

“Don’t Bother Me. I’m Socializing!”: A Breakpoint-Based Smartphone Notification System

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Introduction

- Notifications on mobile devices distract users from in-person social interactions
 - A preliminary survey conducted on n=224
- Activating silent mode, turning off notifications, and not bringing smartphones are ineffective.
- A breakpoint-based notification system was implemented to defer notifications until an opportune moment
- A *breakpoint* is described as a unit of time in between two adjacent actions.
- Four types of breakpoints :
 - a long *Silence*
 - a user leaving the table (*Movement*)
 - others using smartphones (*Use*),
 - a user left *Alone*.



Continued...

- SCAN (Social Context-Aware smartphone Notification System) defers smartphone notifications until a breakpoint during a social interaction.
 - Mobile application that detects social context using built-in sensors
 - Microphone, step detector, IMU, Bluetooth Low Energy (BLE)
- Reduces number of disruptions in a conversation by 54.1%
- Accurately classifies breakpoints
 - Precision of 92.0%
 - Recall = 82.5%



Design & Methodology

Preliminary Study: Online Survey (n=224)

- How does smartphone use affect social interactions?
 - Q1: Do people think smartphone use distracts the conversation?
 - Q2: Do people control or change their smartphone use depending on who they are with?
 - Q3: What causes people to use smartphones during a social meal?

Reasons using the smartphone	% of respondents
Receiving a call	73.7
Replying to an incoming message	73.2
Looking at the notification	69.2
Using apps to help the conversation	65.2
Checking the time	58.0
Sending a message	43.8
Using apps due to notifications	35.7
Using apps for other reasons	37.5
Placing a call	29.9

Table 1. Activities causing the smartphone use during a social meal.



Design & Methodology cont.

Video Experiment (n=73)

- Participants asked to watch recorded social interactions and identify viable 'breakpoints'.

Situation	% of participants
Alone	98.6
Someone leaving the table	90.4
Friends using smartphones	84.4
A long silence	70.8
A short silence	63.1
Eating	47.2
Talking to the waiter	46.6
Conversation	24.2

Table 2. Situations selected by video experiment participants as viable breakpoints during a casual social interaction.

Design & Methodology cont.

SCAN Prototype

- Built for Android 5.0 and up
- Identifies four types of breakpoints
 - Silence
 - Moving
 - Alone
 - Use

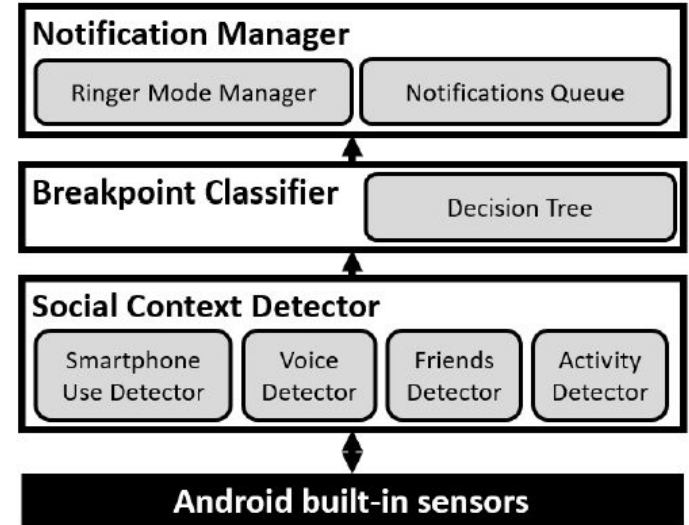


Figure 2. SCAN system architecture. It consists of three main components and leverages built-in smartphone sensors to detect social context.



Controlled Experiment

Objectives

1. Investigate the existence and distribution of breakpoints.
2. Measure the breakpoint detection accuracy of SCAN.
3. Evaluate whether SCAN reduces interruptions caused by notifications.
4. Understand participants' perception of notification management.

Participants

- Ten groups of three friends, all composed of different combinations of age and sex.
- All participants were undergraduate and graduate students.

Controlled Experiment cont.

Setting

- Japanese restaurant near campus to provide a realistic dining setting.
- Collected video recordings of each group to observe how they interacted.

Timeline

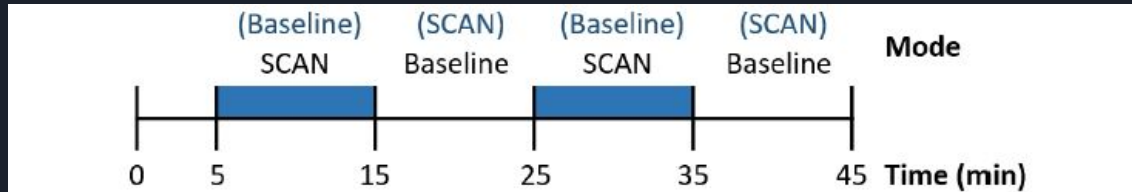
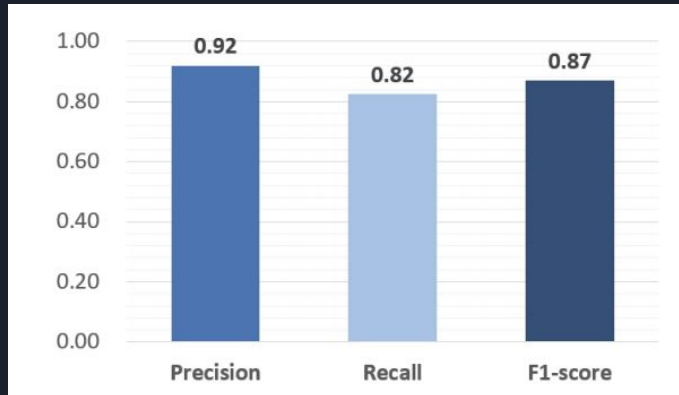


Figure 5. A timeline structure of the experiment. The first five minute is used to allow the participants to get used to the experiment environment. A sequence of mode is alternated for each experiment.

Results

- Breakpoint Distribution (Cohen's $k = 0.85$)
 - Evaluates the accuracy of SCAN's detection by comparing results with ground truth.
- Breakpoint Detection Accuracy
 - Evaluates if SCAN correctly classify breakpoint from the social context.



	Breakpoint Occurrence		Breakpoint Duration (sec.)			
	Frequency	Ratio	Mean	SD	Min	Max
USE	168	48.28 %	53.43	129.47	1	962
SILENCE	162	46.55 %	13.18	6.47	6	35
MOVING	9	2.59 %	101.78	52.86	49	215
ALONE	9	2.59 %	89.89	51.23	34	198

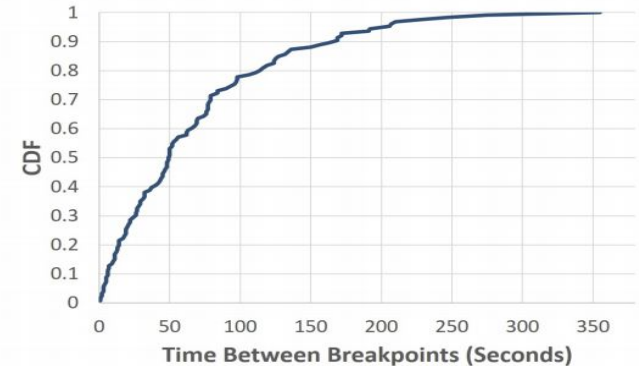


Figure 6. A cumulative distribution of breakpoint intervals.



Results cont.

- Reduced Interruption
 - Evaluates SCAN by obtaining the number of reduced interruptions from the total number of interruption of the the baseline.
 - $P > 0.05$ and Cohen's $d = 0.12$

Interface Condition	# Noti. Received	# Noti. Alarmed	Avg. Noti. Deferred	Avg. Time Deferred (seconds)
SCAN	399	183	2.18	51
Baseline	451	451	N/A	N/A

- Changed in Smartphone use and Conversation duration.
 - Smartphone use $p > 0.05$ and Cohen's $d = 0.34$
 - Conversation Duration $p > 0.05$ and Cohen's $d = 0.35$
 - Participants using smartphone during the interaction.



Critique

Good

- Well structured experiment
- Started broad and then narrowed scope
- Research idea is relevant in today's society; the idea of a system that delays notifications while socializing is occurring could be very helpful
- Categories presented (silence, moving, alone, use) offer organization and priority, can be easily recognized using sensors, microphones, or other equipment

Bad

- The study mostly focused on a single age group (20s)
- SCAN is evaluated for only a short period of time
- More profound mechanism for group detection
- Faulty technology, equipment; could pick up other signals
- Only used one setting; no research done in situations other than dining



QUESTIONS?