

# SMART BACKPACK



## TEAM SIGMA

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# Background

How do people ensure they have all items needed for an event?

## REMINDERS



## CHECKLISTS



How is monitoring and identification done in our society today?

- **RFID TECHNOLOGY**  
An RFID system consists of  
Reader  
Transponder or tag



# Background

## Goals

- Compensate for the failures of a reminder and checklist
  - Active Monitoring of items
- Avoid frustration of losing/forgetting important items

Who are our customers?



# Problem Definition

**What Should Be Happening**

**What's Wrong?**

We need to be able to monitor, track and crosscheck a user's essential items are within close proximity to the user.

## **The Problem Statement**

**What we Plan to do**

We want to design a system that monitors and keeps track of items needed based on a user's schedule and notifies the user whenever an item needed for any of the day's activities goes outside a certain range of the system.

**What Is Actually Happening**

People forget

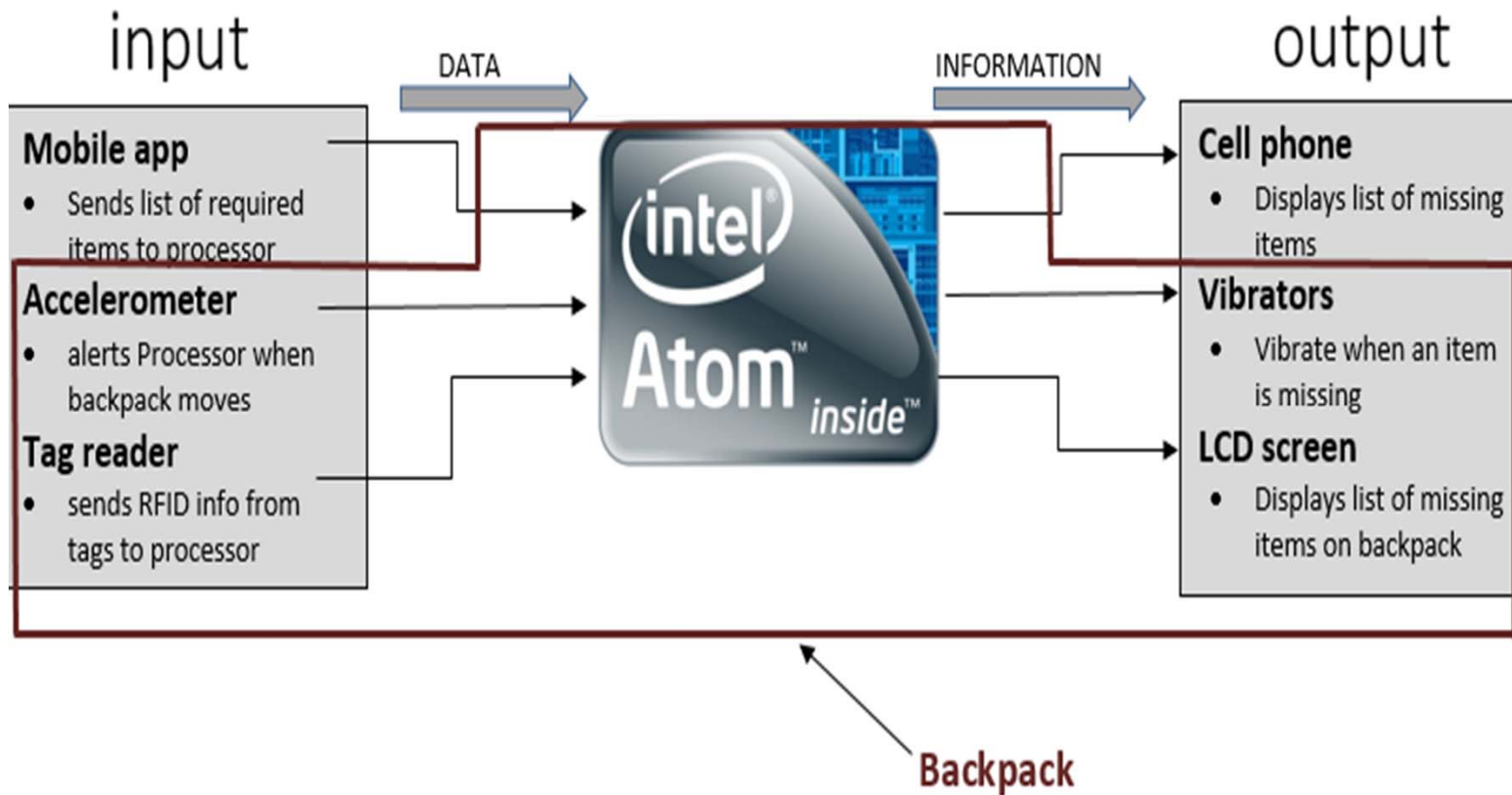
# Design Requirements

	Descriptions
Function	<ul style="list-style-type: none"><li>➤ Issue warning if user attempts to leave without an item needed at their projected destination. <b>(4ft)</b></li></ul>
User Interface	<ul style="list-style-type: none"><li>➤ Allow user to specify which items are needed for each event</li><li>➤ Allow user to view inventory</li><li>➤ Notify the user of items needed if missing. <b>(Smartphone)</b></li></ul>
System capabilities	<ul style="list-style-type: none"><li>➤ Communication link for the monitoring system <b>(Wireless)</b></li><li>➤ Automatically update inventory</li></ul>
Compliance	<ul style="list-style-type: none"><li>➤ Adhere to the relevant standard</li></ul>
Others	<ul style="list-style-type: none"><li>➤ Low Noise level <b>(20db)</b></li><li>➤ Light weight system <b>(3lb)</b></li><li>➤ Optimum battery life <b>(8hrs)</b></li><li>➤ Ease of use <b>(10mins setup, 10mins learning)</b></li></ul>

# Solution Approach

1. Microprocessor obtains user's schedule from organizer
2. Required items are decoded from tasks listed on the schedule
3. RFID reading action is triggered whenever motion is detected by accelerometer
4. Notification (tracking) system is triggered as user leaves the home
5. Microprocessor notifies user whenever items go outside the RFID reader's range
  - Vibration motion, alert sent to phone & displayed on LCD screen

# Solution Approach





# Alternative Approaches

- **Identification and Tracking**

- RFID tags vs Barcode

- **Alert System**

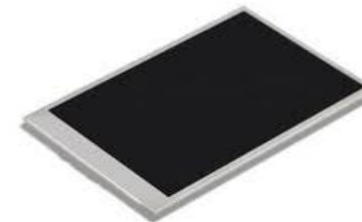
- Vibrators vs Alarm

- **Inventory & Organizer System**

- Google calendar vs Sigma-created app

- **Notification System**

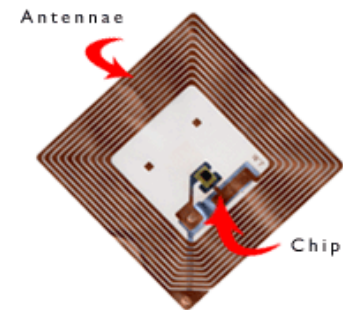
- Phone vs LCD Screen



# Current Status of Art

## Fundamental Theory

- RFID transceiver (reader) antenna emits radio waves
- RFID transponders (tags) within range absorb the energy discharged by the reader
- Absorbed signal is altered(amplitude shift keying) by the tag's data and backscattered to the reader
- The reader receives and compares this modified wave to the original to extract the data



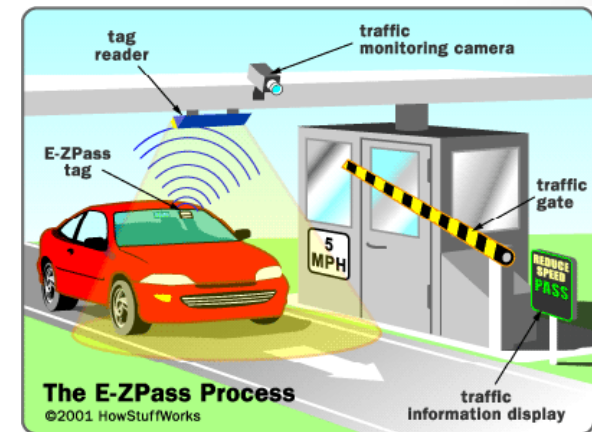
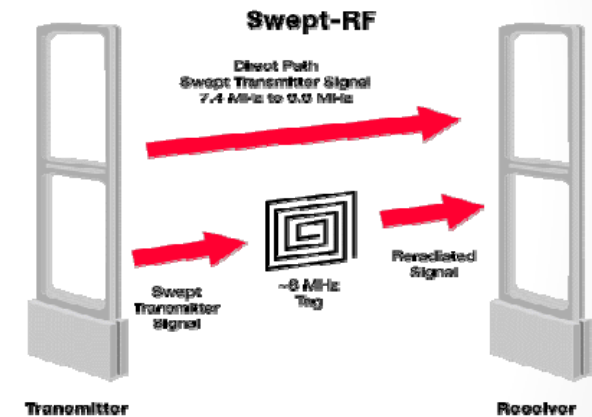
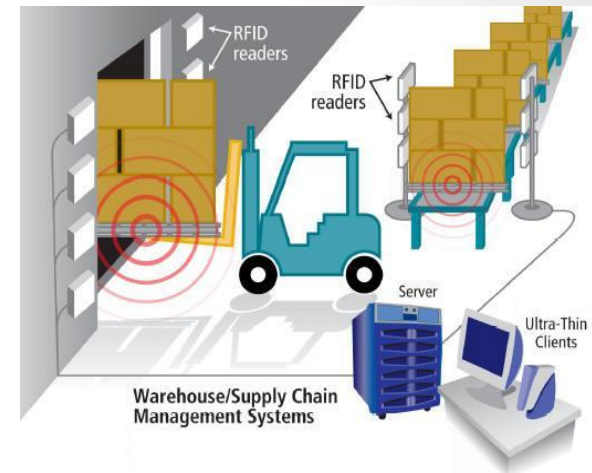
# Current Status of Art

## Features

- Tags can store 2KB of data
- No direct line of sight needed for system
- System can employ WIFI/Bluetooth technologies
- Tags can be located through triangulation

## Weaknesses/Improvement Points

- Tradeoffs occur with change in RFID signal frequency
- Expensive
- Many metals and liquid(aluminum foil, water, etc.) can cause interference in the system
- No global standard
- Difficult for the average consumer to operate



# Tasks and Project Management

## Deliverable

Functional Smart Backpack product that reliably and time effectively recognizes missing items and sends appropriate reminders

## Team Assignments

Hardware Team	Software Team
Ellwood Lane	Jennifer Okafor
Samuel Omosuyi	Paul Alade
	Kalonji Bankole

## Timeline

Tasks	Duration	Expected Completion Date
Develop Simulations and Algorithms	45 days	December 1, 2012
Order Parts	30 days	December 31, 2012
Develop Prototype	45 days	February 14, 2013
Test and Refine Prototype	45 days	March 31, 2013

# Verification plan

Steps	Function	Test
<b>Calendar information</b>	Information is making it from app/phone to processor	Information is properly showing on processor
<b>System state</b>	Motion turns on RFID reader	Does RFID reader turn on as a response to movement
<b>Tag identification</b>	Reader is recognizing tags within region	Tags are being read
<b>Tag proximity</b>	Error message is sent when tag moves outside of region	Processor correctly realizes that a certain tag is missing
<b>User notification</b>	Error message is received by user through each outlet	App/Vibrator/LCD screen correctly function
<b>Home location</b>	RFID reader goes to sleep when inside home	RFID reader turns off once home tag is read

# Costs and Resources

Budget(\$2500)	
Components	Cost
RFID reader and tags	\$300
Accelerometer	\$30
LCD screen	\$40
Vibration System	\$15
<b>Total</b>	<b>\$385</b>

Physical Resources	Technical Resources
Matlab	Classwork background
PSPICE	Practical corporate experience
C++	
Intel board	

# Conclusion

## Need

- Many people forget required items or important materials when moving between tasks

## Benefits/Objectives

- Backpack will assist users in ensuring that important items are never left behind

## Engineering Solution

- RFID reader and tags, accelerometer, LCD screen, and a vibration system form the basis of Sigma's solution

## Timeline and Milestones

- Documented goals in place to ensure that Sigma's product is completed within given time parameters



# Q and A



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