



DropApp



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Motivation

- There are many products out there that help you find your phone once its lost
- Unfortunately once its lost it can be damaged or stolen
- The sooner the owner realizes their phone is missing the more likely they will be to find it and it be working
- The best way to get the user their phone back as soon as possible is to alert them as soon as the phone thinks it's lost... AKA DropApp!

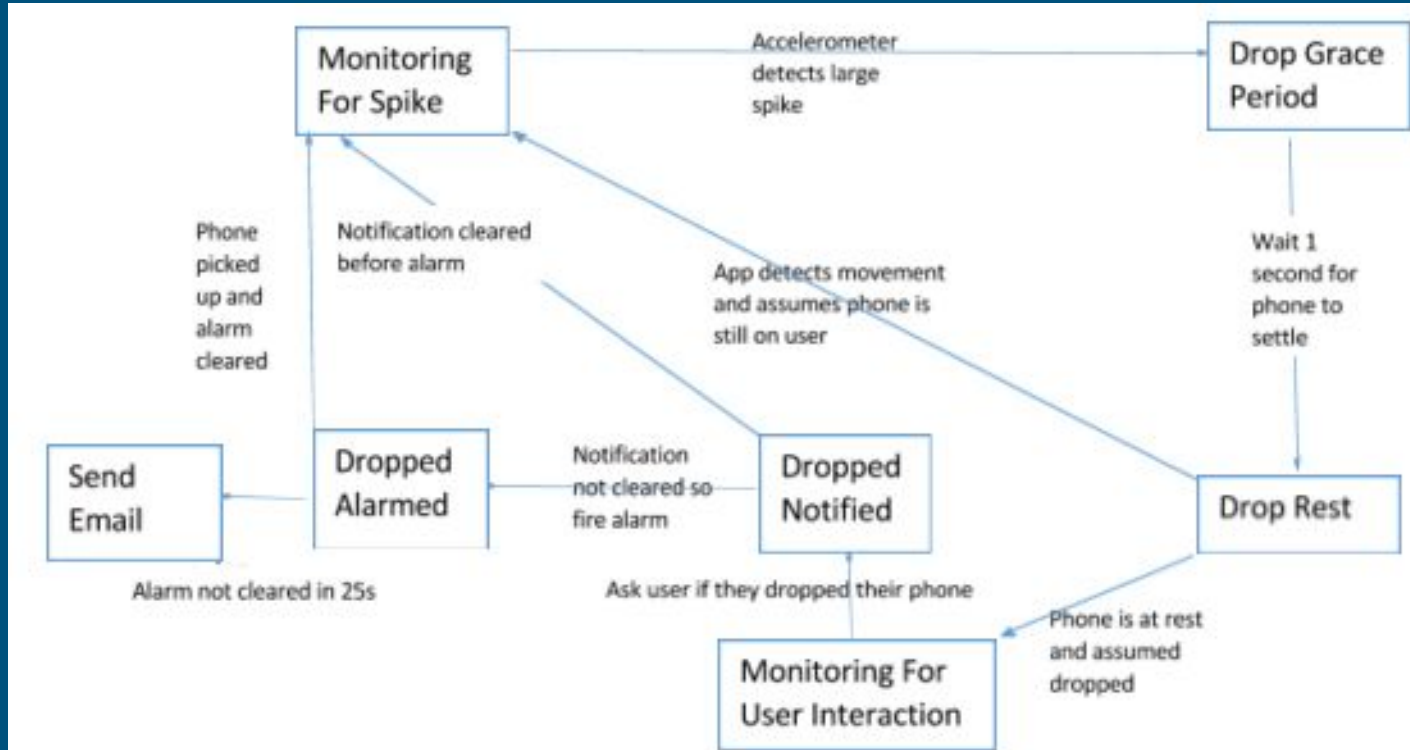
DropApp Basics

- DropApp aims to prevent the user from losing their phone by notifying them as soon as the phone thinks it has been dropped and separated from the user
- The user will be notified with an alarm after ten seconds of their phone being dropped allowing for a speedy recovery avoiding damage or theft.
- As a last resort, the user will be emailed the gps coordinates of their phone if the user does not clear the alarm.

How It Works

- Uses phone's accelerometer to find the total acceleration every 25ms
 - $\sqrt{x^2+y^2+z^2}$
- Looks for a specific pattern in the total acceleration
 - Large spike and then a “rest” period
- The spike is the phone hitting the ground
 - Can be between 50 and 200
- The rest is the phone sitting on the ground not moving
 - Fluctuates between 9.5 and 10.5 (gravity)
- Once a spike has been read the phone then checks to see if it stays in the resting period for 10 seconds, then fires an alarm after the time

State Transitions



Phone Drop Detection

- When the user's phone takes a tumble the first thing that happens is a 5 second period of the user's phone trying to figure out what happened
 - Looks at accelerometer data to see if there was a spike and a rest period
- After these 5 seconds the phone makes a decision
 - If the phone thinks it was not dropped because the user is still moving with their phone it goes back to looking at accelerometer data and does not raise an alarm
 - If the phone does think it was dropped and not picked up then a notification on the user's phone appears asking if the user dropped their phone
 - If this notification is not cleared within 5 seconds then the user's phone's alarm goes off

If All Else Fails...

- In the event that your phone is dropped and not recovered there is a backup plan
- If the alarm is not cleared the phone records the gps coordinates and emails the information to a pre-configured email address
- This should allow the user to return to the area of the drop and recover their phone

Initialization

- Before the user can rely on the app they must do some setup:
 - Calibration
 - Due to the vast variations in the Android hardware available, the raw accelerometer data provided to the app differs greatly from device to device.
 - The calibration process is used to understand the sensitivity of the accelerometer on the phone through a deterministic repeatable process.
 - The user is asked to drop their phone 3 feet onto a soft surface such as a pillow 3 times.
 - The largest value is recorded from each drop, and averaged to calculate the 'drop threshold'. The 'drop threshold' is used during the app's monitoring algorithm.
 - Recovery email
 - The email address used to notify the user of the lost phone's GPS coordinates.

Challenges

- Drop detection algorithm
 - Recording *a lot* of data of varying activities and drop cases
 - Identifying a pattern to build an algorithm against
- Varying hardware
 - Accelerometer data is different on every device
 - Built the 'Calibration' function to understand the user's phone better
- Email notification
 - Send an email in the background without user's interaction
 - Decided to use 'GmailBackground' library

Target Consumer

- Anyone concerned about losing their phone
- People who move around with their phone often
 - Hikers, joggers, ...etc
- People who may not notice when their phone escapes them
 - Elderly, inebriated, mentally or physically disabled, ...etc

Future Innovations

- More robust algorithm
- Handling of specific edge cases and scenarios
 - Toss phone lightly on bed
 - In a moving vehicle

Things We Learned

- Nick
 - People do weird things with their phone creating a nightmare scenario for figuring out how to handle all these edge cases.
- Ben
 - Android is a very dynamic platform. Understanding and handling different devices is a really important step when targeting this wide audience.
- Kyle
 - Different models of mobile devices have different hardware specifications, and this also extends to the capabilities of the sensors used. The accelerometer of one device may be more or less sensitive than that of another device and had to be accounted for with the DropApp calibration method.
- Josh