Emu: Engagement Modeling for User Studies

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Engagement is essential to enhance study quality

Push messaging drives 88% more app launches
Notification management

They are annoying distractions

Productivity enhancing
Grateful; they alert me to things I am interested in
Others

20%
26%
52%

Existing solutions:
Deliver
Delay
Block

Our approach:
Deliver me only when <condition> is met

Source: http://info.localytics.com/blog/the-inside-view-how-consumers-really-feel-about-push-notifications
It is challenging to specify contextual conditions programmatically.

Remind user:

- measure the blood pressure if the user doesn’t do it within 15 minutes after running

Challenges:

- When to send reminders?
- When the activity start/end?
- Concurrent conditions?
82 lines of codes to encode the contextual condition because we need to keep track of several clocks!
2 goals to achieve in Emu:

1. **Specify complex contextual events** to reduce the burden for study designers or app developers

2. **Increase the engagement** of participations in user study or medical interventions
Related work

- Context-aware sensing
- Programming language

Venn diagram:

- STFL (PETRA’09)
- Emu (Ubittiention’17)
- PrefMiner (UbiComp’16)
- Okoshi et al (UbiComp’15)
- Lu et al (SenSys’10)
- InterruptionMe (UbiComp’14)
- Fogarty et al (TOCHI’05)

Interruptibility
A typical intervention cycle

1. Condition match
2. Notification
3. User compliance
Emu task

```java
Task taskBP = TaskBuilder.create()
    .repeat('every day')
    .when('walking for 1 hours or running for 15 minutes')
    .then('nearBPMachine within 1 hours')
    .notify('Measure blood pressure', PRIORITY_MEDIUM, 'snooze 2 times', 'every 15 mins')
    .launch(bpActivity)
    .report(bpCallBack, 'timeout 2 hours')
    .startTask(BP_TASK_ID);
```
Complex contextual event

**Scenario 1:**
- Conjunctions,
- disjunctions, or mixed

```java
Scenario 1: TaskBuilder.when(
    "walking for 1 hour
    or running for 15 minutes");
```

**Scenario 2:**
- Sequential conditions

```java
Scenario 2: TaskBuilder
    .when("running for 15 minutes")
    .then("measuringBloodPressure
    within 1 hour");
```
Notification preference

TaskBuilder.notify(
    "Measure blood pressure", // content
    PRIORITY_MEDIUM, // priority
    "snooze 2 times", // number of snoozes
    "every 15 minutes" // snooze gap
);

Notification configuration + User preference* = Deliver time & style

*PrefMiner: mining user’s preferences for intelligent mobile notification management, UbiComp’16
System architecture

Push-based context inference
System architecture

- Presentation Manager
- User Preference Manager
- Event Database
- Query Parser
- Task Manager
- Sensing Module

- History of task status
- Context-based notifications
Evaluation results

- **Android framework**: 82 lines of codes
- **Emu**: 20 lines of codes

75% less lines of codes

**at least 22 studies can benefit from Emu in our survey**
Thanks for listening

• *Increasing user engagement is important but hard*

• *EMU is designed to alleviate developer’s burden*

• *We propose a language and the architecture to address these challenges*

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