



LIVELABS

SINGAPORE MANAGEMENT UNIVERSITY

Using Mobile Technology to Improve Educational Space Usage and Student Engagement

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What Is LiveLabs?

Government funded test-bed focus on mobile computing technologies

Organization can run large scale experiments in a REAL environments and on REAL people

Focus on developing and testing context-aware mobile applications & services

Smartphones / Wearables & Context



GOAL: CREATE NEW TECHNOLOGIES, SERVICES & APPLICATIONS TO LEVERAGE UPON SUCH PHYSICAL-WORLD CONTEXT

Affective Context

This section displays two screenshots of applications related to affective context. The left screenshot shows a 'Mood History' interface with a 'Month Selector' set to January 2012, a 'Daily Mood Average' chart, and a 'Single Day Mood History' view. The right screenshot shows a 'Social Graph' interface with a network diagram of people, a 'Conversation' summary, and a 'Social Graph' visualization.

Semantic Context

This section illustrates semantic context with three images. The first image shows a person mowing a lawn, representing a specific activity. The second image shows a group of business professionals in a meeting, representing a social context. The third image shows a person walking through a shopping mall, representing a location-based context.

Micro-Activity Context

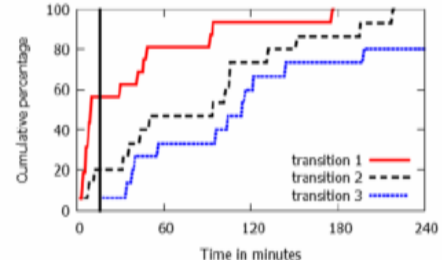
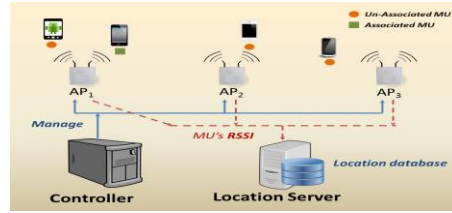
This section illustrates micro-activity context with three images. The first image shows a silhouette of a person in a running pose. The second image shows a silhouette of a person in a different running pose. The third image shows a person walking up a set of stairs, representing a specific movement or activity.

LiveLabs: Mobile/Wearable/IoT Analytics Tech



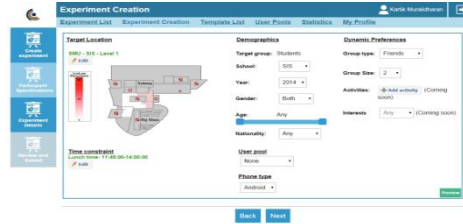
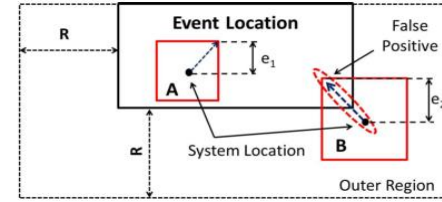
Indoor Location

- ❖ Wi-Fi based server side location
- ❖ Energy-efficient; +6 meter accuracy



Group/Queuing Detection

- ❖ Dense, Indoor Urban Spaces
- ❖ Location (Wi-Fi)+ Movement (Sensors)
- ❖ Estimate Queue Wait/Service Times



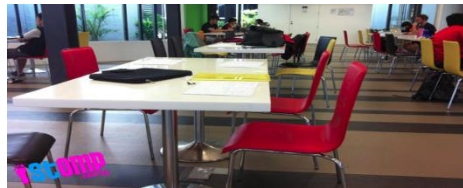
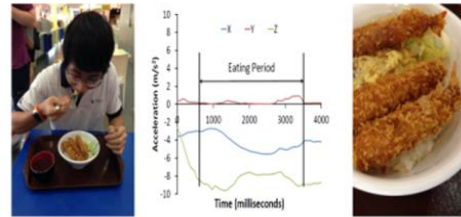
Behavioral Experimentation

- ❖ Location/context impact on consumers
- ❖ Targeted promotions, surveys, events



Wearable Analytics

- ❖ Eating detection and diet monitoring
- ❖ In-store and in-mall shopper activity
- ❖ Emotions and affective responses



IoT+ Human Analytics

- ❖ Cheap sensing for occupancy detection
- ❖ Operational optimization of BLE beacons



Problem: Analysing Space Usage Across Campus

1. Are my study spaces being effectively used?

- Do we need more?
- Are 24 hour spaces needed?

2. Is there a right mix of work / life spaces?

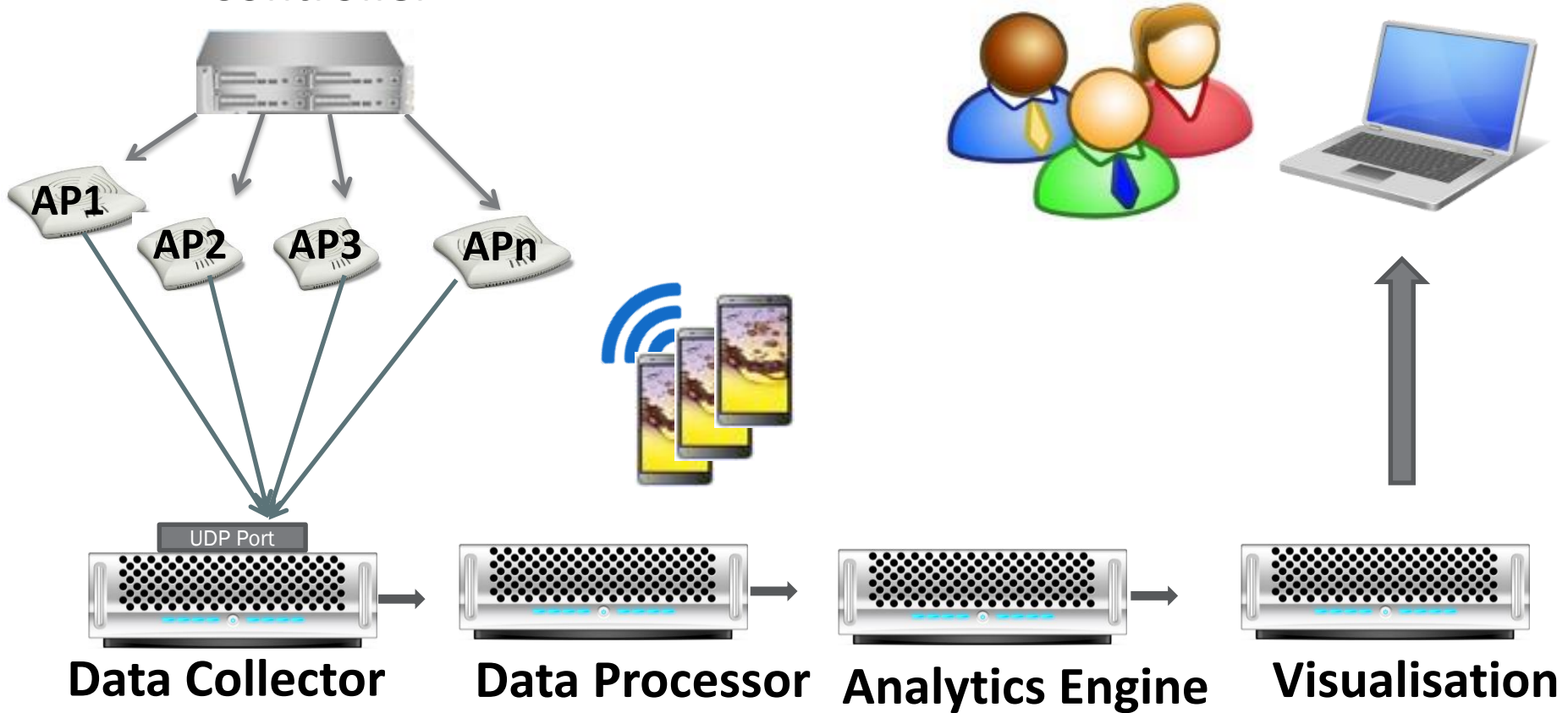
- What is the usage of shared / dedicated spaces?

3. How do we increase safety on campus?

- Avoid areas that have nobody in them

Solution: LiveLabs Location Analytics System

RTLS Enabled Controller



Who Uses Us?



SMU Campus



UMASS Amherst



Republic Poly



**Suntec Convention
Centre**



National Museum

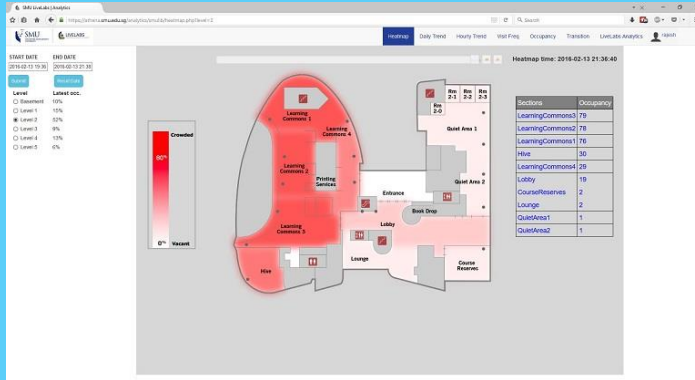


Sentosa Island

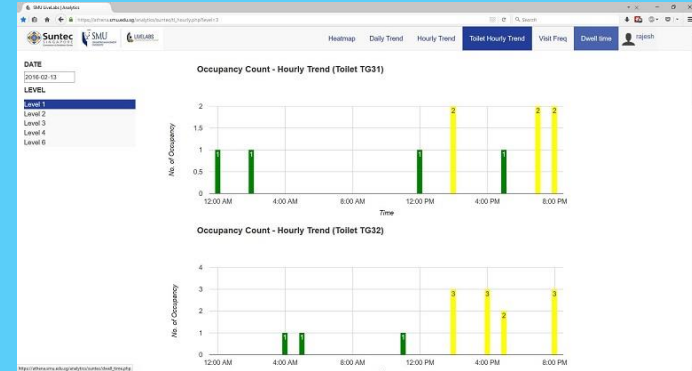


Singapore Expo

Demos of Real Deployments



Heatmaps of SMU



Toilet Usage at Suntec

Group summary

Group size	Beech Station	Imbiah Lookout	Port Of Lost Wonder	Mount Faber Leisure Group	HabourFront	Total
2	181	160	150	82	38	611
3	99	97	98	55	43	392
4	53	87	58	45	36	279
5	33	69	38	47	24	211
6	22	50	22	30	10	134
7	15	33	23	16	7	94
8	13	21	8	9	3	54
9	7	13	7	12	0	39
10+	33	18	16	32	0	99
Total	456	548	420	328	161	1752

Sentosa Analytic Portal
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Visitor Counts at Sentosa

To review a list of promotions created

Image	Merchant name	Title	Description	Terms & Conditions
	30% off Islander Family Membership	30% off Islander Family Membership (U.P \$50)	Enjoy UNLIMITED admissions to the State of Fun and enjoy a host of fabulous privileges and much more! There is never a dull moment when you are on an island!	1) Not valid with other offers/promotions, discount vouchers, membership privileges, unless otherwise stated. 2) Guest to present MySentosa Mobile App with valid coupon for redemption. 3) Last redemption on 31 Dec 2015. 4) Other T&Cs apply.
	The Coffee Bean & Tea Leaf®	1-for-1 Iced Tea/Coffee	Beat the heat by enjoying a refreshing Iced Tea/Coffee!	1) Not valid with other offers/promotions, discount vouchers, membership privileges, unless otherwise stated. 2) Valid during promotional/redemption period only. 3) Guest to present MySentosa Mobile App with valid coupon for redemption. 4) Last redemption on 31 December 2015.
	Merlion Cafe	FREE Kaya Toast & Drink Set (Merlion Cafe)	Local Drink (choose ONE from): 1) Bandung 2) Grass Jelly 3) Coffee Tea	1) Not valid with other offers/promotions, discount vouchers, membership privileges, unless otherwise stated. 2) Valid during promotional/redemption period only. 3) Guest to present MySentosa Mobile App with valid coupon for redemption. 4) Daily redemption until 7:00pm, limited to 30 redemptions per day at Merlion Cafe. 5) Last redemptions on 31st December 2015.
	Wave House Sentosa	\$55++ Combo: 1 Hour FlowRider and Burger/Pizza	Combo includes: 1) Buggy Ride from Beech Station 2) One hour FlowRider® 3) Choose between 1 Famous Handmade	1) Not valid with other offers/promotions, discount vouchers, membership privileges, unless otherwise stated. 2) Valid during promotional/redemption period only. 3) Guest to present MySentosa Mobile App with

Marketing Trials at Sentosa

Problem: Finding Free Seats in Library / Cafeteria

1. Free seats are hard to find in these places

- Especially at peak hours (noon or exam period)
- Seat hogging is also an issue

2. Scale requires a cheap easy to deploy solution

- Hundreds / thousands of seats and tables

3. Should be accurate and privacy preserving

- Need precise “spot” level accuracy
- No cameras except for initial testing

Solution: Capacitive Sensing

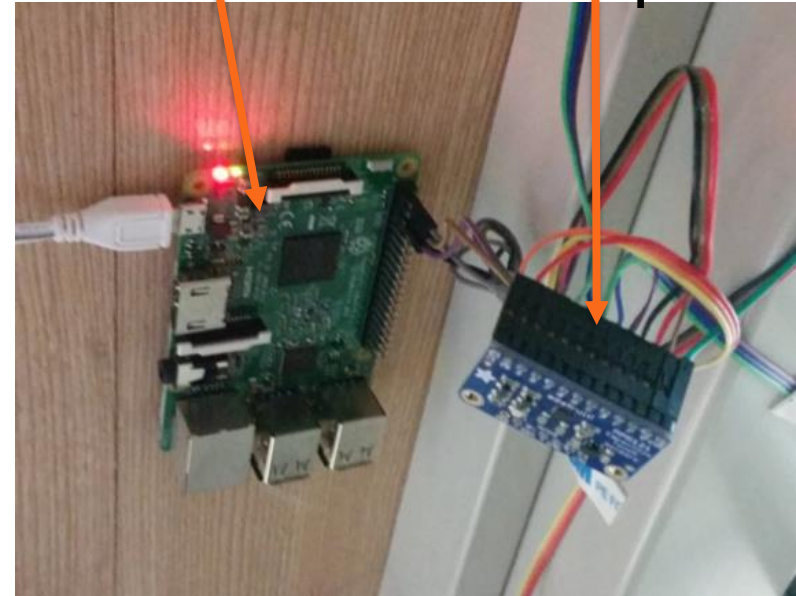
Wire

Aluminum foil



Raspberry Pi

Capacitive Chip



SMU Library Deployment & Visualisation



Colors indicate state of seat

Problem: Engaging Effectively With Students

1. Communication channels for students & faculty

- Web-based e-learning tools exist. Not that effective
- Need a mobile solution to engage effectively
- Class forums and messaging in an easy mobile manner

2. Provide social and university events & signups

- Make it trivial to find and attend events of all kinds

3. Create a shared campus community online

- Gamification, forums, messages, etc.

Solution: EVA Live (native Android & iOS)

1. Improve class communication

- Class List & Forums, General Forums
- Class Polling & Attendance (soon)

2. Manage Calendar Events

- Class, CCA , & Talk Events

3. Resource Booking

4. Gamification to make App fun & interactive

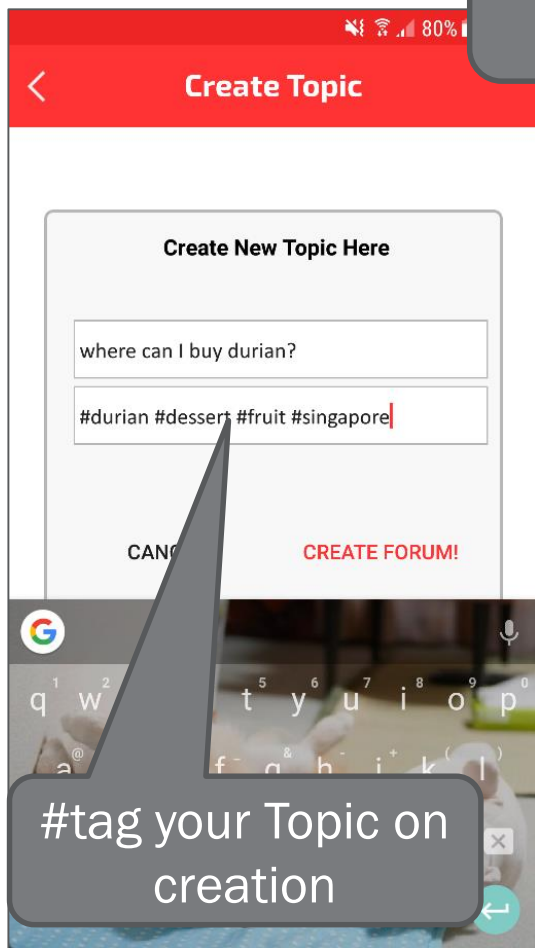
- Trivia, Photo Comp, Scavenger Hunt, & Leaderboard

5. Web Portal

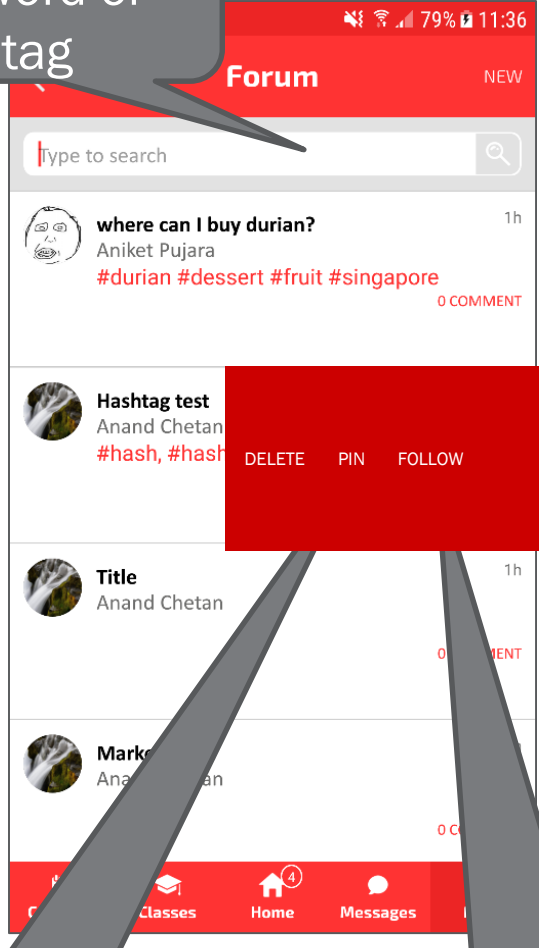
- Class & General Forums, Poll Creation & Results
- Attendance Mgmt, & Analytical Reports (soon)



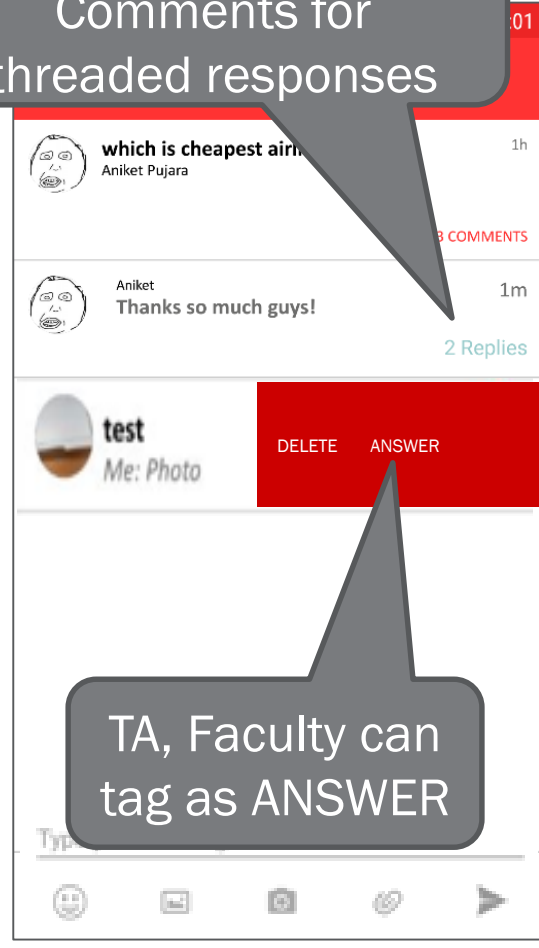
EVA Live : Forum Example



Search by Keyword or #tag



Tap to see Replies to Comments for threaded responses



Faculty PINs an important Topic/Question

Student Follows

Takeup Rate: EVA Live

- 1. Used successfully for 3 undergrad core modules**
 - 500+ students
 - Larger deployment planned from next sem onwards
- 2. Downloaded by more than 4,000 students**
 - Over the last 3 years
- 3. Has been modified into a conference app**
 - Used by top-tier ACM SIGMOBILE conferences
 - MobiSys 2016, 2017, HotMobile 2017, 2018, MobiCom 2016, 2017
 - Official licensed app of the 2017 Singapore Fintech Festival
 - 15,000+ attendees

Summary

- Many different uses of mobile tech for campus use
- Improve campus space usage
 - Mobile apps to effectively engage with students
 - Identify free tables / chairs on campus
 - Crowd tasking to improve the campus (*)
 - Detect stress in students in a scalable way (*)
 - Emotion recognition to improve e-learning (*)

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