Ubiquitous and Mobile Computing CS 403x: *Mobile Phone Based Drunk Driving Detection*

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Introduction

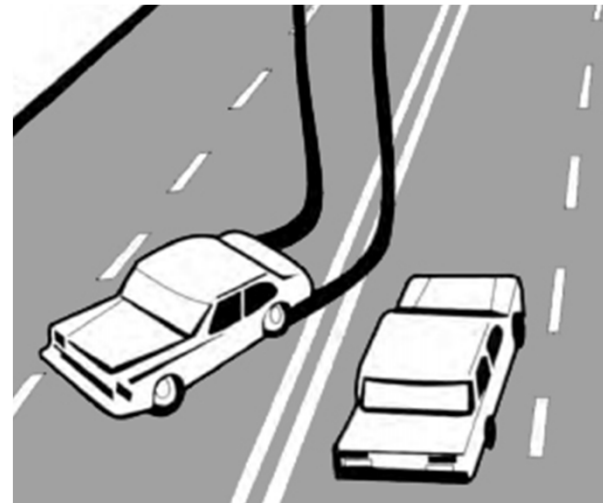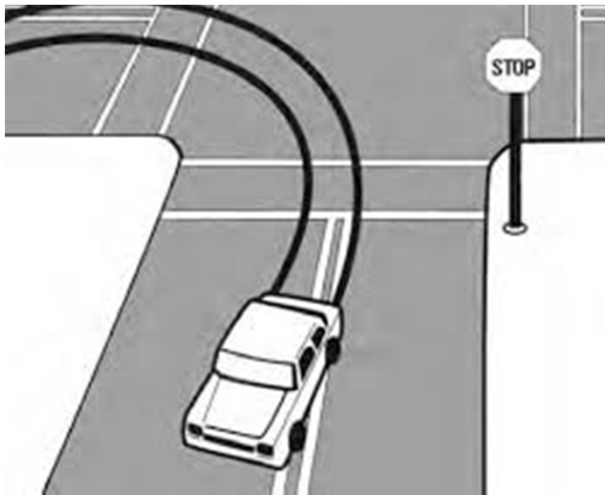**12,407**
~32%
$51 Billion

Introduction

<**1%** of drunk drivers are arrested each year

Why?

- Detection relies on **visual observations**
- Too much road, not enough patrol officers
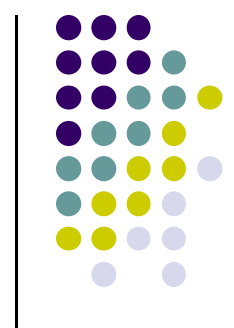- Drunk driving patterns are **subjective**

Motivation

How can we solve this?

Motivation

- Smartphones
  - Contain all necessary sensors
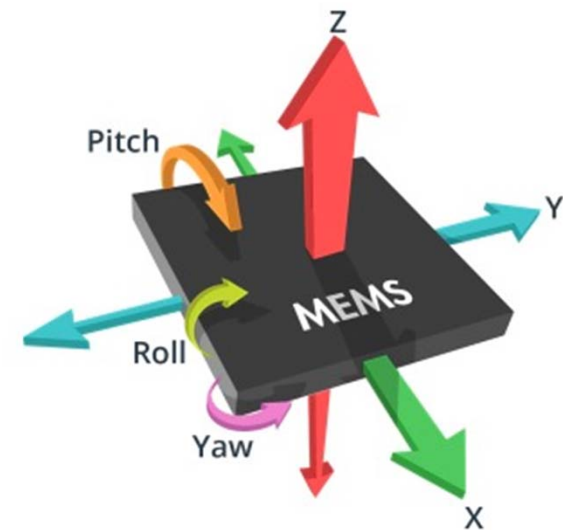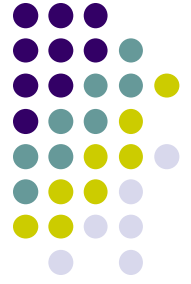 - Self-contained
  - Highly portable

Motivation (cont.)

- Only simple sensors needed
  - E.g. accelerometer and orientation

- Communication and speakers good enough for alerting

Vision

- Mobile application
  - Reliable
  - Non-intrusive
  - Lightweight
  - Power Efficient
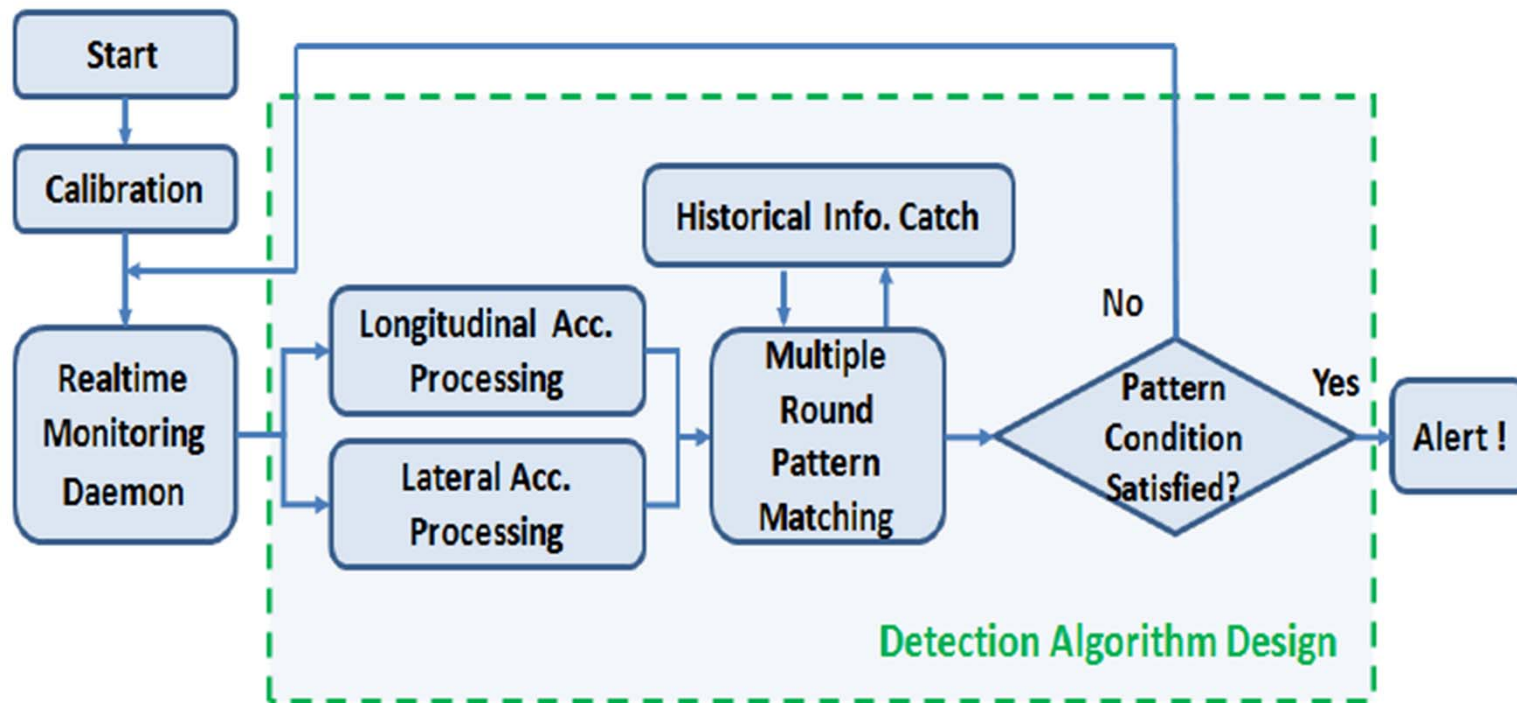 - **NO Additional hardware or service cost**

Related Work

- Visual observation - eyelid, gaze, head movement, facial expression
  - Safety hazard
- Saab - AlcoKey
  - Compatibility compromised
- Experimental work

Methodology - Overview

- Acceleration based detection algorithm
  - Accelerometer & orientation sensors
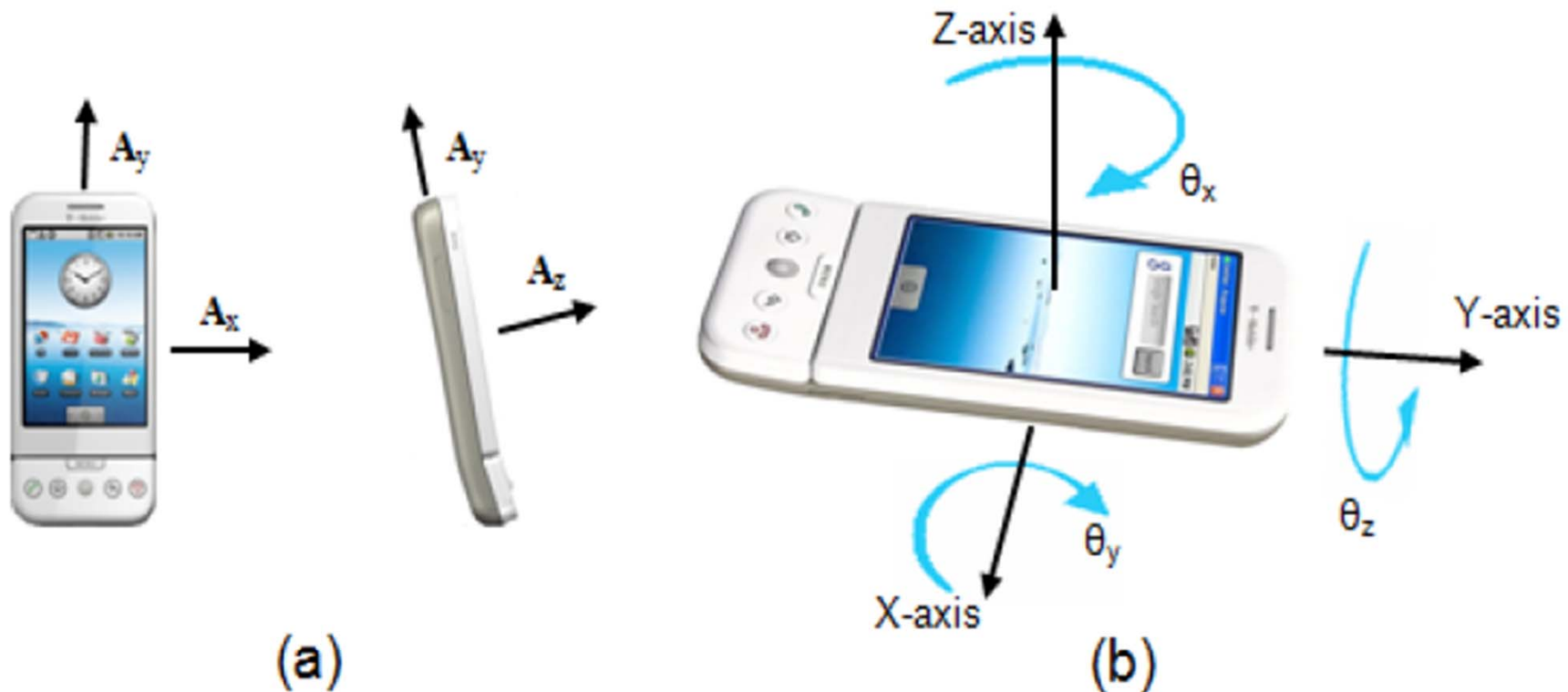
Methodology - Scientific Explanation

Fig. 3. (a) Acceleration readings in direction of x-, y-, and z-axis with regard to the body of the mobile phone. (b) The posture of mobile phone is decided by yaw (θ_x), pitch (θ_y) and roll (θ_z).

Methodology - Scientific Explanation (contd.)

- Lateral acceleration pattern matching
- Longitudinal acceleration pattern matching
- Multiple round pattern matching
- Historical information catch component

Methodology - Demo!

https://www.youtube.com/watch?v=pAkfccmIHt8

Methodology - Implementation

- In paper - used Eclipse and Android 1.6 SDK
- 5 major components -
  - user interface, system configuration, monitoring daemon, data processing, alert notification
- Triggering condition - 2 matching patterns

Methodology

- Assumptions
- Limitations
  - Limited data sets - 72 sets for drunk driving, 22 sets for regular driving
  - Phone slide impacts result accuracy
  - April 2010 paper

Results

- Collected data based on drunk driving behaviors
  - Lane position maintenance
  - Speed control
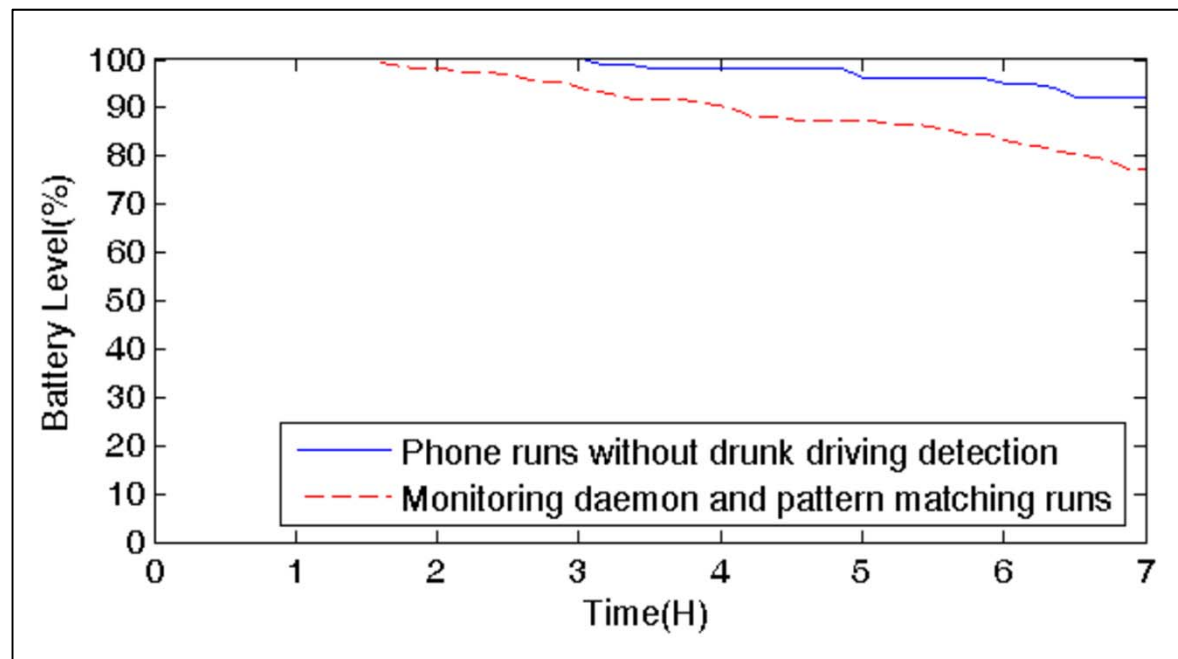 - Separate datasets for training and evaluation

Results

- Experimental performance test

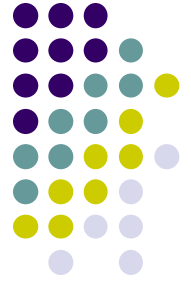|	Abnormal Curvilinear Movements	Problems of Speed Control
FN Rate (%)	0	0
FP Rate (%)	0.49	2.39
FN Rate (%) (Phone Slides)	14.28	0
FP Rate (%) (Phone Slides)	1.09	2.72

Results

- Energy Efficiency

Discussion

- Some issues in design and implementation
  - GPS
  - Camera

Conclusions

- Low false detection rates
- Reasonable energy consumption
- Use all mobile sensors in the future

References

- *Mobile Phone Based Drunk Driving Detection,* J. Dai et al in PervasiveHealth 2010