ECE 445

Anti-lost/theft alarming system for personal belongings

Project Proposal

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1.0 Introduction

1.1 Statement of Purpose

Title: Anti-lost/theft alarming system for personal belongings

Many precious personal belongings, either by theft or carelessness, are easily lost and will cause serious damage. According to a report by TechCrunch: US citizens, on average, lost one smart phone annually, which will cause 30 billion dollar loss of money in 2012. Not to mention the lost of wallet, which may cause the lost of your driving license, cash and credit cards.
Our idea is to use wireless communication technology to remarkably decrease the loss rate of those important items you carry. Since those personal belongings (i.e. wallet, cell-phones, keychain) are supposed to be very close to you, we would pair them up(use transmitters and receiver) with a portable base device that could be easily hooked up/carried in your jacket/coats. This device will detect if any of the personal belongings are too far away from you (for example more than 2-5 meters) and send out an alarm indicating this item is under potential risk of loss.

1.2 Objectives

1.2.1 Goals

The goal of our project is to design an effective alarming system that could prevent the potential loss of user's personal belongings. During an incidence the user should have a better change to get back the losing item guided by the beep sound from the losing item.

1.2.2 Functions

- Pair up all the precious items to the system
- Alert the user under an incidence
- Trace back the potential lost item

1.2.3 Benefits

- Decrease the loss rate of personal belongings
- Identify the losing item so user can concentrate on the losing item.
- Manual on/off the base device + Password protection

1.2.4 Features

- Wireless setup multiple items
- Portable base devices easy to carry
- Low energy cost and long battery life

2.0 Design

2.1 Block Diagrams

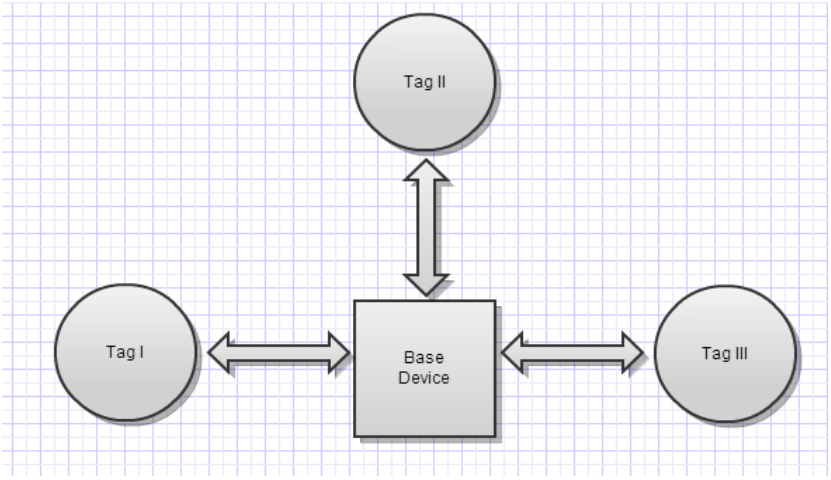

Figure 1 Top Level System Layout

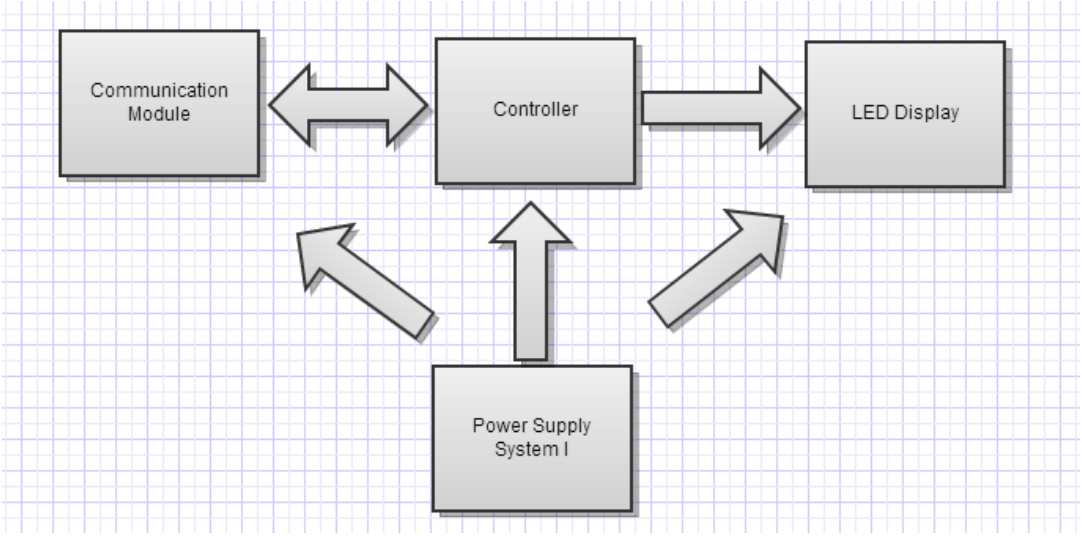

Figure 2 Block Diagram of Base Device

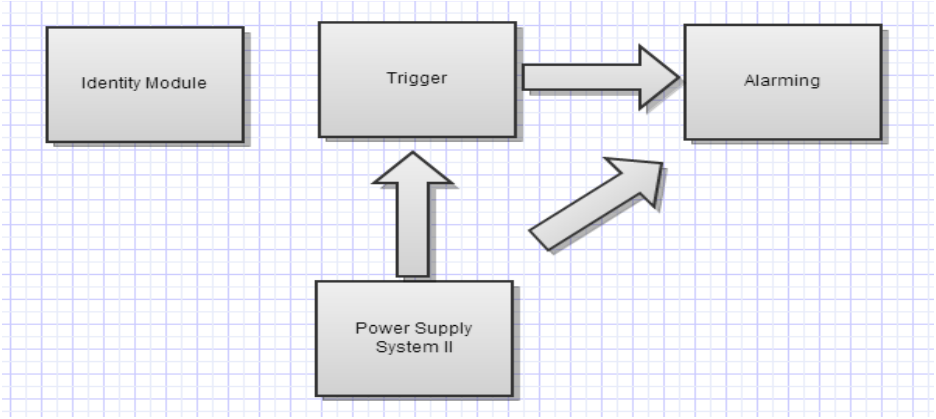

Figure 3 Block Diagram of Tag on Each Personal Items

2.2 Block Descriptions

- Top Level System (Consist of one Base Device and several Tags)

➢ Base Device

Our alarming system have a portable base device that should be carried by the user to protect the surrounding items. It will prevent all the paired up tags from running away.
Details will be explained on next section

➢ Tags

Tags are supposed to put on the items to prevent losing. Ideally the base device should work with arbitrary number of tags.

- Base Device Module Description

➢ Power Supply System I

Power Supply System I will power up Communication Module, Controller Module and LED Display Module. It will use proper batteries and a circuit to regulate/modify the output to make sure proper power was delivered.

➢ Communication Module

Communication Module is working under directions of the controller. It will keep trying to communicating with all the tags. It will send information to the controller if a tag is current within the range. And after controller decided to trigger the alarm, it will communicate with the trigger. Communication Module linked Base Device communicate with all the tags.

➢ Controller Module

Controller will getting data from Communication Module, once a tag is out of range and under potential risk of lost, it will command the Communication Module to trigger the alarm.

➢ LED display

LED display is working under directions of the controller. It will display the information needed by users

- Tag Module Description

➢ Power Supply System II

Power Supply System II will power up Identity Module, Trigger and the Alarming Buzzer. It will use proper batteries and a circuit to regulate/modify the output to make sure proper power was delivered.

➢ Identity Module

Identity Module will Contain the information (Identity) of the personal item so that the base device could indicate which item was losing. It will passively communicate with Communication Module at certain distance as a distance checker.

➢ Trigger Module

The Trigger Module was powered by Power Supply System II to trigger the alarming sound. It is necessary because the base device needs to communicate with the Tag.

➢ Alarming Module

Alarming was powered by Power Supply System II, triggered by the Trigger Module, and should help user to trace back their losing items.

3.0 Block Level Requirements and Verification

3.1 Requirements

- Base Device
  - Power Supply System I

Power Supply System I must be able to output two different voltage correctly match different components.

- Communication Module

Communication Module can check if a Tag is within the setup range via RFID technology. It must be able to communicate with Trigger Module as well using wireless communication.

- Controller Module

Controller will be designed using SCM embedded System and sophisticatedly programmed. It must interfere with Communication Module correctly and determine of an item is under risk.

- LED display

LED display will indicate the status of system (On/Off), Identity of the losing Item(Name) and other information (i.e password, lock/unlock).

- Tag
  - Power Supply System II

Power Supply System II must be able to output proper power to the alarming Buzzer.

- Identity Module

Identity Module will Contain the information (Identity) of the personal item. Can passively communicate with Communication Module at certain distance (3-5meters).

- Trigger Module

The Trigger should be able to receive signal from Communication Module and trigger the Alarm buzzer via wireless communication.

- Alarming Module

Alarming sound should be loud enough to be heard at a long range. It should be powered properly by Power Supply System II.

3.2 Verification

- Base Device
  - Power Supply System I

Power Supply System I will first be tested alone using multi-meter indicating the output voltage and power. They it will be monitored by the multi-meter while the system is running. Since it is low voltage and low power there should not be any potential danger.

- Communication Module

Communication Module is the most importance part of our system and needs lots of testing and verification. It will be modified(by modifying power of the transmitter or signal strength) so that around a certain distance (ideally around 3 meter), it cannot get any feedback from the Identity Module. It will also be tested if it could correctly triggered Alarming system.

- Controller Module

To verify the Controller, a check on the code will be performed. First, a check will be performed to see if controller could achieve information from Communication Module. Then, a check will be performed when a testing tag is out of range for a certain time, to see if the controller will send out a command to Communication Module which will trigger the buzzer.

- LED display

LED display will be verified at last, when the other component are working correctly, it should display the status of the system to user correctly.

- Tag
- Power Supply System II

Power Supply System I will first be tested alone using multi-meter indicating the output voltage and power. They it will be monitored by the multi-meter while the alarm buzzer is running and powered by the power supply. Since it is low voltage and low power there should not be any potential danger.

- Identity Module

Identity Module will be verified by showing it will feedback the right identity once the communication Module is trying to check it. And it will not give any feedback once it was out of range.

- Trigger Module

The Trigger should be able to receive signal from Communication Module and trigger the Alarm buzzer

- Alarming Module

Alarming was tested that once it was powered by function generator, it could be easily heard at a range of 5-8 meters.

3.3 Tolerance Analysis

The most critical and challenging part of our design will be the distance judgment via wireless communication technology. The current solution to it will be a modification on the range of RFID signal: when a tag is out of range our system will pay attention to it. Since it is really hard to trigger the alarming system at an exact range. We will be trying to make sure the alarm will be triggered around 2-5 meters, which is a acceptable range that an item is under high risk of losing. To achieve this goal we need to choose RFID chip carefully with proper power output and signal strength. It may needs lots of testing to determine and modify the out-of-range distance.

4.0 Cost and Schedule

4.1 Cost Analysis

4.1.1 Labor

Name	Hourly Rate	Total Hours Invested	Total = Hourly Rate x 2.5 x Total Hours Invested
Wenhao Li	$35	180	$15750
Yunchi Sun	$35	180	$15750
Xiying Wang	$35	180	$15750
Total		540	$47250

4.1.2 Parts

Item	Price/Unit	Quantity	Cost ($)
PCB	$25	2	$50
RF Front-End	$5	2	$10
RF Transceiver	$9	4	$36
Microcontroller IC	$1	4	$4
Power Management IC	$5	4	$20
Large Piezo Buzzer	$2	4	$8
Battery	$50	1	$50
Total			$178

4.1.3 Grand Total

Section	Total
Labor	$47250
Parts	$178
Total	**$47428**

4.2 Schedule

Week	Task	Member
2/4	Finalize and hand in proposal Background research and basic design Mock Design Reviews Sign-up	ALL
2/11	Sign up and for design review Research and Design Wireless Module Research and Design Power Module Research and Design Alarm Module Order parts	Yunchi Wenhao Yunchi Xiying
2/18	Test Parts to make sure they meet the requirement Finalize the design schematic for each Module PCB design DR Sign-up	All Wenhao & Yunchi Xiying
2/25	Design Review Improve the Design	All
3/4	Build the Wireless Module Build the Power Module Build the Alarm Module	Wenhao Yunchi Xiying
3/11	Individual Progress Report Research and design physical enclosure for the transmitter Program the microcontroller	All Yunchi Wenhao

3/18	Spring Break	
3/25	Mock-up Demo Order physical enclosure	All Yunchi
4/1	Revise PCB Design Order first revision PCB Build the system on PCB First Round Test	Wenhao & Yunchi Yunchi All
4/8	Second Round Test & Debug Assemble the system into enclosure Order final revision PCB	All Yunchi
4/15	Final Test & More Debug Begin Final Report Demo and Presentation Sign-up	All Wenhao Xiying
4/22	Demo and Presentation	All
4/29	Presentation and Final Paper	All