



Programming with Android: Module Overview



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General Course Considerations

- Preliminary considerations: YES, slides in ENGLISH!
- Dynamic course, with problems due to ongoing adaptation process
 - Lots of the credits for the Android material go to proff. Luca Bedogni and Marco Di Felice
 - People, support, devices and labs, material, numbers...
- Motivations for the course (...you know why you are here, but...)
 - Enabling expression of potential for students towards apps world and projects
 - Activating bindings with research themes: Social, Privacy, M2M
 - Both Android AND iOS! Highly required both in the market (75% vs 25% share)
 - The classes distribution will be 70% ANDROID and 30% iOS to cope with projects potential
 - Need your help to make it evolve into something better year by year
 - Be patient, be constructive, be ambitious



General Course Considerations

- This year schedule
 - Monday 12-14 (iOS)
 - Tuesday 12-14 (Android)
 - Thursday 12-14 (Android)
- Always check for last minute changes (news on VIRTUALE, explained later).
- Old material for slides and code on <http://www.cs.unibo.it/projects/android/2020/>



Android ... **Why?**

GOALS OF THE MODULE:



- Introduce the Android architecture
- Implement Android applications
- Think in *Android terms*



Android ... Why?

App Store Growth Throughout The Years

iOS App Store + Google Play • Worldwide

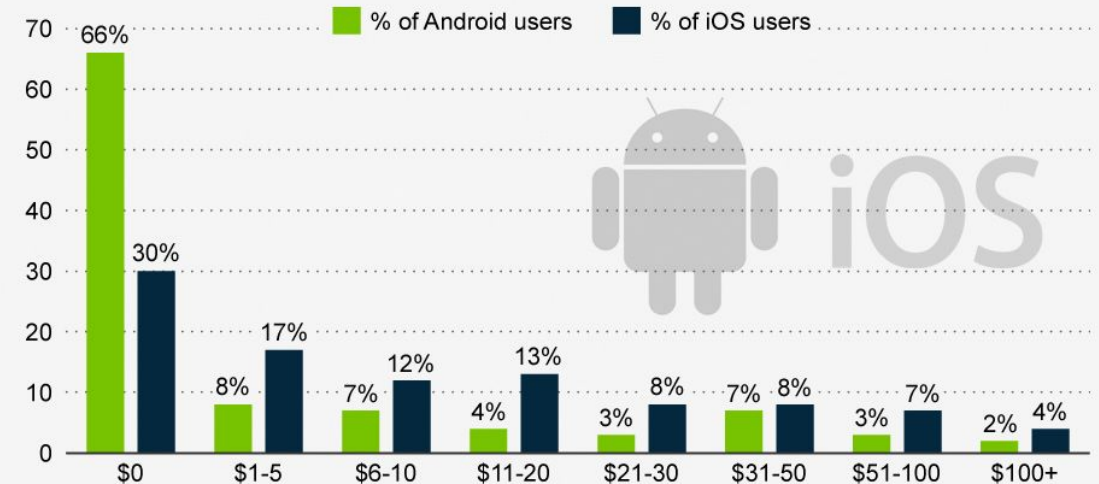


appfigures insights

Mobile Trends for 2018

Two Thirds of Android Users Don't Pay for Apps

Amount of money spend on smartphone apps in the last year



Base: 509 Android owners and 387 iOS owners

statista The Statistics Portal



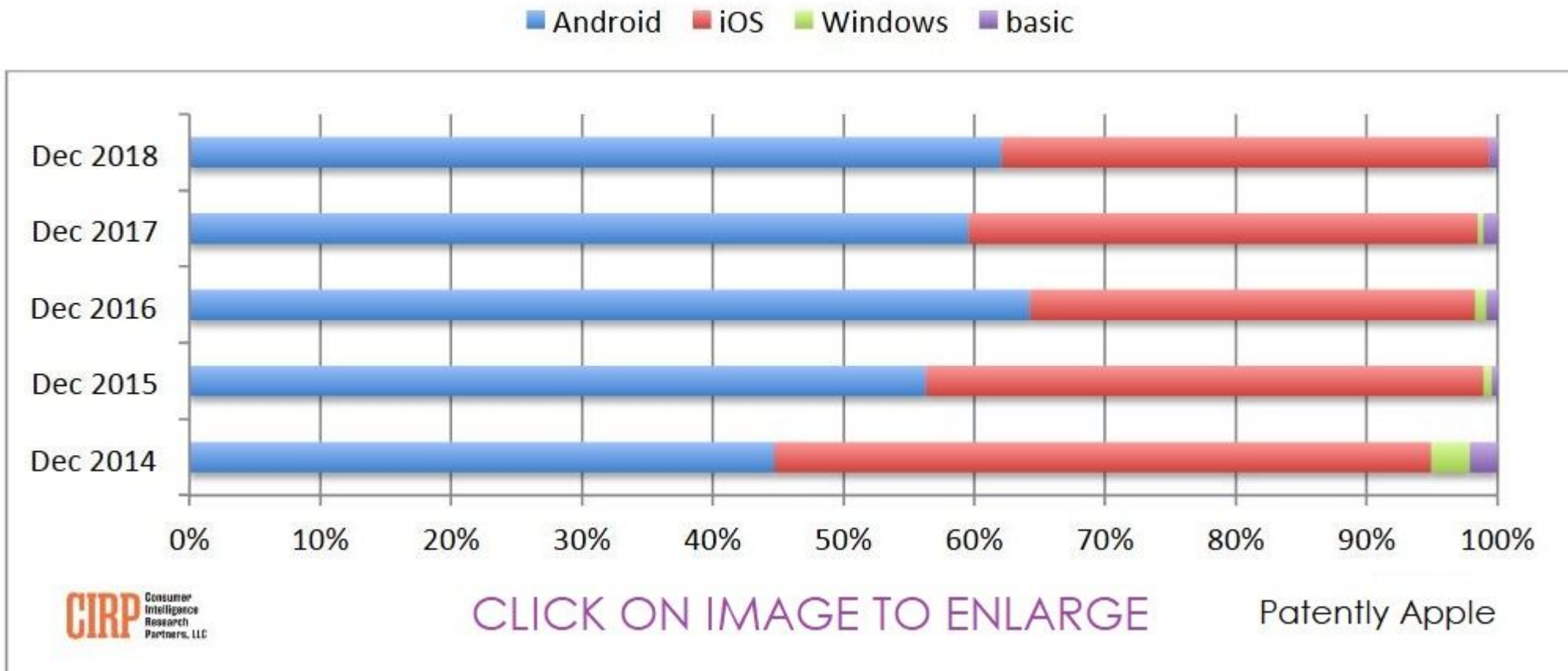
Source: Online Publishers Association

Source: <https://www.macrumors.com/2018/04/04/app-store-apps-shrank-in-2017/>



Android ... Why?

Chart 1: Operating System Share of Mobile Phone Activations

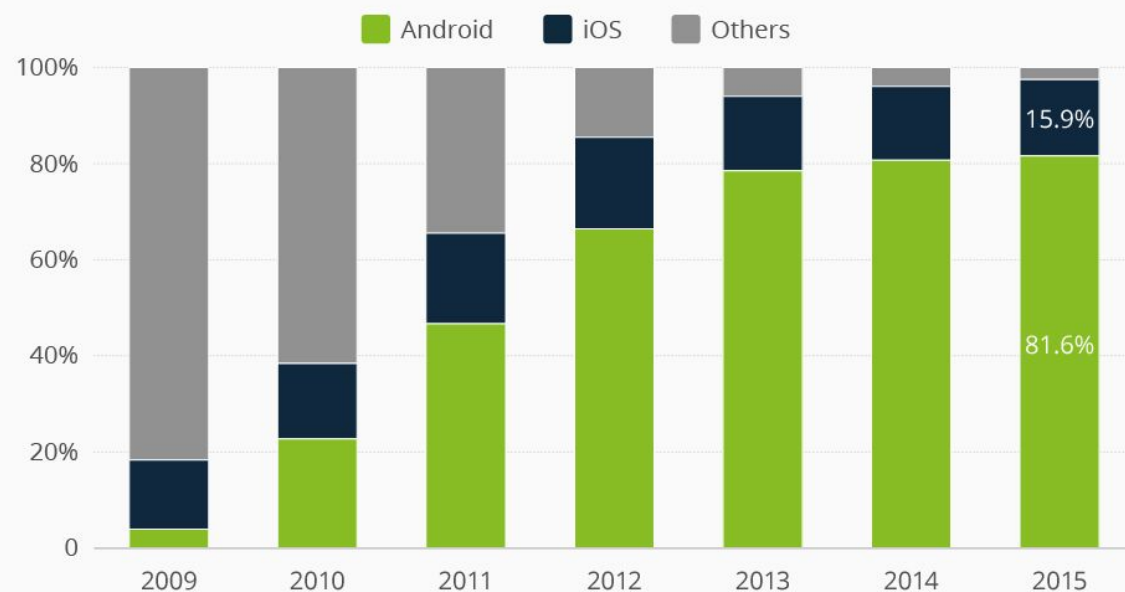




Android ... Why?

Android and iOS Are the Last Two Standing

Worldwide smartphone operating system market share (based on unit sales)

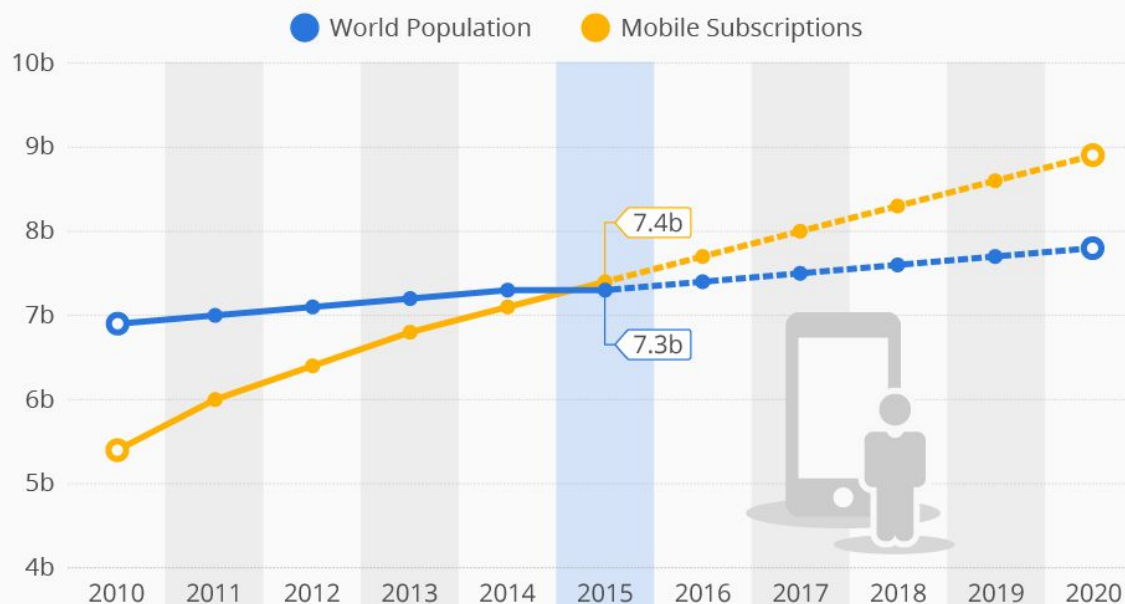


@StatistaCharts Source: Gartner

statista

Mobile Subscriptions to Outnumber the World's Population

World population vs. estimated number of worldwide mobile subscriptions



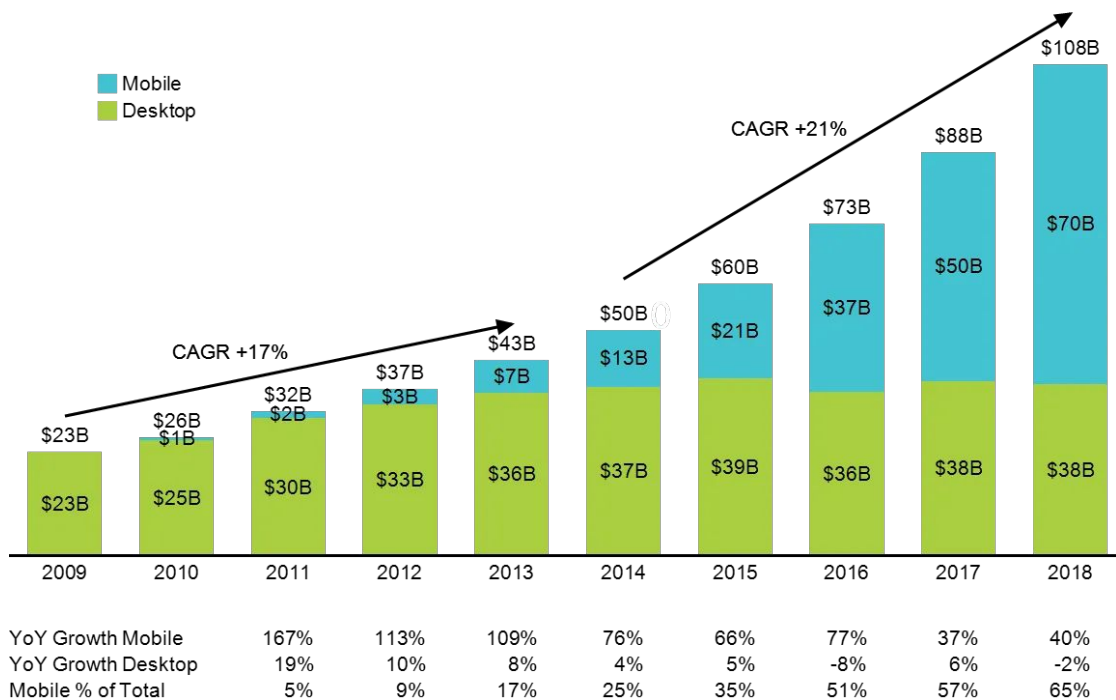
@StatistaCharts Sources: Ericsson, United Nations

statista



Android ... Why?

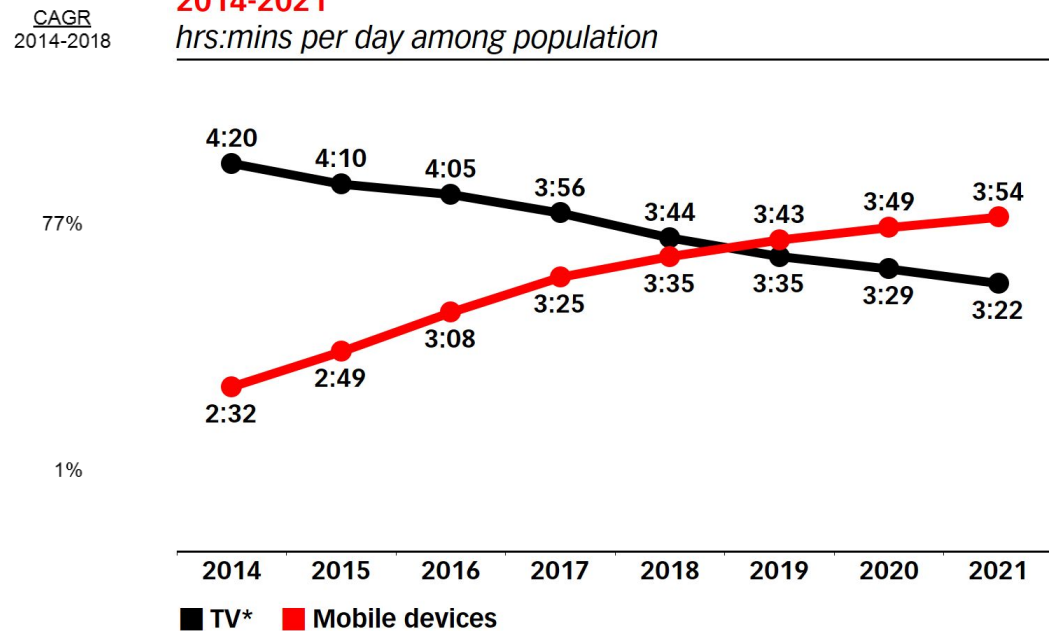
MOBILE INTERNET USERS WORLDWIDE



MOBILE DEVICE DIVERSIFICATION

TV and Mobile Devices: Average Time Spent in the US, 2014-2021

hrs:mins per day among population



Note: ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking; for example, 1 hour of multitasking on desktop/laptop while watching TV is counted as 1 hour for TV and 1 hour for desktop/laptop; *excludes digital

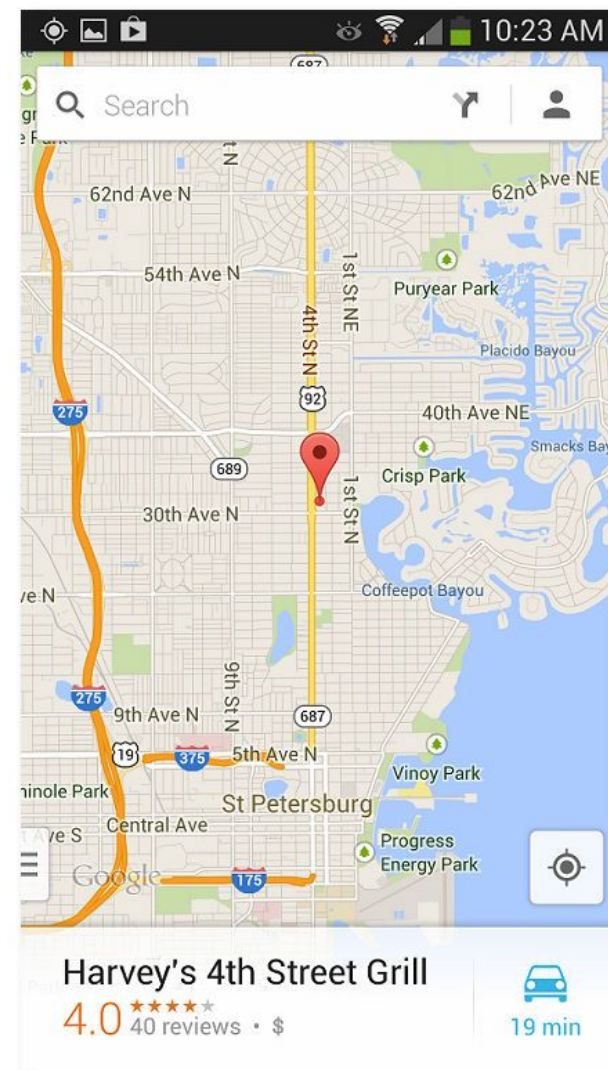
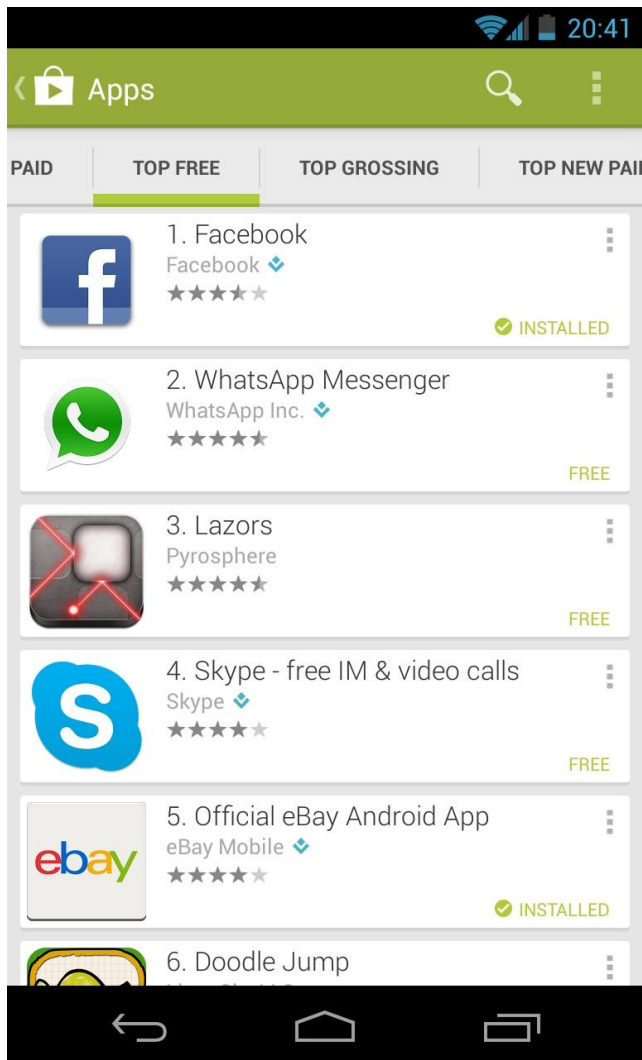
Source: eMarketer, April 2019

T10195

www.eMarketer.com

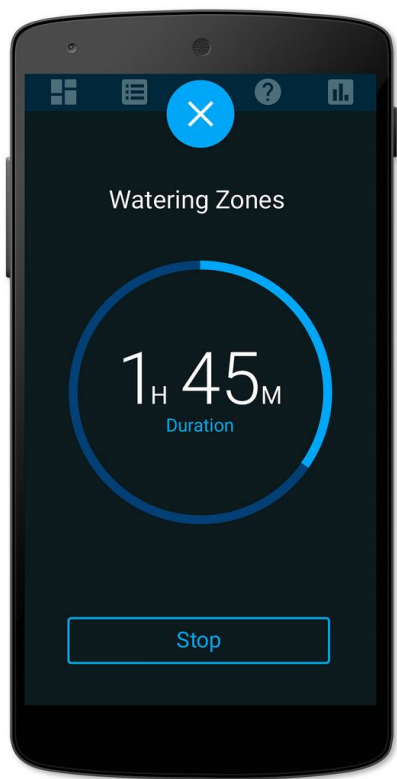
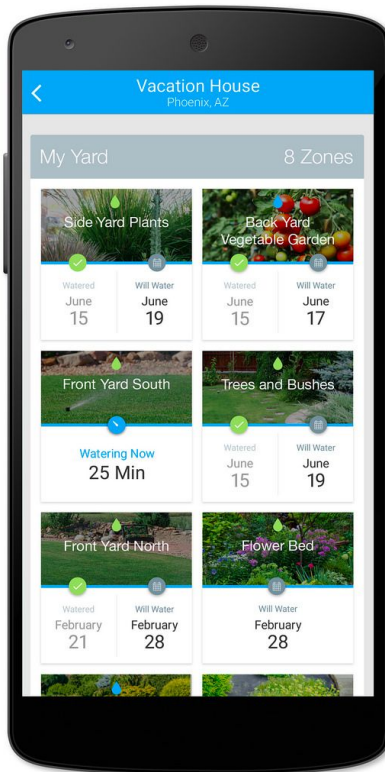
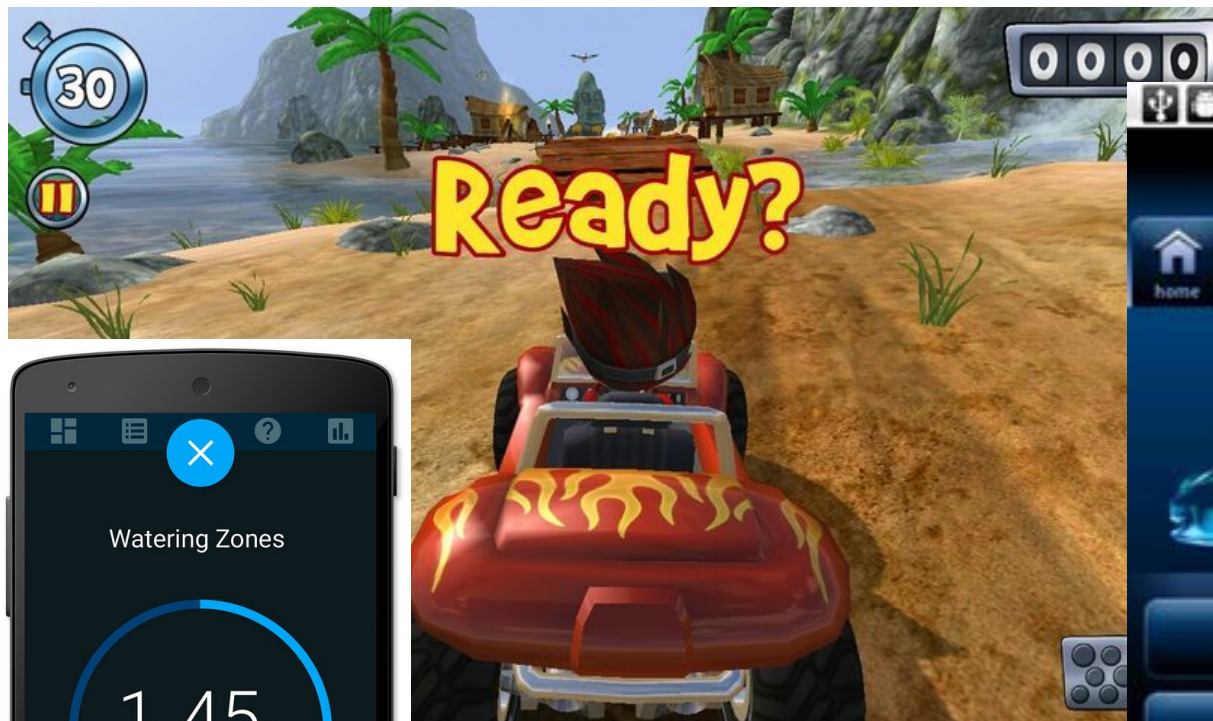


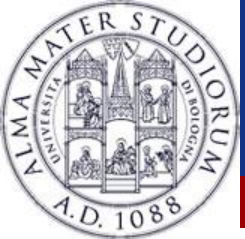
Android: Some Examples ...





Android: Some Examples ...

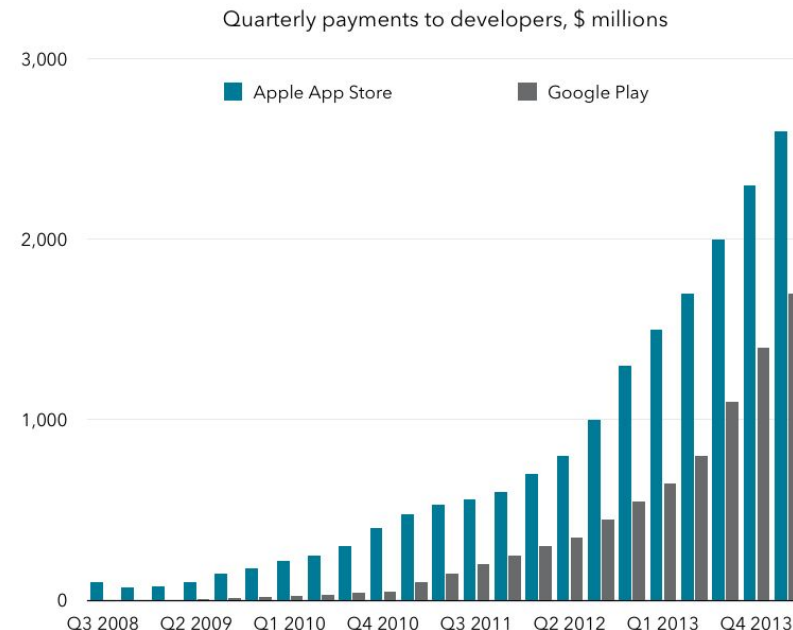




Android: where is the business?

App: più popolari a pagamento

 1. Minecraft Mojang ★★★★★ 6,99 €	 2. Geometry Dash RobTop Games ★★★★★ 1,99 €	 3. IPTV Extreme Pro Paolo Turatti ★★★★★ 1,19 €	 4. F1 2016 Codemasters Software ★★★★★ 2,29 €	 5. Hitman Sniper SQUARE ENIX Ltd ★★★★★ 80% OFF 0,99 €	 6. Football Manager SEGA ★★★★★ 7,49 €
 7. Scribblenauts Re-imagined Warner Bros. Internatio ★★★★★ 0,74 €	 8. Costruisci con SpongeBob Nickelodeon ★★★★★ 0,10 €	 9. 60 Seconds! Atomic Adventure Robot Gentleman ★★★★★ 4,09 €	 10. Nova Launcher Prime TeslaCoil Software ★★★★★ 4,50 €	 11. WeCroak KKIT Creations ★★★★★ 0,99 €	 12. Torque Pro (OBD2 Scanner) Ian Hawkins ★★★★★ 3,55 €



Source: Google, Apple, Jackdaw Research estimates

- **RATIONALE: Focus on amount of applications sold, not on price of single applications ...**
- **How to forget ADs ...**

	Google	Apple	Microsoft
Number of users (in millions)	900	600	12
Number of apps (in thousands)	800	1250	160
Number of developers (in thousands)	150	235	45
Number of downloads (in billions)	48	50	.65
Paid to developers (in millions)	900	5000	100



Android: versions

2008
API 1



Apple Pie 1.0

2009
API 3



Cupcake 1.5

2009
API 4



Donut 1.6

2009
API 5



Eclair 2.0/ 2.1

2010
API 8



Froyo 2.2

2010
API 9



Gingerbread 2.3.x

2011
API 11



Honeycomb 3.x



Ice Cream Sandwich 4.0.x



Jelly Bean 4.1/4.2/4.3



KitKat 4.4



Lollipop 5.0



Marshmallow 6.0



Nougat 7.0



Oreo 8.0



Pie 9.0

2011
API 14

2012
API 16

2013
API 19

2014
API 21

2015
API 23

2015
API 24

2017
API 26

2018
API 28

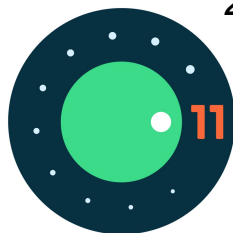
2019 - API 29



Initially "Android Q"

No more desserts...

2020 - API 30



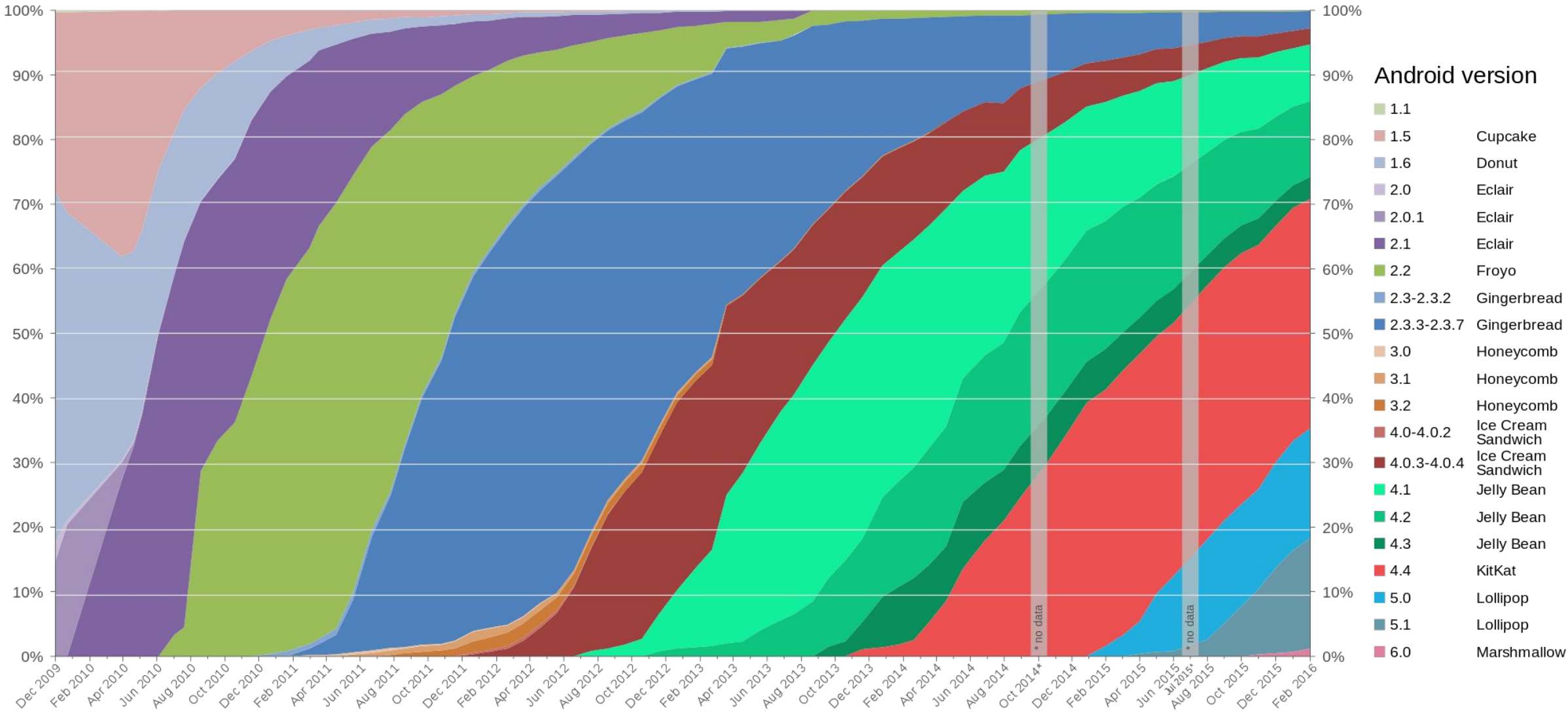
2021 - API 31
2022 - API 32



2023 - API 33
Tiramisu



Android: versions





Android ... **How?**



1. The Android **Project**
2. Android **Architecture** and **Components**
3. Android Component: **Activities**
4. Android Component: **Intents**
5. Android **Resources** System
6. Android **Layout**: View and ViewGroups
7. Android **Event** Management Systems
8. Android **Data** Management
9. Android **Navigation**



Android ... **How?**



10. Android **Network** Management System
11. Android and Google **Maps**
12. Android **ViewModel** and design patterns
13. Android **System** Services
14. Something about **Kotlin**
15. Something about **hybrid frameworks**



Android ... How?



Textbook

Android: Guida per lo sviluppatore

Author

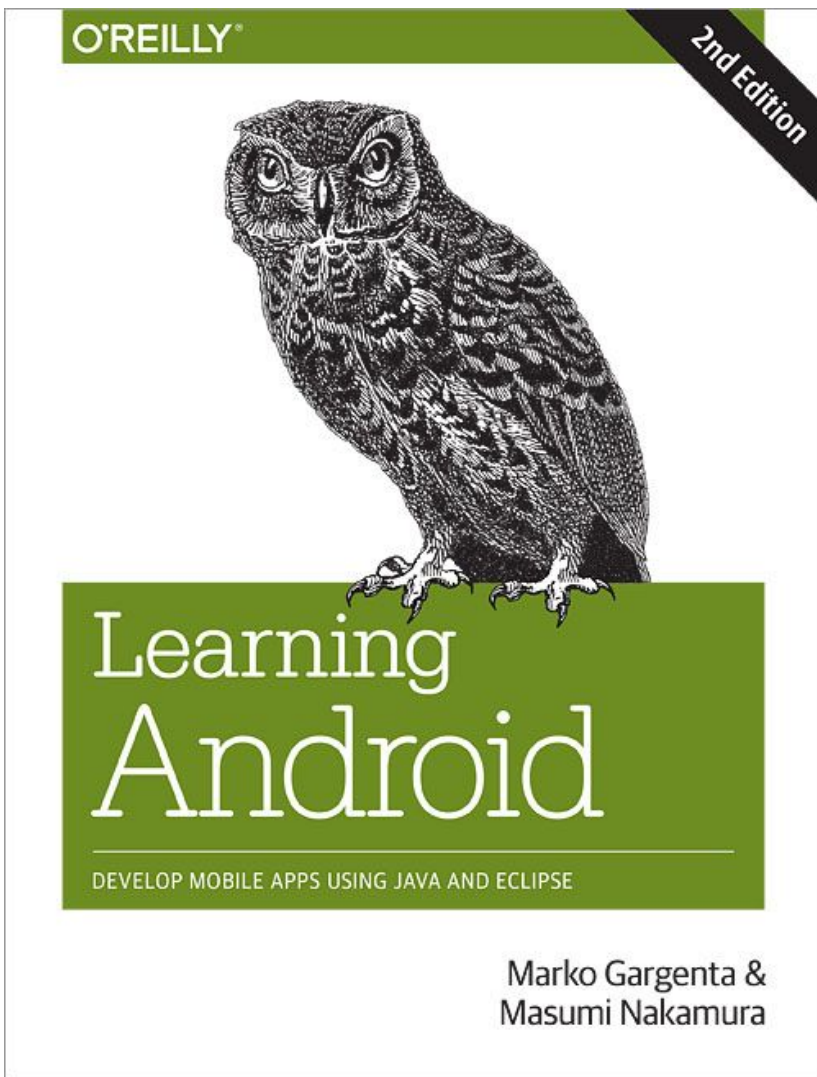
Massimo Carli

Other resources:

- Slides
- Online Tutorials
- Newsgroups



Android ... **How?**



Textbook

Learning Android (O'Reilly)
(outdated but a good reference...)

Author

Marko Gargenta & Masumi Nakamura

Other resources:

- Slides
- Online Tutorials
- Newsgroups



Android ... **How?**

PRE-REQUISITES:

□ Object-Oriented Programming

We will use **Java** for Android applications coding.

(other languages are used: Kotlin, Lua, Clojure, Kivy ...)

This year we will also look into Kotlin!

□ XML Essentials

(We will mix ***declarative*** and ***programmatic*** approaches, just like Web applications do)



Android ... **How?**



Why Java?

It's been the official language for years and most supported until last year.

As for now, it's not the most used, Kotlin took over last year, however since we know Java we can focus on the Mobile Architecture.



Exam: Project and Oral Exam

- Exam is made of two parts: project and oral.
- Project can be delivered over the year in 6 deadlines: June, July, September, November, January, February.
- Can either follow the specification of the proposed project or propose your own, either way it's **individual** or, at most, for groups of **two**.
 - In the case of your own proposed project, obtaining a confirmation from me or the tutor is **compulsory**.
- The course is not valid for a certification (too short)
- Mixing thesis, project and/or internship (tirocinio)? **Talk to me first.** (see <http://iot-prism-lab.nws.cs.unibo.it/proposals/>)
- Want to develop in iOS, Angular, Flutter, React Native (etc. etc.)? Specifications are the same.



Exam: Project and Oral Exam (cont'd)

- Exam is made of two parts: project and oral.
- The physical exam has to be booked by the student through AlmaEsami (dates will be announced in advance).
- The oral is on both parts, therefore, do not prepare only the parts concerning your project as theoretical background is demanded.



Android ... **Contacts**

WEBSITE

<https://www.unibo.it/it/didattica/insegnamenti/insegnamento/2022/367016>

General info about the course

federico.montori2@unibo.it

for meetings (always **upon appointment**), questions, thesis

luca.sciullo@unibo.it

for questions about the projects



Android ... **Virtuale**

WEBSITE

□ Register at:

□ <https://virtuale.unibo.it/>

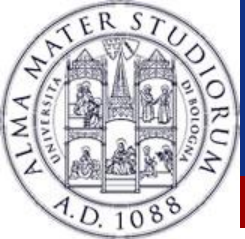
□ Class URL

□ <https://virtuale.unibo.it/course/view.php?id=38406>

□ Registration

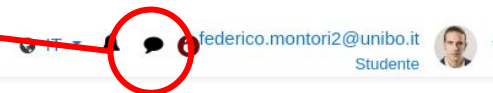
□ Should be active automatically for your study plan

□ if not, register spontaneously using the pwd: **lamlamlam**



Android ... Virtuale

Wanna send me a message/e-mail about the course?



- Virtuale
- Laboratorio di Applicazioni Mobili
- Partecipanti
- Badge
- Valutazioni
- Sezioni
- Introduzione
- Introduzione al Corso
- [Android] SDK Install
- [Android] System Architecture
- [Android] Resources
- [Android] Activities & Fragments
- [Android] Intents
- iOS Programming in Swift
- [ANDROID] View
- [ANDROID] Kotlin
- [ANDROID] Background Operation



ALMA MATER STUDIORUM - UNIVERSITÀ DI BOLOGNA
VIRTUAL LEARNING ENVIRONMENT

Laboratorio di Applicazioni Mobili

DASHBOARD / I MIEI CORSI / LABORATORIO DI APPLICAZIONI MOBILI

General Description

All the news and the PROJECT DEADLINES

Il tuo stato di avanzamento

Annunci

Slides for each lecture, Exam sessions!

Introduzione al Corso

- Slide introduzione al corso, parte iOS
- Intro corso - Parte Android

DESCRIZIONE

Codice: 66860 - Laboratorio di Applicazioni Mobili
Corso: Informatica Per Il Management
Campus: Bologna
Codice: 66860 - Laboratorio di Applicazioni Mobili
Corso: Informatica
Campus: Bologna
Anno Accademico: 2021/22
[Sito Web di Luciano Bononi](#)

PANOPTO

Questo corso non è ancora stato attivato.



Android ... Virtuale

We will use Virtuale for the project delivery. There you will find the track and a place where to deliver your project.

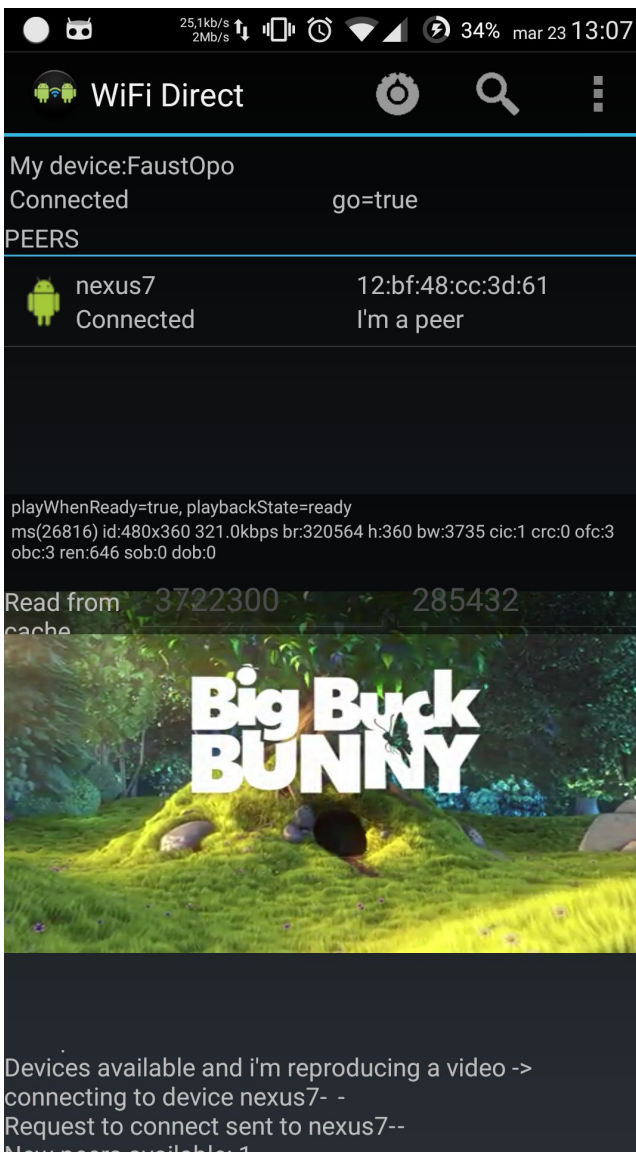
- It is not active yet for this year, this is the one from last year

The screenshot shows a course management interface. On the left is a sidebar menu with the following items: Laboratorio di Applicazioni Mobili, Partecipanti, Badge, Valutazioni, Sezioni, Introduzione, Introduzione al Corso, [Android] SDK Install, [Android] System Architecture, [Android] Resources, [Android] Activities & Fragments, [Android] Intents, and iOS Programming in Swift. The main content area is titled 'Projects' and contains a list of project items, each with an icon and a checkbox on the right:

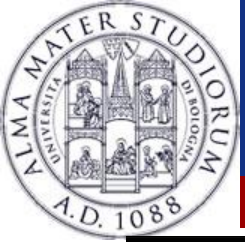
Project Name	Checkbox
Project Forum	<input type="checkbox"/>
Project Specification IMPORTANT READ CAREFULLY	<input type="checkbox"/>
Slides	<input type="checkbox"/>
Consegna Progetto Giugno	<input type="checkbox"/>
Consegna Progetto Luglio	<input type="checkbox"/>
Consegna Progetto Settembre	<input type="checkbox"/>
Consegna Progetto Novembre (BONUS)	<input type="checkbox"/>
Consegna Progetto Gennaio	<input type="checkbox"/>
Consegna Progetto Febbraio	<input type="checkbox"/>



Students Projects



Fausto Di Natale Collaborative Dynamic Adaptive Video Streaming



Students Projects

Espiel Espiel

LPS

Coordinate 44,6896
10,65217

Elevazione 56m s.l.m

Altitudine 0m

Piano Terra

Reggio Ospizio

Via Donatello

Parco gli Ippocastani

Google

Espiel Gestione Edifici

▶	Piano: 0	Calcolato: 0	11:29:08	0
	Altitudine: 0	Calcolata: 0	1010.3180	0
▮▮	Piano: 0	Calcolato: 0	11:29:09	1
	Altitudine: 0	Calcolata: 0	1010.3080	1
▮▮	Piano: 0	Calcolato: 0	11:29:10	2
	Altitudine: 0	Calcolata: 0	1010.2764	2
▮▮	Piano: 0	Calcolato: 0	11:29:11	3
	Altitudine: 0	Calcolata: 0	1010.2813	3

Fabio Franzoso

Espiel – Floor level recognition
Using atmospheric pressure

L. Bedogni, F. Franzoso, L. Bononi, “A Self-Adapting Algorithm based on Atmospheric Pressure to Localize Indoor Devices”, on Proceedings of the 2016 IEEE Global Communications Conference: Ad Hoc and Sensor Networks (Globecom 2016) December 4-8 2016, Washington DC, USA

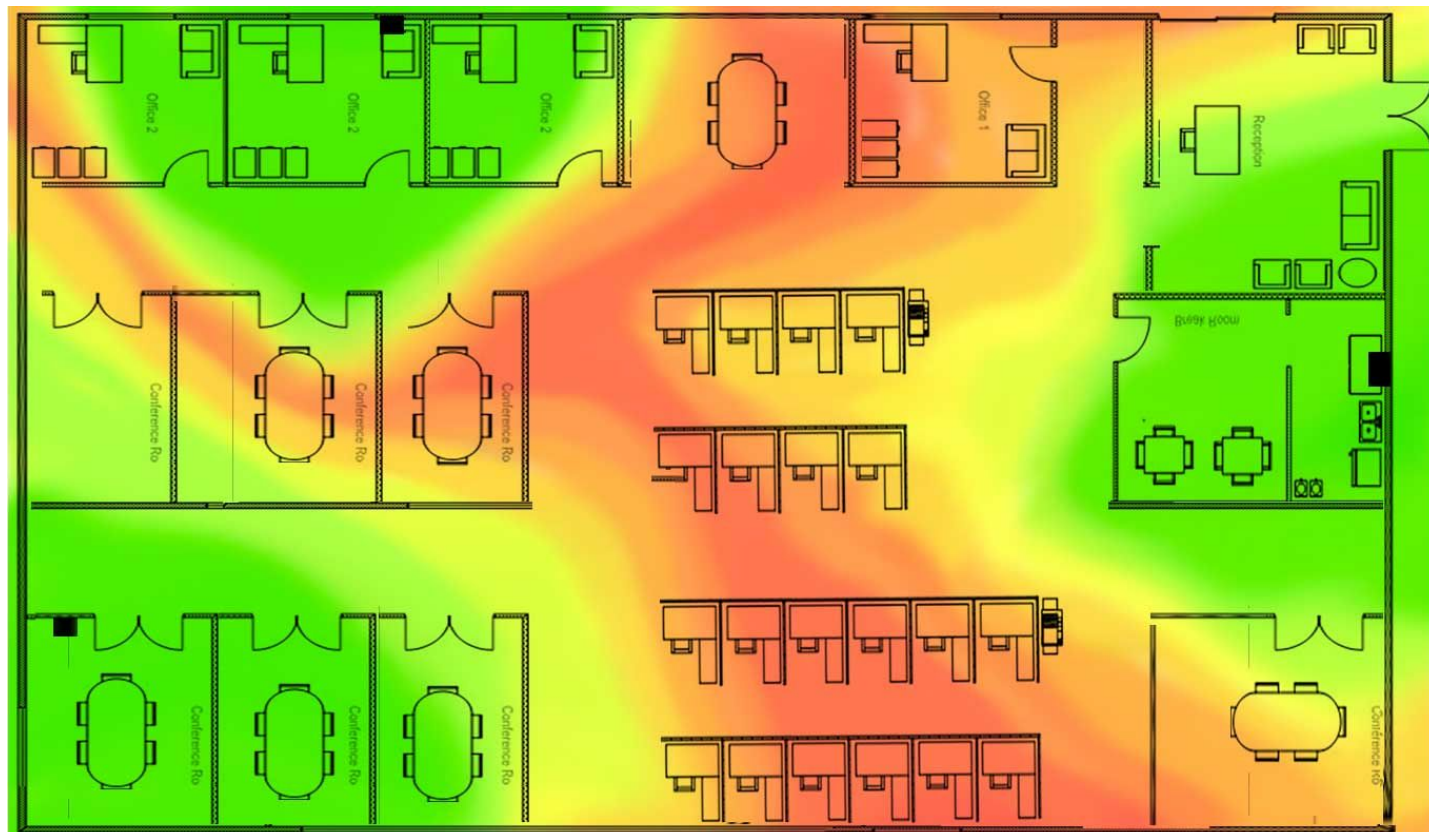


Students Projects



Erik Minarini

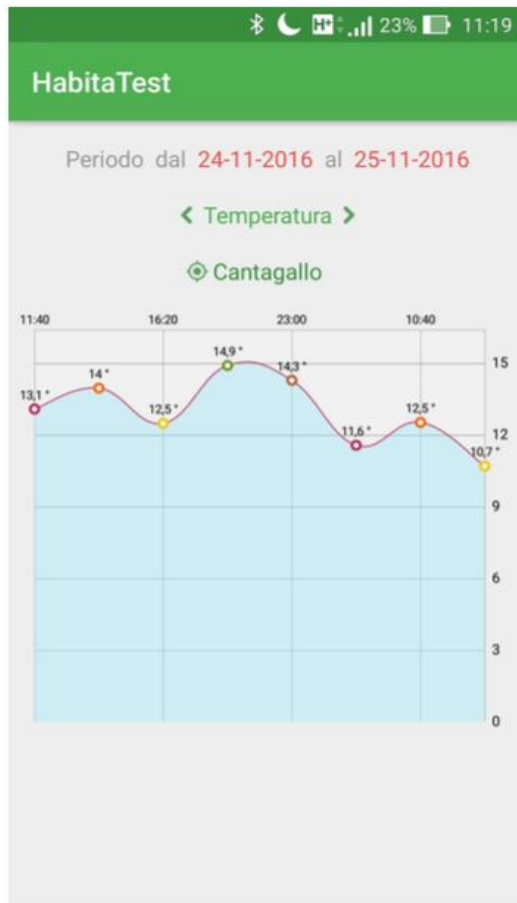
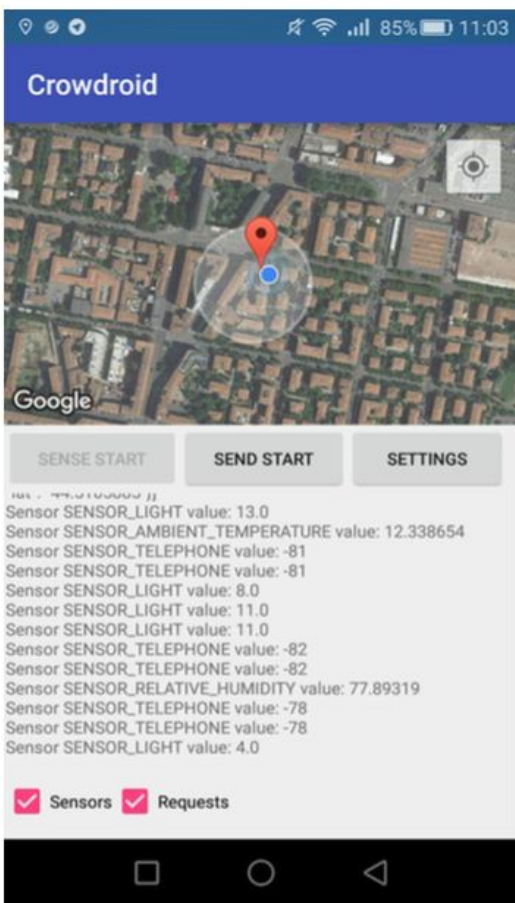
Heterogeneous indoor
Localization using WIFI
Fingerprints





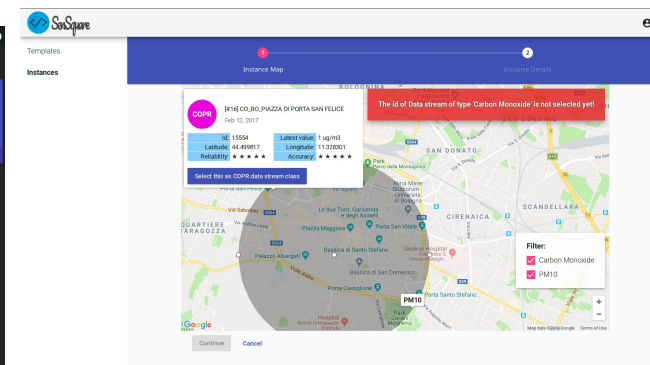
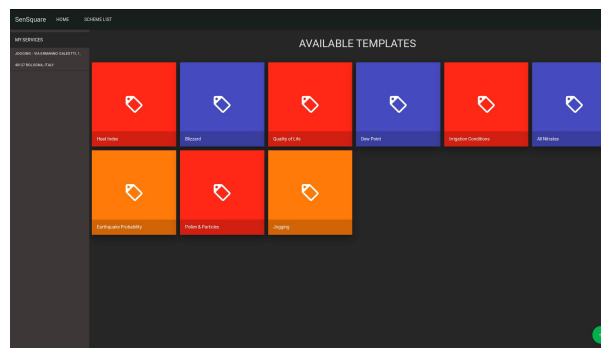
Students Projects

Alain Di Chiappari, Davide Crestini, Valentina Tosto, Gianluca Iselli Sensquare, an heterogeneous platform for the IoT



Montori, Federico; Bedogni, Luca; Iselli, Gianluca; Bononi, Luciano, Delivering IoT Smart Services through Collective Awareness, Mobile Crowdsensing and Open Data, In: 5th IEEE International Workshop on Pervasive Context-Aware Smart Cities and Intelligent Transport Systems (PerAwareCity 2020)

Montori, Federico; Bedogni, Luca; Di Chiappari, Alain; Bononi, Luciano, SenSquare: A mobile crowdsensing architecture for smart cities, in: IEEE 3rd World Forum on Internet of Things, WF-IoT, 2016, pp. 536 - 541

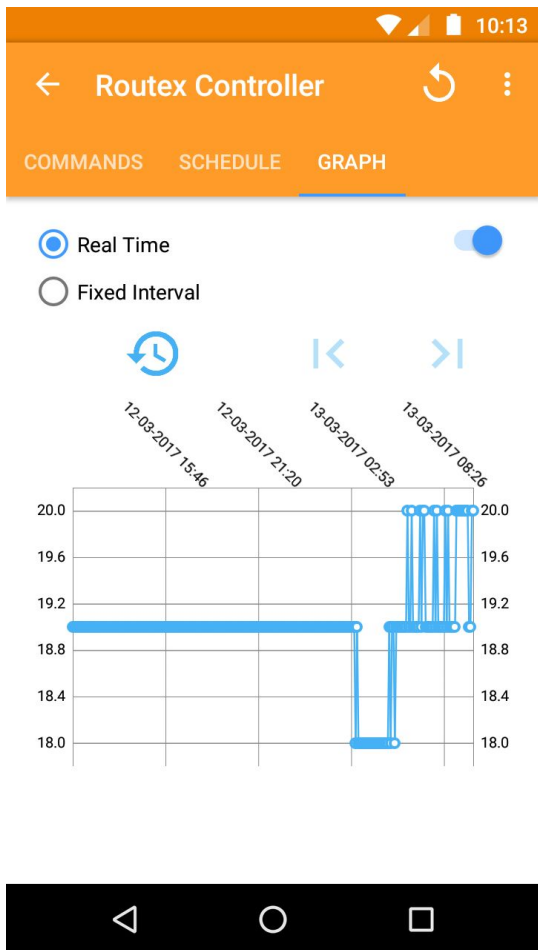




Students Projects

Filippo Morselli

Routex, a service-oriented multi-platform gateway for the IoT



The screenshot shows the 'Add schedule element' dialog. It has a 'Command' dropdown set to 'Get'. Below it is a 'Command Argument' field. There are two radio buttons: 'Frequency' (selected) and 'Time'. Under 'Frequency', there is a table for setting the schedule:

Hours	Minutes	Seconds
24	4	29
0	5	30
1	6	31

At the bottom of the dialog are 'CANCEL' and 'OK' buttons.

Montori, Federico; Bedogni, Luca; Morselli, Filippo; Bononi, Luciano, Achieving IoT Interoperability through a Service Oriented In-Home Appliance. In: Proceedings of GLOBECOM 2017.

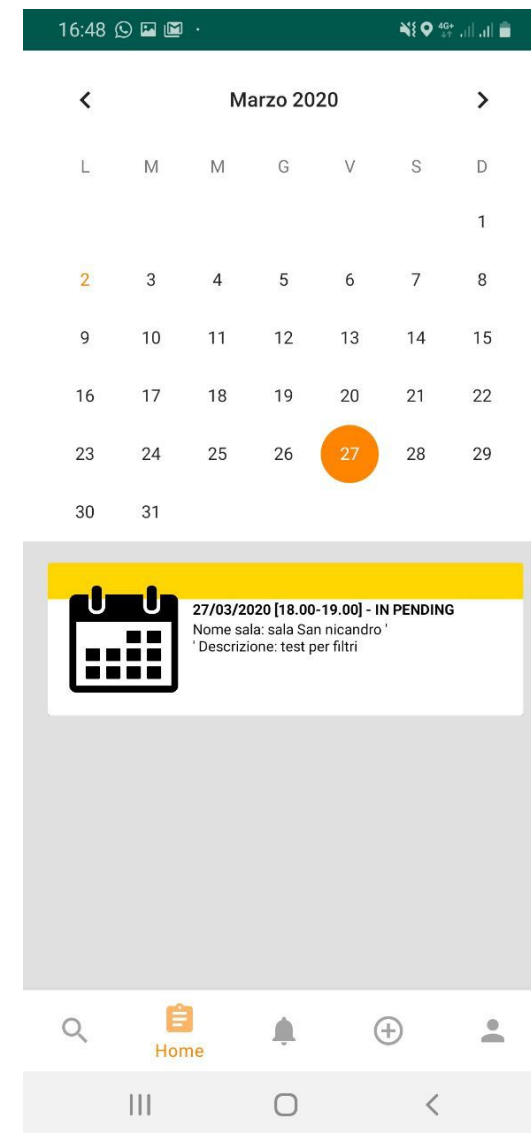
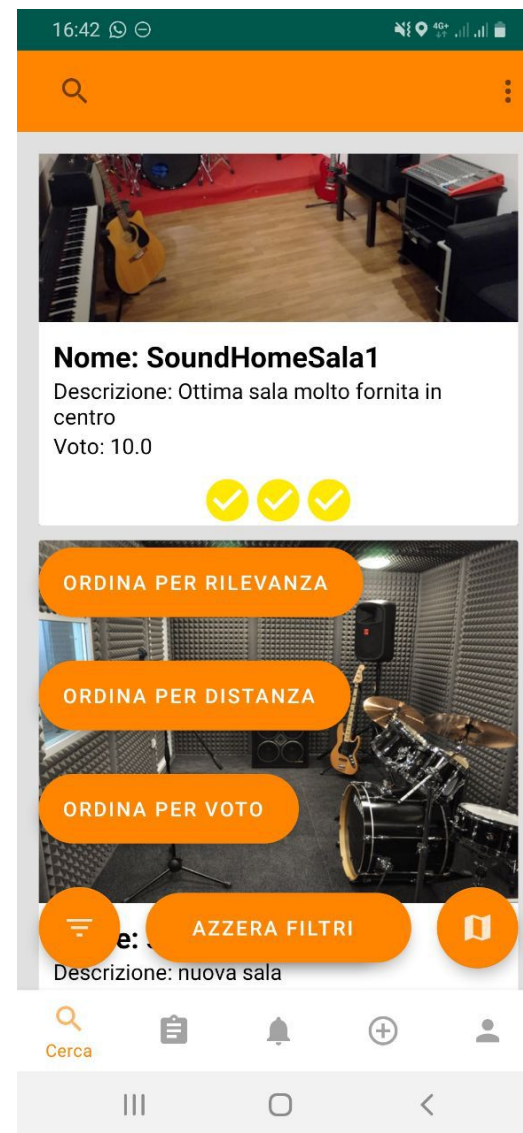




Students Projects

Matteo Tancredi

ReHo: a sharing economy app for booking rehearsal rooms and meeting other musicians.

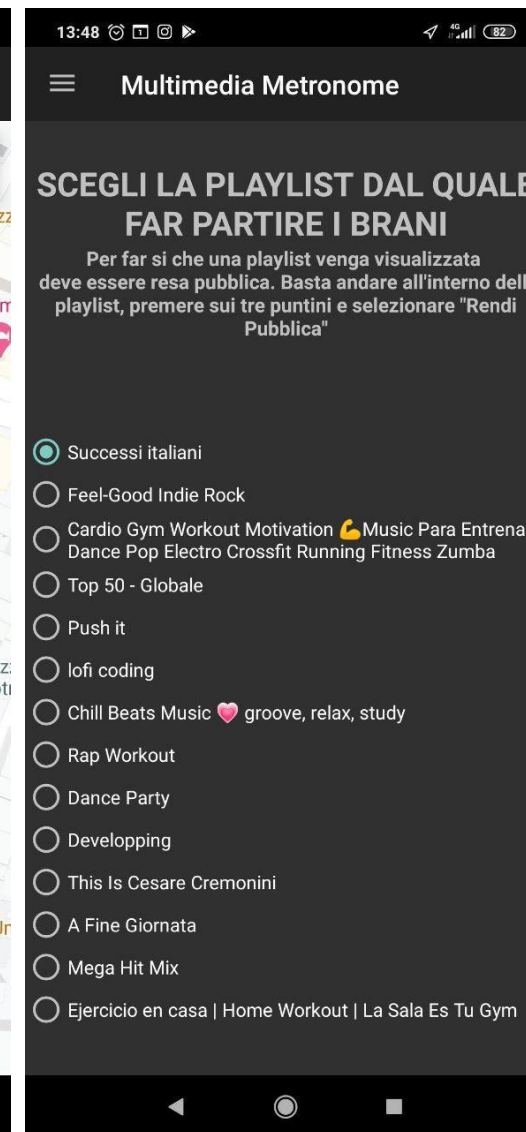
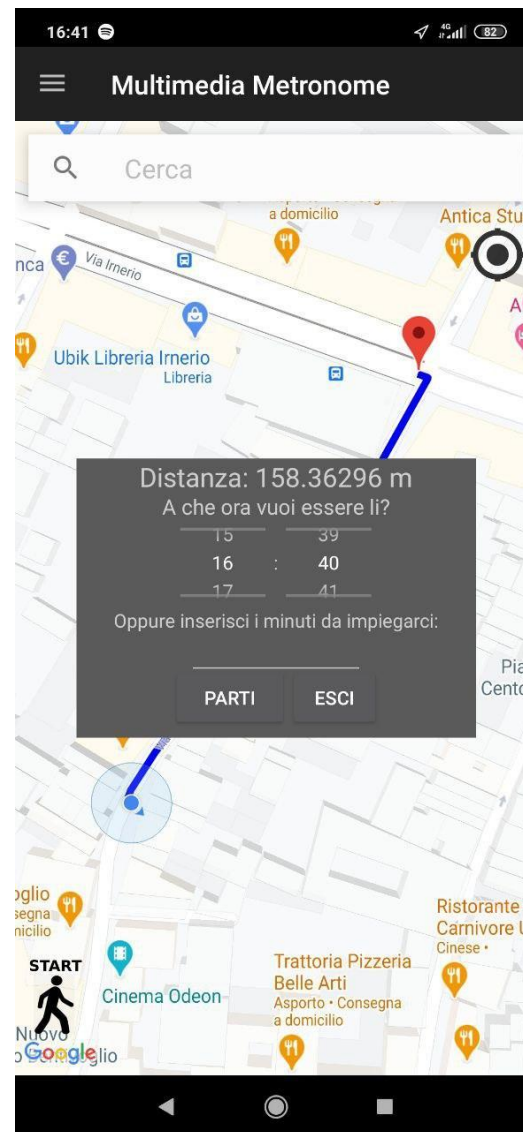




Students Projects

Emanuele Fazzini

BPMWalker: an adaptive app to guide the user's walking pace through the beat

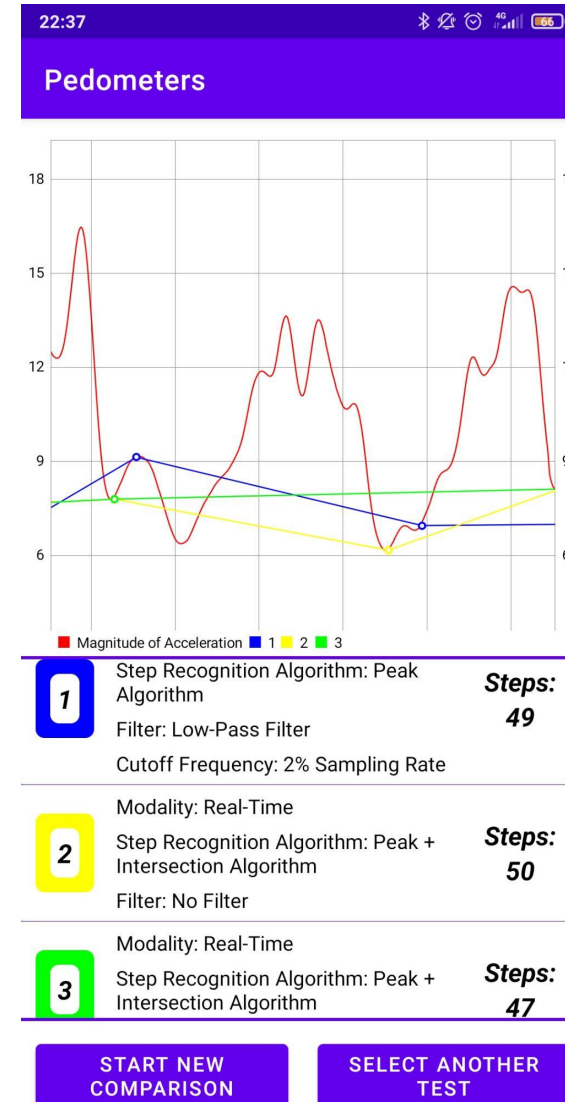




Students Projects

Giacomo Neri

Implementation of several pedometer algorithms and their real-time comparison.

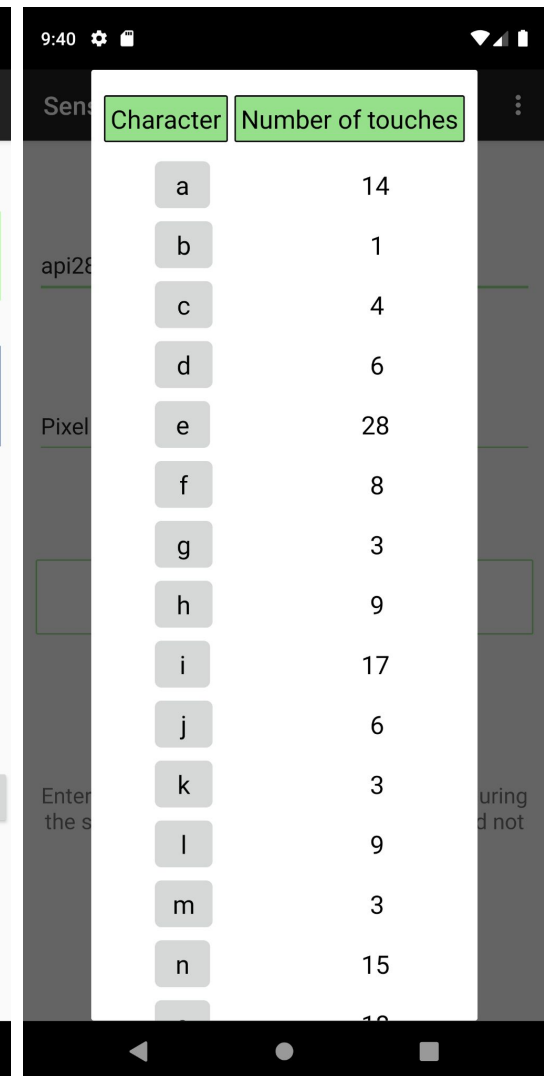
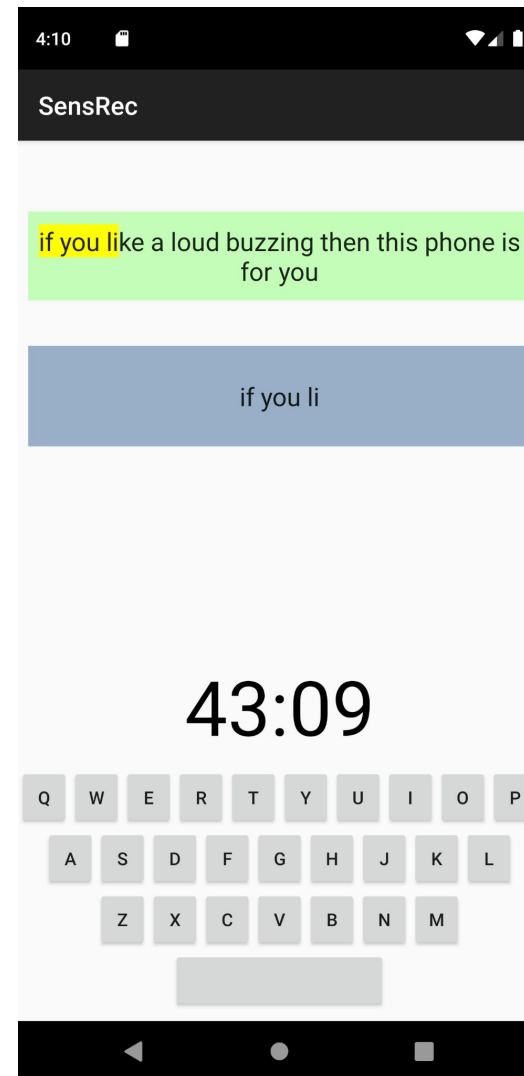




Students Projects

Giulio Augello

Keylogging of human touches through inertial sensors.

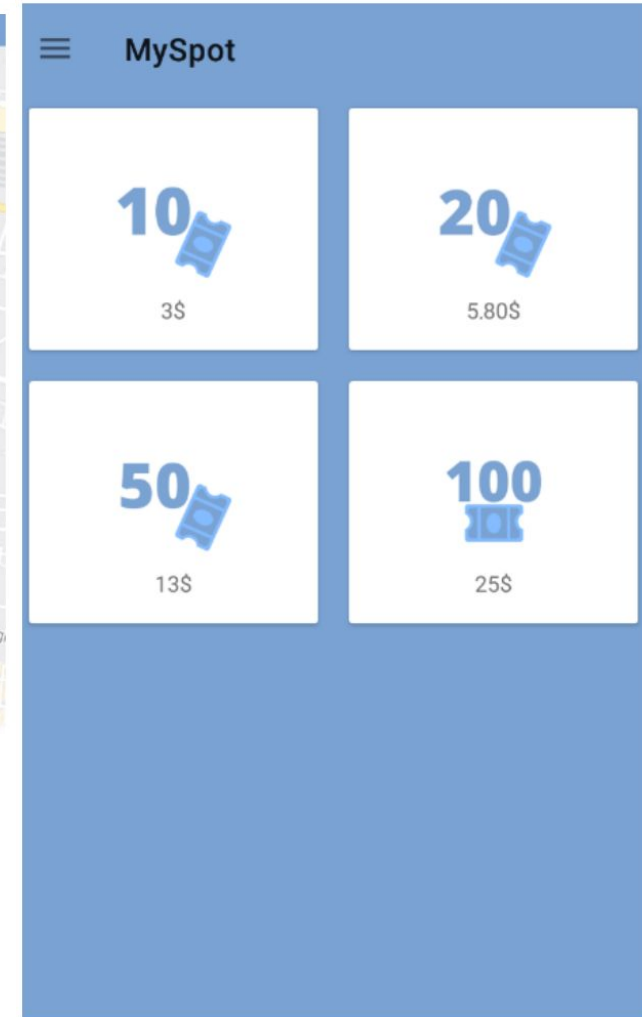
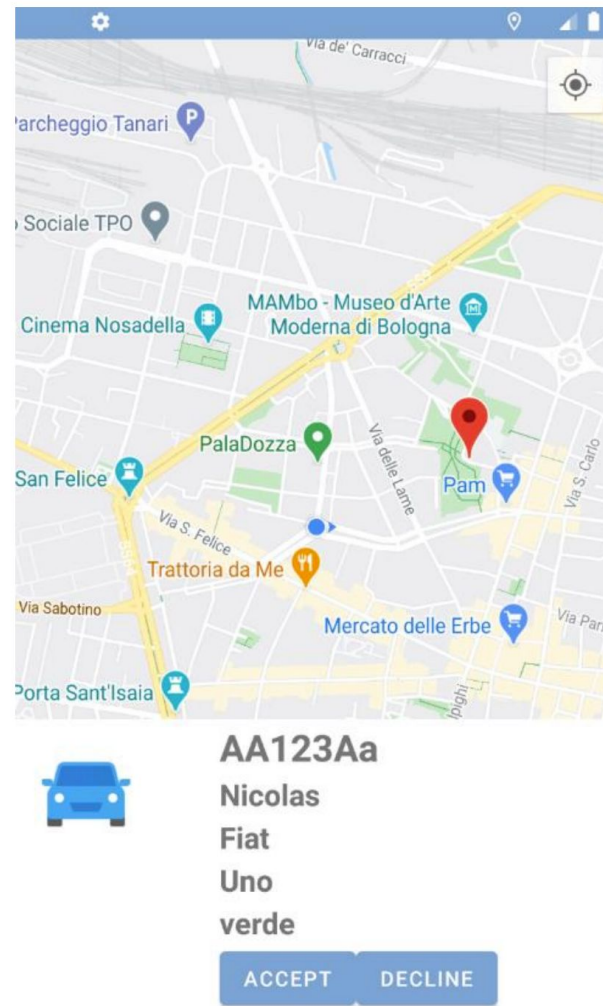




Students Projects

Qazim Mucodema

MySpot: an app for the exchange of parking spots

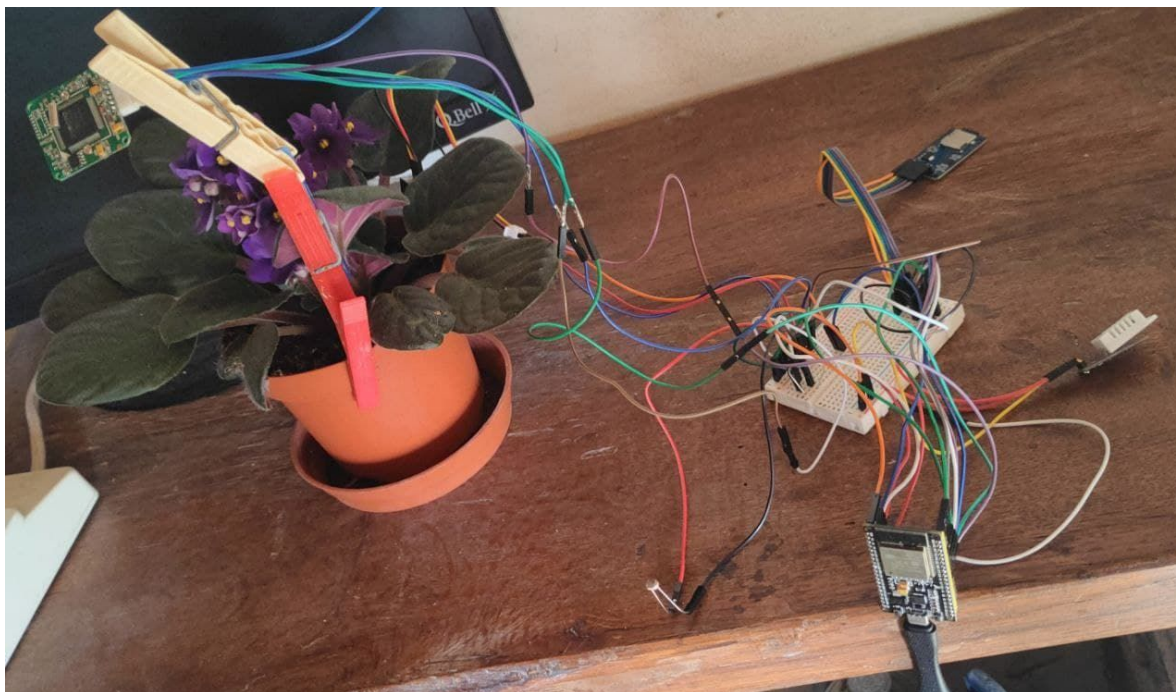




Students Projects

Federico De Giorgio

PlantANalyzer, an app for monitoring plants



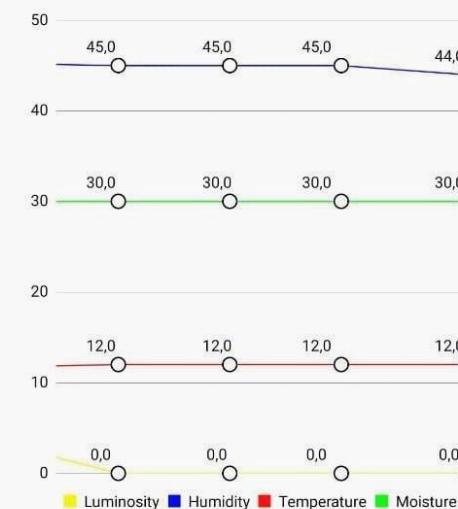
PlantAnalyzer

Last photo and last 10 detections



30 nov 22:30

30 nov 22:00





Students Project

Sofia Tortolini

GiftFits, a social network for exchanging gifts and suggestions

