Initial Project Document - Divide and Conquer

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DEPARTMENT OF
ELECTRICAL & COMPUTER ENGINEERING

UNIVERSITY OF CENTRAL FLORIDA

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Senior Design I

GROUP 8

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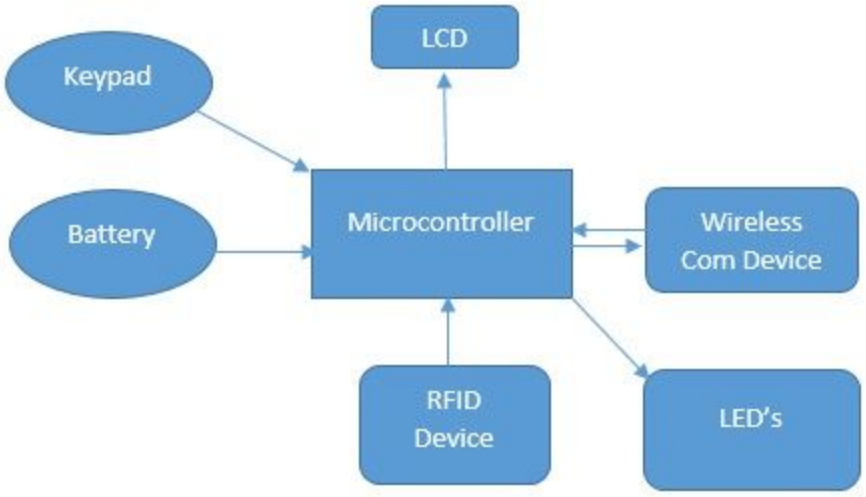
Introduction:

Our alarm system is one that is focused on adding additional features that aren't typically found within most home alarm systems. Our secondary focus can be best described as one that adds extra convenience and saves a little bit of extra money for the end-user. One of the main changes is the alarm system will be featuring a more robust computer then typically used and the addition of an LCD screen. This allows the alarm system to feature things such as access logs, RFID and a greater capacity to synch with other devices in a way not previously seen from home alarm systems. A side effect of this also means we can allow for quite a bit of user customization as well if time permits. One of the biggest changes on the money saving front, will be the absence of a subscription plan, which although not unheard of, hasn't fully caught on in popularity due to these systems typically lacking anything to really set them apart.

Design Narrative:

A: Microcontroller

Our microcontroller is the most important part of our device and functions as our hub to everything else. Essentially as a small computer, it will need to be programmed to read our information from our multiple portions of the device. The requirements of our programming, are it has to distinguish the from different I/O's, drive various LED's and an LCD depending on which state our system is in. This means it will most likely need to feed our data in serially, to our LCD display depending on type. Due to limitations of these devices, one of our requirements is that an appropriate number of pins for our use must be available. Our other limitation is that there must be plenty of memory to store our data. Due to the heavy nature of our application requirements, smaller microcontrollers will most likely be unsuitable. Preliminary research into this topic, leads to the idea that an unfamiliar programming language may be needed. It will also have to serve as our memory for all access events and possibly a record of alarm triggers. The last possible use for this as our application, would be it may be used as a power source for at least some of the internal portion of our device. This means we have to be careful with the amount of voltage and current drawn for our device. A basic flowchart can be seen below.

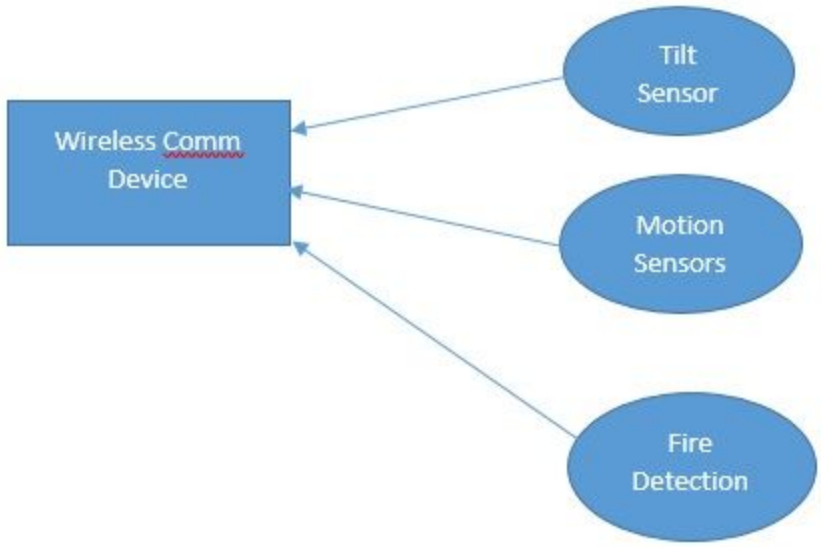


B: LCD Display:

Our LCD display will be one of the other most important factors in our device. Due to the nature of requiring system logs and such for our device, a colored LCD or Black and White would be ideal. Most research into them indicates it will take a considerable amount of pins for this type of display, which means we must plan accordingly. The methods by which they appear to be run in general seems to be either through pins in a serial fashion or through the use of a GPIO pin setup. The refresh rate doesn't need to be necessarily to high for our application. In terms of dimensions a smaller 320x240 pixel resolution most likely will be suitable for our applications as it would be easily readable. The common config appropriate for our use would be that the screen sits on top of our microcontroller.

C: Wireless Communication:

Our method of transmission has yet to be determined for our use. However, within our design we have only two real factors in general when it comes to this. Our first factor will be the range which is also our most important factor. This is mainly because if our range is bad, the device becomes unusable. The other factor is data transmission rate, which is the less important factor for us, as we require only a very small amount of data when it comes to this. This will serve as our hub to all our remote devices such as motion and tilt sensors.



C: RFID:

RFID technology is one of the important features when it comes to our device. This is shortened for Radio Frequency I.D and essentially is the ability to read chips without plugging them in directly to a device by using wireless communication. According to research it will be required to run on a lower frequency band as this is extremely popular with the N-Tag type chips. Part of this relates to the fact that no license is required for these applications when within this range. Most RFID chips appear to hold much more data then we will need for the most part. The data transfer rate for our application appears to be negligible.

D: Sensors:

Our device requires three types of sensors that essentially will be hooked up with an antenna to transmit to our wireless communication device. The most basic one should be our Tilt Sensor which is supposed to be affixed to a standard outer door handle. This allows the user to know when someone attempts to access the handle. The premise of how they work appears to just be a basic switch that closes when it is rotated. Our second sensor type is a motion sensor. These appear to operate in many different ways varying from Passive Infrared, MicroWave, Ultrasonic, Vibration and more. Ultrasonic for example will detect only a moving object and Passive Infrared has a bit of a startup time.The type best suitable for our application is to be

determined. Our fire sensor can measure a few things such as heat and carbon. This is yet to be determined, although, the heat sensor appears to be the most common application.

Project Constraints:

We as team have already ran into a couple of constraints in our project that have limited us to making a final decision about the technology we would like to use. First and most importantly is our microcontroller. Since we are going to include an abundance of inputs and outputs in our design, then we need to choose a microcontroller that will be able to accommodate all of our peripheral devices and sensors while maintaining a financial friendly security system. By implementing a 4x4 push button keypad in our design, we have already used up four inputs since four bits is equal to a total of 15 different signals.

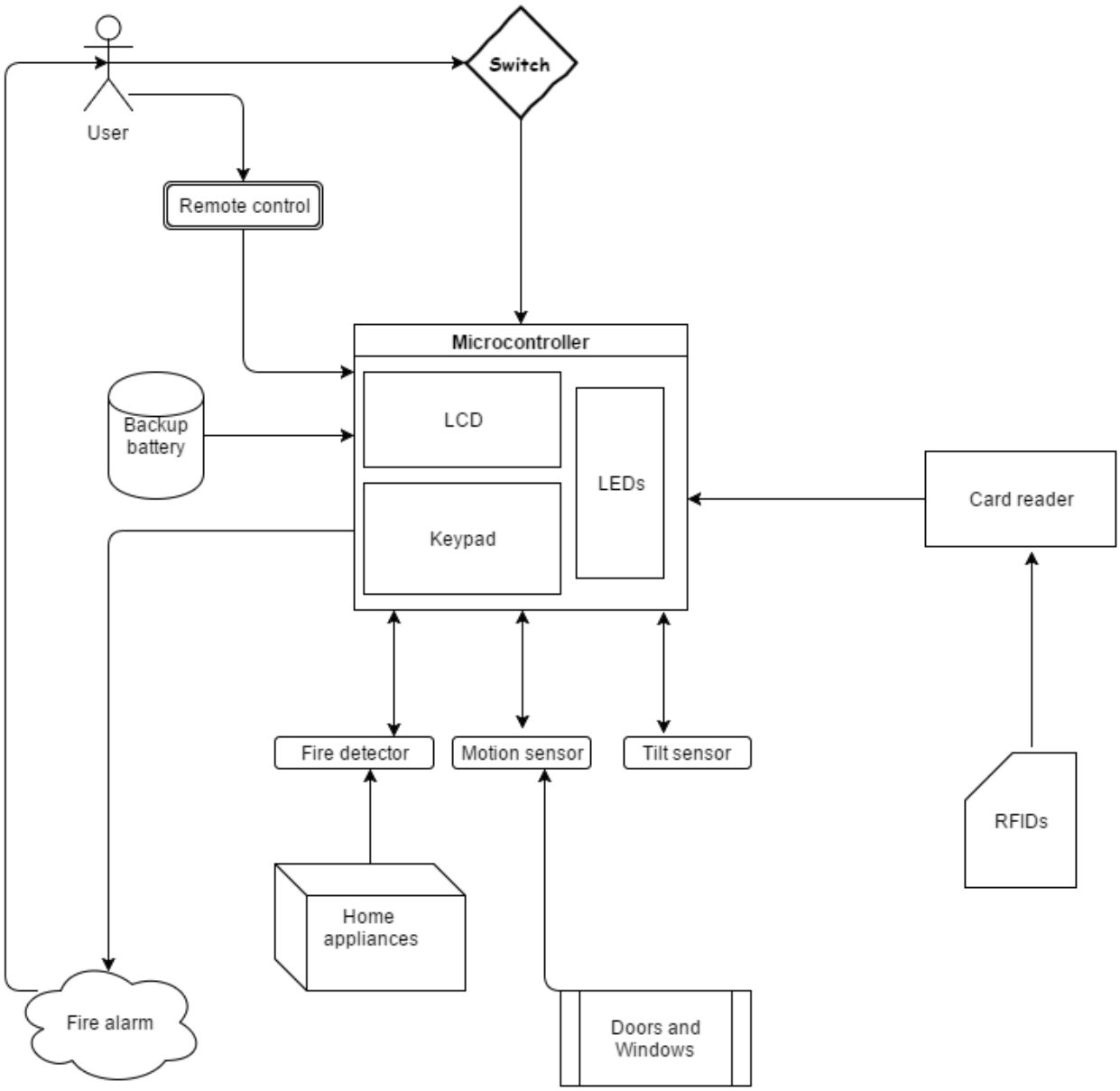
Another constraint we have come across is memory. If we decide to use a "fancy" liquid crystal display to make the system more user friendly and aesthetically pleasing, then this is going to cut into the amount of memory that we are going to have available in our design. We are assuming that memory will not be an issue, but if we do have technical complications, then we will have to use a more basic "text only" LCD display.

The low power of the microcontroller will limit us to what kind of sensors will be used. For example, the Arduino Uno's maximum output current for a input/output pin is 50mA. The little research we have done so far has rendered the gas sensors and carbon monoxide sensors useless since the minimum operating current for these devices exceeds the maximum current the microcontroller can output.

Block Diagram

Based on our features, we come up with this diagram. It is subject to change with changes in our features and requirements.

Block Diagram



Remote control: to be acquired. The remote control is turn on/off the system within distance.
Microcontroller: to be acquired. The microcontroller will be implemented with an LCD, a keypad and LEDs.
LCD: to be acquired. A simple LCD screen to display the state of the system.
LED: to be acquired. Some LEDs (red and green) to indicate the state of the system

Keypad: to be acquired. A basic keypad for the user to input data.
RFID: to be acquired. The RFID is to give the user a better way to unlock the system.
Card reader: to be acquired. To read the RFID card.
Backup battery: to be acquired. A backup battery to support the system in case of a power outage.
Switch: to be acquired. The switch is to manually turn on/off the system.
Fire detector: to be acquired. To detect fire around the system.
Motion sensor: to be acquired. To detect motion around the system.
Tilt sensor: to be acquired. To detect
Fire alarm: to be acquired. To let the user know when there's fire.

Specifications:

As of right now, these are the only specifications that we are aware of. These values are not set in stone since we have research more in depth about the parts that we would like to implement. Nevertheless, these values are estimations of what to expect from our project.

Input Voltage	9 volts
RFID Operating Frequency	13MHZ
RFID Range	<1feet
Maximum Input Power	<10W
Length	12 inches
Width	10 inches
Weight	<10lbs
Backup Battery Type	Lithium-ion
Battery Life	<10 Hours
Motion Sensor Range	15 Feet
Number of Sensors	~4

Cost Analysis:

Part	Price
Microcontroller	$50
LCD	$100
RFID	$20
Keypad	$10
Sensors	$100
Miscellaneous	$50
Total Cost	$330

Project Milestones:

Number	Task	Start	End	Duration (Weeks)	Task completed by
Senior Design 1					
1	**Brainstorming**	5/16/2016	5/23/2016	1	The Team
2	**Project Selection & Role Assignments**	5/23/2016	5/30/2016	1	The Team
Project Report					
3	Initial Document - Divide & Conquer	5/27/2016	6/3/2016	1	The Team
4	Table of contents	6/3/2016	7/1/2016	4	The Team
5	First Draft	6/3/2016	7/8/2016	5	The Team
6	Final Document	7/8/2016	8/2/2016	4	The Team
Research & Documentation					
7	Microcontroller	6/3/2016	6/24/2016	3	The Team

8	Battery Backup System	6/3/2016	6/24/2016	3	Phillip
9	LCD Display	6/3/2016	6/24/2016	3	Josh
10	Motion Sensors	6/3/2016	6/24/2016	3	Tony
11	Fire Sensors	6/3/2016	6/24/2016	3	Tony
12	Tilt Sensors	6/3/2016	6/24/2016	3	Tony
13	RFID Tag implementation	6/3/2016	6/24/2016	3	James
14	Software	6/3/2016	6/24/2016	3	The Team
Design					
15	Microcontroller	6/24/2016	7/15/2016	3	The Team
16	Battery Backup System	6/24/2016	7/15/2016	3	Phillip
17	LCD Display	6/24/2016	7/15/2016	3	Josh
18	Motion Sensors	6/24/2016	7/15/2016	3	Tony
19	Fire Sensors	6/24/2016	7/15/2016	3	Tony
20	Tilt Sensors	6/24/2016	7/15/2016	3	Tony
21	RFID Tag implementation	6/24/2016	7/15/2016	3	James
22	Software	6/24/2016	7/15/2016	3	The Team
23	Order and Test parts	7/15/2016	8/2/2016	4	The Team
Senior Design 2					
24	**Build Prototype**	8/22/2016	10/10/2016	7	The Team
25	**Testing & Redesign**	10/10/2016	11/7/2016	4	The Team
26	**Finalize Prototype**	11/7/2016	11/21/2016	2	The Team
27	**Peer Presentation**	TBA	TBA		The Team
28	**Final Report**	TBA	TBA		The Team
29	**Final Presentation**	TBA	TBA		The Team