everyone on the team has agreed to share any financial burden created by the project equally, we will seek sponsorships and other means to finance this project. Upon selecting a project, and receiving approval we will submit proposals to companies interested in investing in fire alarms and those looking to showcase their semiconductor and component products. A tentative list includes: Texas Instruments, Taiwan Semiconductor Manufacturing, Honeywell Fire Systems, Siemens (Building Technology Division), and UCF. If no sponsorship or financial help is achieved, the team is responsible for any costs incurred.

**Project Timeline**

