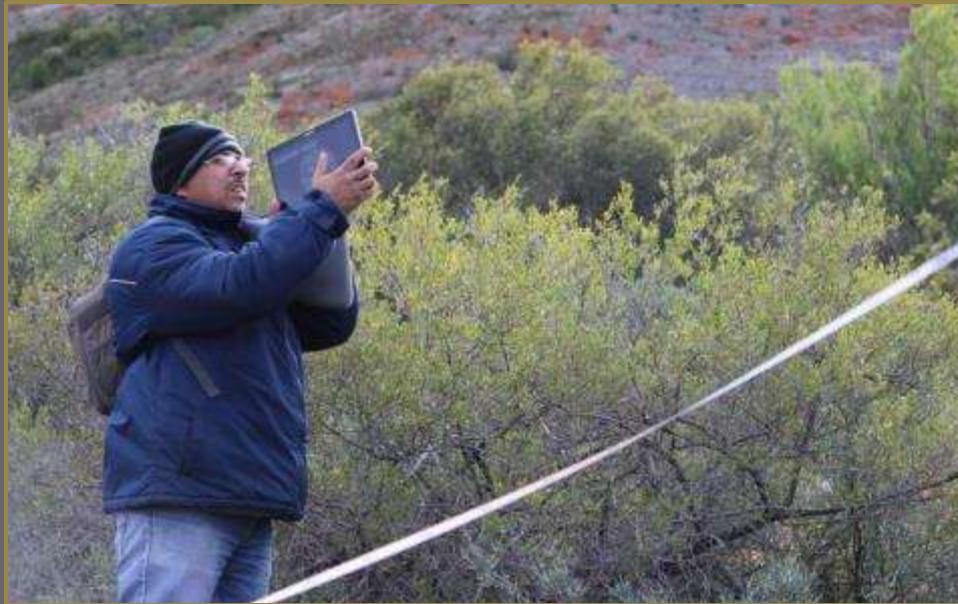


SMARTPHONES, TABLETS AND APPS FOR FIELDWORK?



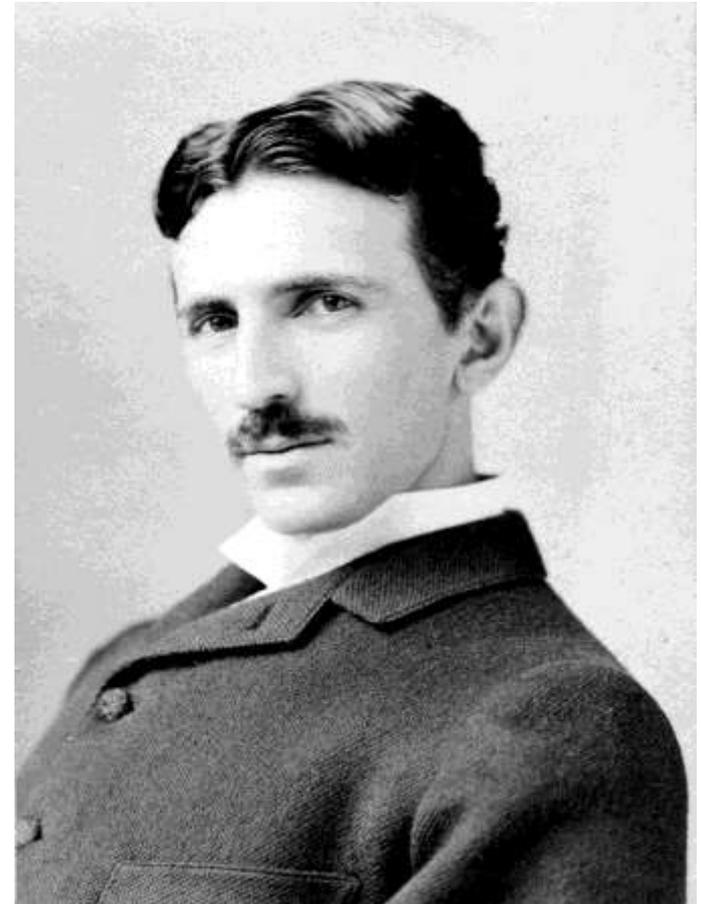
GSSA Research Skills Workshop
03 July 2016
Wilderness Hotel, Wilderness



Clement F Cupido

Mad predictions on cellphones

"When wireless is perfectly applied the whole earth will be converted into a huge brain, which in fact it is, all things being particles of a real and rhythmic whole. We shall be able to communicate with one another instantly, irrespective of distance. Not only this, but through television and telephony we shall see and hear one another as perfectly as though we were face to face, despite intervening distances of thousands of miles; and the instruments through which we shall be able to do his will be amazingly simple compared with our present telephone. A man will be able to carry one in his vest pocket." -**Nikola Tesla, 1926**



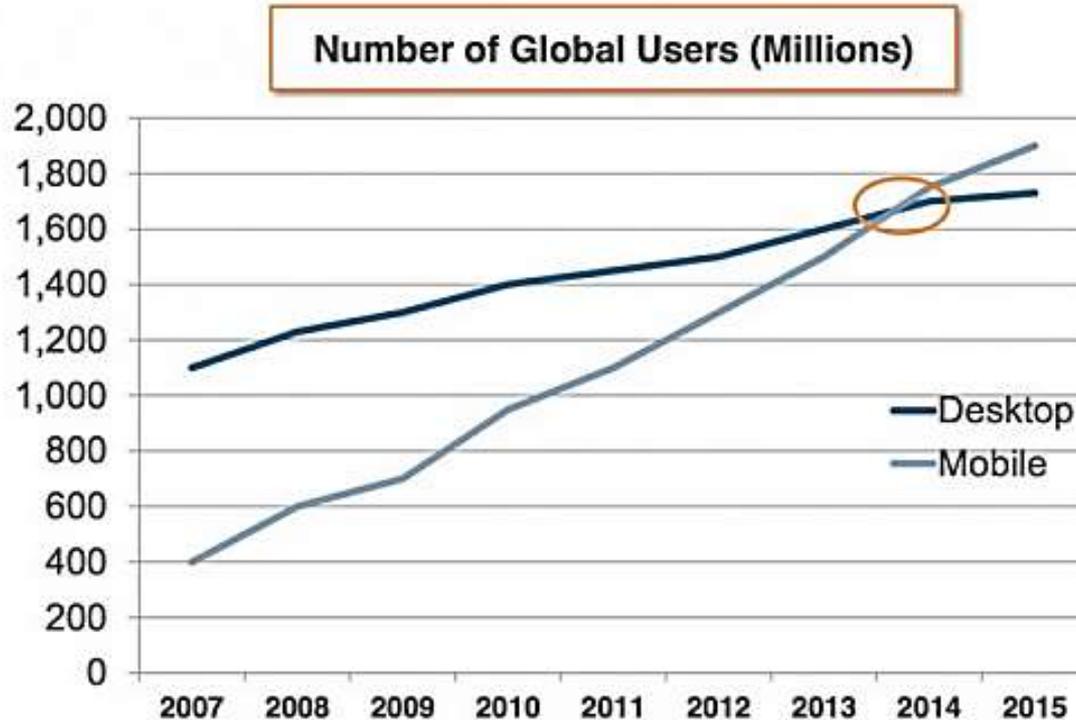
Enter the era of wireless communication!

- A **smartphone** is a mobile phone with an advanced mobile operating system
- Combine features of a cell phone with personal digital assistant (PDA), media player and GPS, accelerator, gyroscope and more.
- With benefit of touchscreen and apps, internet and photographic technology = powerful tool



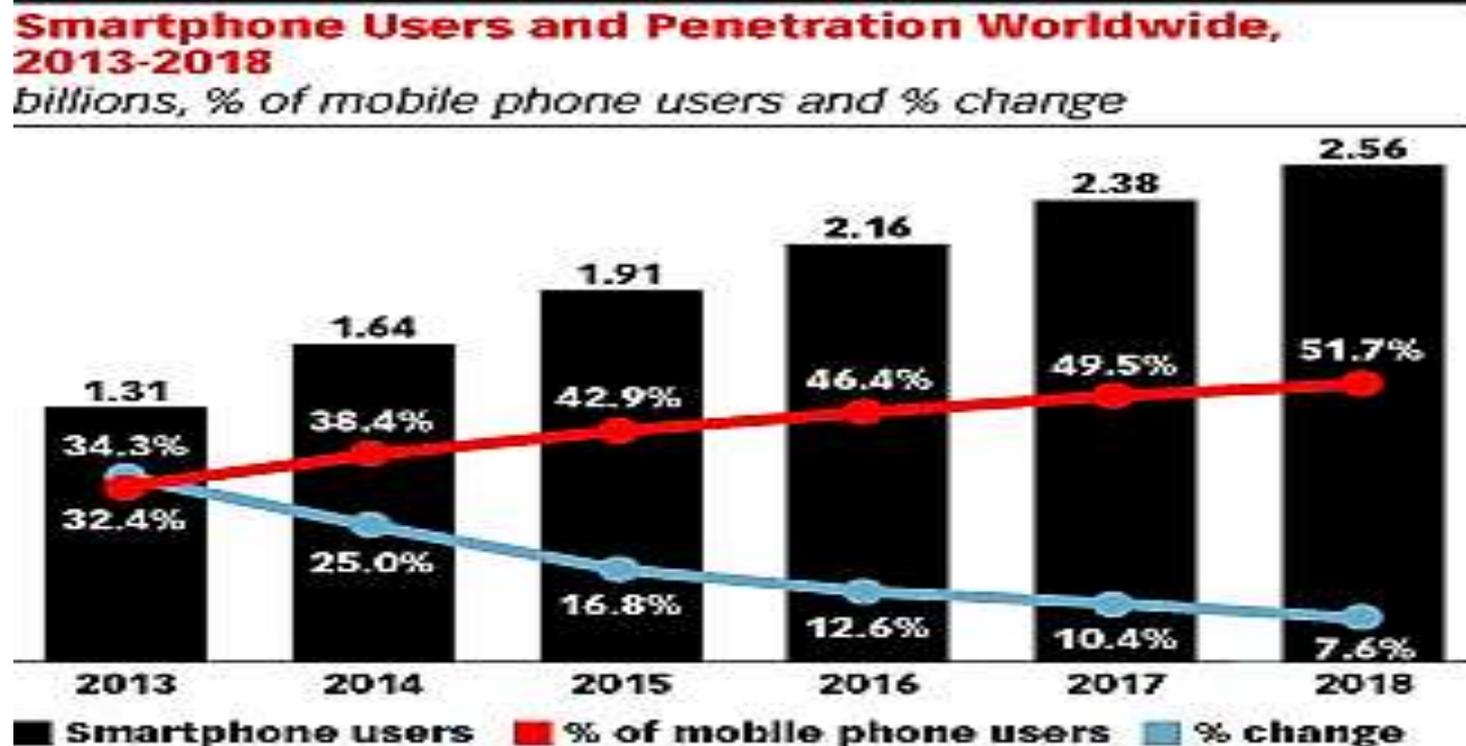
More predictions

- "Mobile to overtake fixed Internet access by 2014" (Mary Meeker, 2008)



Smartphone predictions

- Smartphone users worldwide will surpass 2 billion in 2016



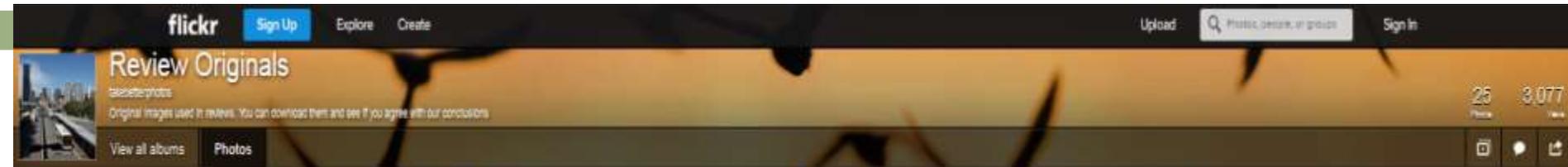
Note: individuals of any age who own at least one smartphone and use the smartphone(s) at least once per month

Source: eMarketer, Dec 2014

The Smartphones camera

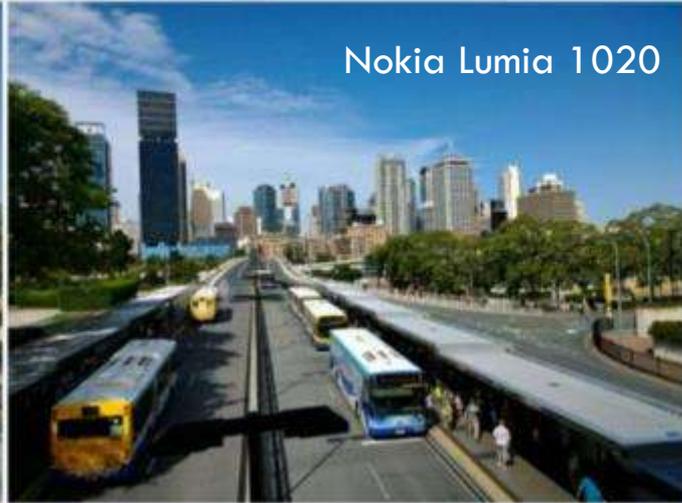
- Entry-level smartphones have **low mega pixel** as well **small sensor size** resulting in poor picture quality.
- E.g. 18mp camera (phone) with small sensor isn't as good as 10mp DSLR with an APS C sensor.
- Some smartphones actually high-end point-and-shoot cameras with larger sensors up to 1" with >20 megapixels and 4K video.
- Some can store their pictures in **RAW** image format

How do smartphones cameras compare with 'real cameras'?





Canon EOS 40D



Nokia Lumia 1020



Nikon D800



iPhone 5s



Canon EOS 40D (\$2k in 2007) 1/250s, f/8, ISO 100, Canon 16-35 f/2.8L II professional lens, raw, center crop



Edge crop



iPhone 5s 1/320s, f/2.2, ISO 32, jpeg, Apple camera app, center crop



Edge crop



Nokia Lumia 1020 1/2000s, f/2.2, ISO 100, jpeg, center crop



Edge crop



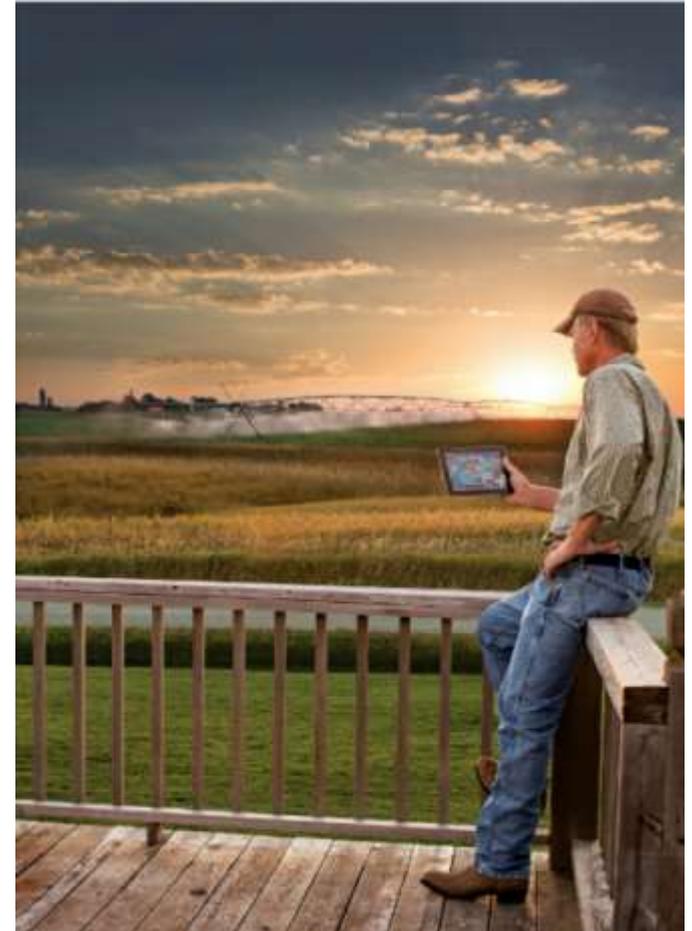
Canon EOS 20D (\$2k in 2004) 1/250s, f/8, ISO 100, Canon 16-35 f/2.8L II professional lens, jpeg, center crop



Edge crop

What are Apps? How many out there?

- Android users were able to choose between 1.5 million apps from *GooglePlay*
- Apple's App Store second-largest app store with 1.4 million available apps
- **over two-thirds of apps in the store are "zombies"** (tracking service Adeven, 2013)



Demonstration of the use of Apps





First Aid Guide

Bleeding

Respiratory

Allergies & poisons

Hot & cold related

Bones muscles & joints

Other emergencies



Hot & cold related

Burns & scalds

Heatstroke

Hypothermia



Heatstroke

Heatstroke

Heatstroke can occur as a result of prolonged exposure to high temperatures. It can be caused by overexertion in warm environments, or as a result of a fever. Elderly people suffer a greater risk of heatstroke, as their bodies cannot easily adjust to changes in temperature.

Symptoms

- Raised body temperature.
- Flushed, hot skin.
- Headache and/or dizziness.

Action

Step 1: Rest the casualty in a cool area, and increase air supply by opening windows or using a fan.

Step 2: Call emergency services and arrange for casualty to go to hospital.

Step 3: Shower the casualty with cool (not cold) water (or wrap in a cool, wet sheet/towel), and fan until temperature falls.

Step 4: Give casualty fluids to drink (water or a rehydration drink such as a sports drink). Do not give alcohol or caffeine based drinks, or medication such as paracetamol or aspirin.

Step 5: If temperature begins to rise again repeat the process above.

Important

If casualty's temperature rises again, repeat cooling actions above.

Demonstration of the use of Apps



Toolbox

 Smart Tools	 Tool Box	 ON Ruler	 Calculator	 Unit Converter	 Smart Voice Recorder
 Hill Gradient	 Clinometer				

Toolbox



Which apps work well?

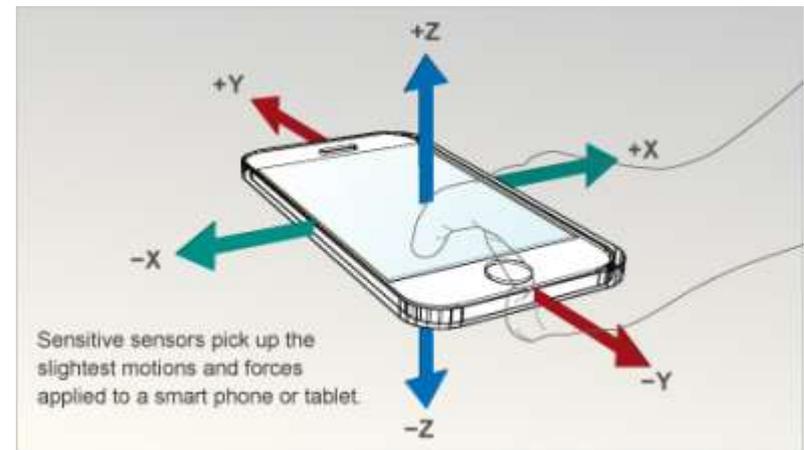
Apps dependent on:

Calculations

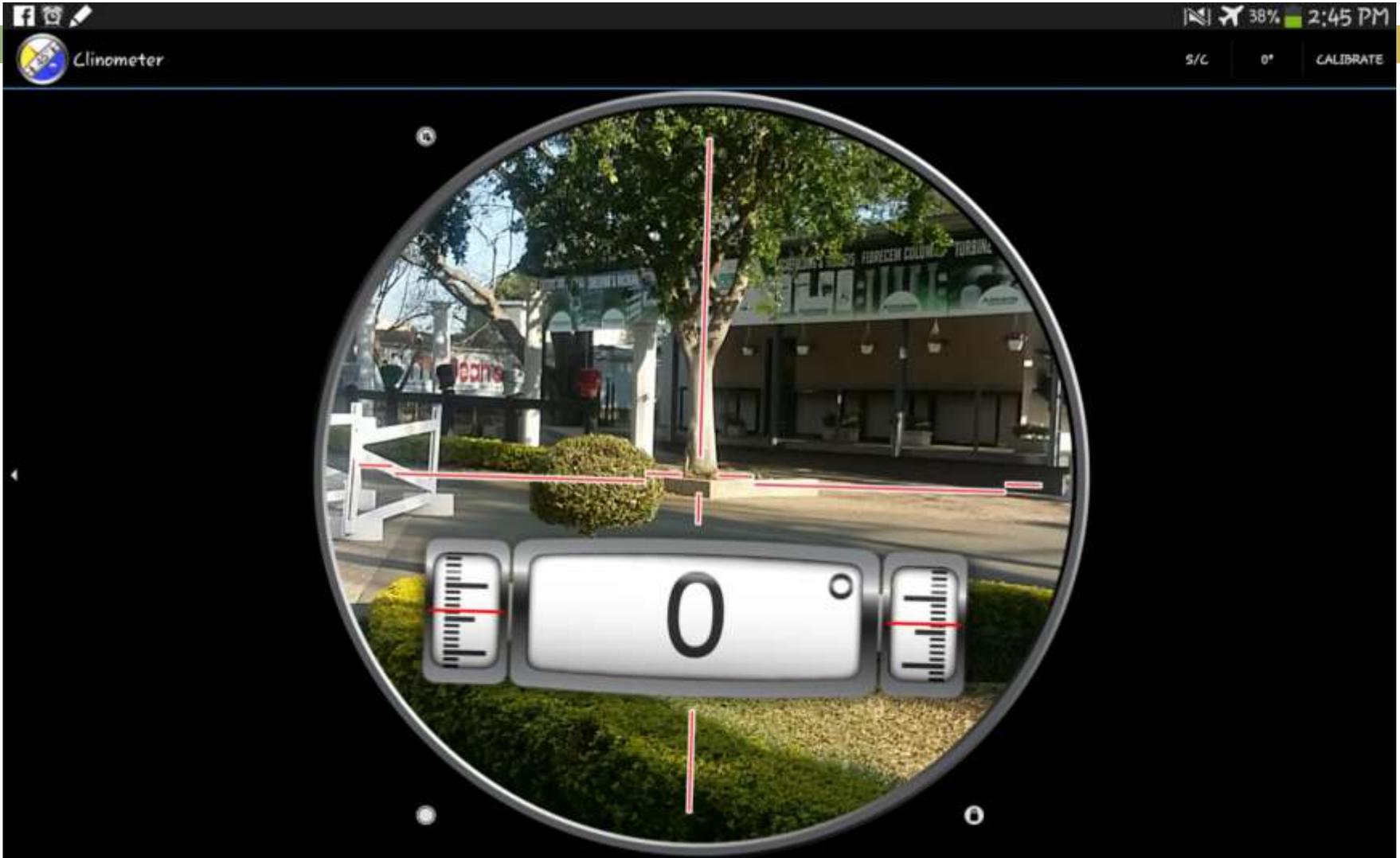
Algorithms

GPS

Accelerometer



Clinometer





37% 2:46 PM

Clinometer

S/C 0° CALIBRATE





Play Store



Camera



Research Met...



Toolbox



GPS, maps &...



Editorr



Soil



Forest Fire D...



AFIS



Random Numb...



TRESTIMA



BirdLasser



Yr



First aid



Agriculture



Field guides...



Misc apps



Maps



PlantNet

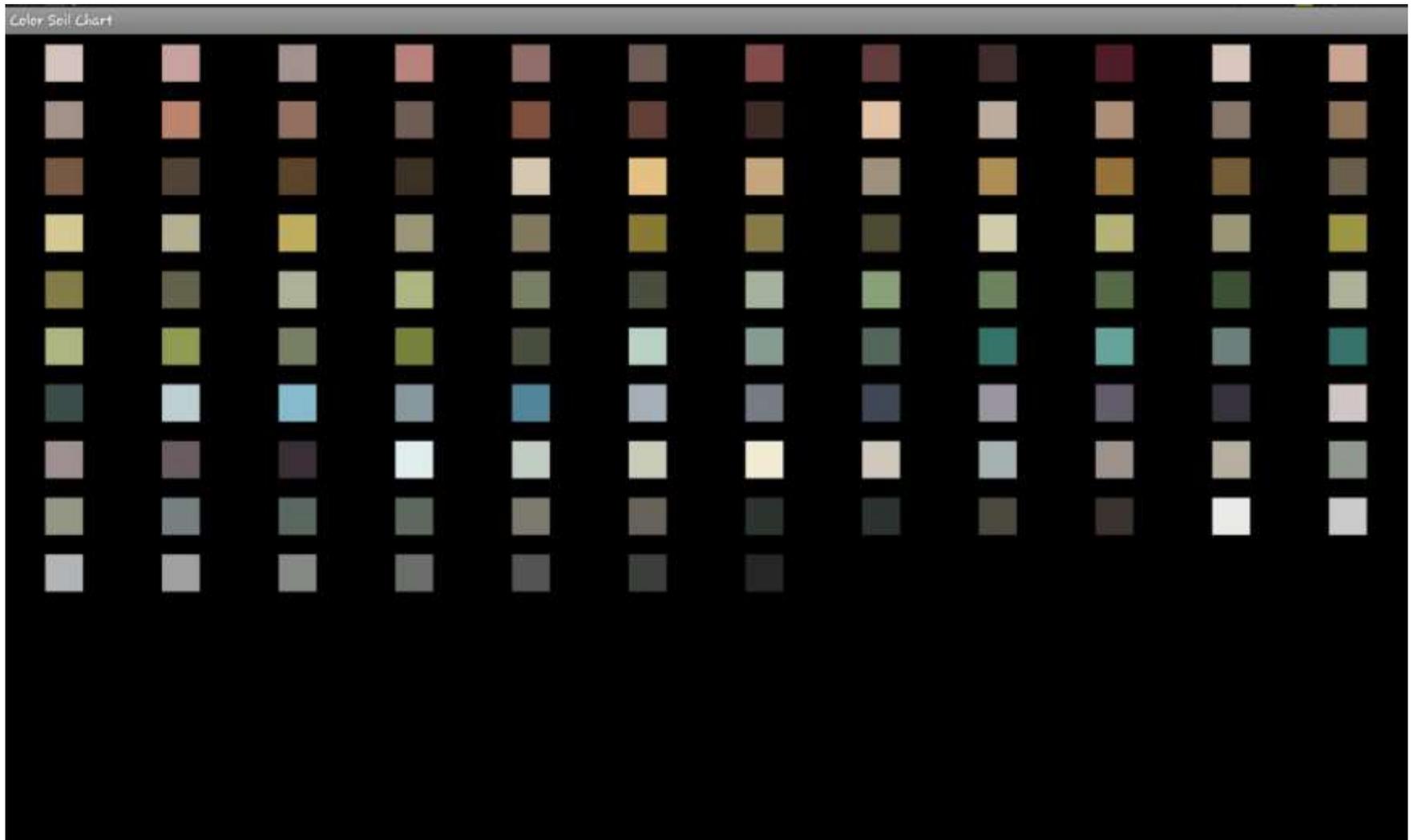


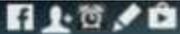
TreeLogy

Soil Color Chart 1



Soil Color Chart 2

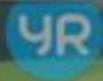




84% 9:45 PM

GPS, maps & tracking

			
Maps	OSMTracker for Android™	GPS Essentials	GPS Status



YR



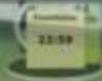
First aid



Agriculture



Field guides...



Misc apps

Google



GPS Essentials

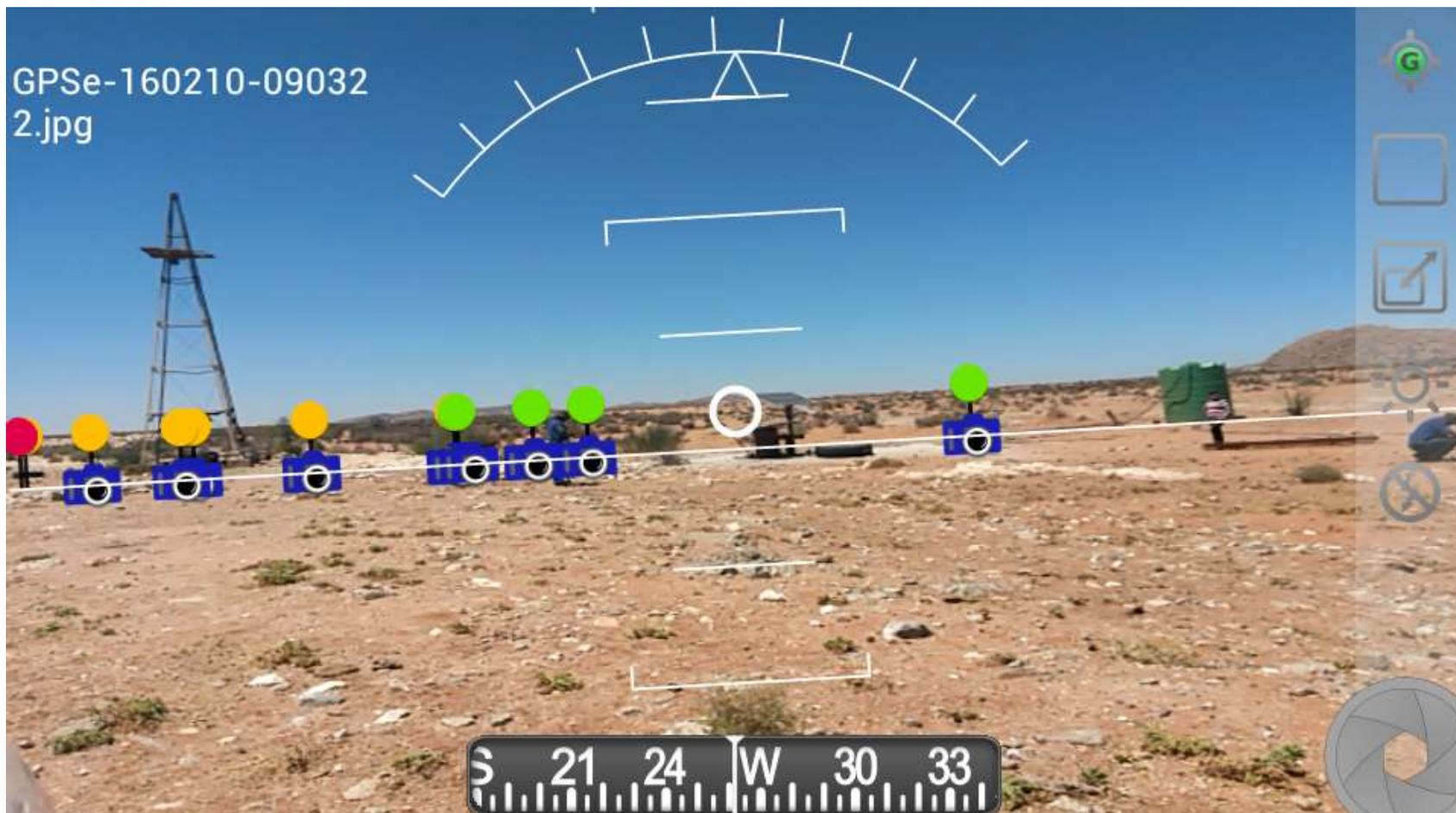


Probably the most complete GPS tool on Android Market:
Navigate, manage waypoints, tracks, routes, build your own
dashboard from 45 widgets.



0.01	km/h	06:50:37	SAST AM
Average Speed		Sunrise	
28	% Bat	08:46:25	SAST AM
Battery Level		Moonrise	
5.00	m	-	
Accuracy		Target Altitude	
E30.373500			
Longitude			
S-29.591427			
Latitude			
000	°		
Course To			

GPSe-160210-09032
2.jpg





point 24
5

Image © 2016 DigitalGlobe

Image © 2016 DigitalGlobe
Image © 2016 CNES / Astrium
© 2016 Google
Image Landsat

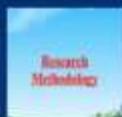
Go



Play Store



Camera



Research Met...



Toolbox



GPS, maps &...



Editorr



Soil



Forest Fire D...



AFIS



Random Numb...



TRESTIMA



BirdLasser



Yr



First aid



Agriculture



Field guides...



Misc apps



Maps



PlantNet



TreeLogy

Advance Fire Information System (AFIS)

Home About Services Products Media Contact

AFIS Viewer



THE ADVANCED FIRE
INFORMATION SYSTEM (AFIS)
IS A SATELLITE-BASED FIRE
INFORMATION TOOL THAT
PROVIDES NEAR REAL TIME
FIRE INFORMATION TO
USERS ACROSS THE GLOBE.





Current Location

LAT: -29.592 LON: 30.373

	FDI	Temp.	Humidity	Wind
Sun	46	20,0 °C	71%	7 kph
Mon	56	25,0 °C	49%	10 kph
Tue	55	24,0 °C	90%	15 kph
Wed	42	20,0 °C	94%	18 kph
Thu	53	23,0 °C	82%	18 kph

Last burned Fire frequency Curing
 Land cover Urban / Built-up (residential, mixed) 65%



Lowveld FDI Calculator



Temperature* 22 °C
Wind Speed* 0 kph
Humidity* 30 %
Rainfall mm
Days since rainfall 12 days
Curing %

* indicates required field

MODERATE

Suitable for prescribed burning to remove moribund and/or unpalatable grass material, or to construct burnt firebreaks.

Plant identification



← Explorer

Search

Acacia farnesiana (L.) Willd.
Ancient Cassia, Cassie
Fabaceae

Acacia karroo Hayne
Karoo Thorn
Fabaceae

Acacia longifolia (Andrews) Willd.
Sydney golden wattle
Fabaceae

Acacia mearnsii De Wild.
Black Wattle
Fabaceae

Acacia pycnantha Benth.
Broadleaf Wattle, Golden Wattle
Fabaceae

Acacia raddiana Savi
Fabaceae

← Explorer

Acacia karroo Hayne
Karoo Thorn

© Photoflora

www.tela-botanica.org/bdtfx-nn-102-synthese#

Botanical forming wild plants

The French botanical network

Home BOTANICAL News Network Projects

Home - plants sheets - France metropolitan

SEARCHING FOR A NAME

Scientific name | Common name | Clear (or from scientific name input) | Search | Card access

Advanced search in the database BDTFX 3.0.0

Acacia karroo Hayne FABACEAE
Mimosa odorosa

Systematics | Description | Etymology | Ecology | Taxonomy | Bibliography | Distribution | Culture | Protection

Description

Organism: Mimosa odorosa

Organic Type: Mesophanerophyte (liero) (deciduous)

Plant formation: magnaphanerophyte

Origin: introduced (South Africa)

Reference: **spume Simple** | **Sexuality: hermaphrodite**
Fruit: pod | **Color: yellow** | **Blown** | **Pollination: entomophilie**
July to August | **Dissemination: hémérochore**

View x / Full

Distribution

Ecology

climatic characteristics

Latitude: 40°N - 50°N

Number of months: 1 - 12

Temperature: 0°C - 30°C

Continentality: 1 - 10

soil characteristics

Reaction (pH): 4 - 8

Humidity: 1 - 10

Tolerance: 1 - 10

Nutrients: 1 - 10

Salinity: 1 - 10

Moisture Organique: 1 - 10

Geographical distribution

View x / Full

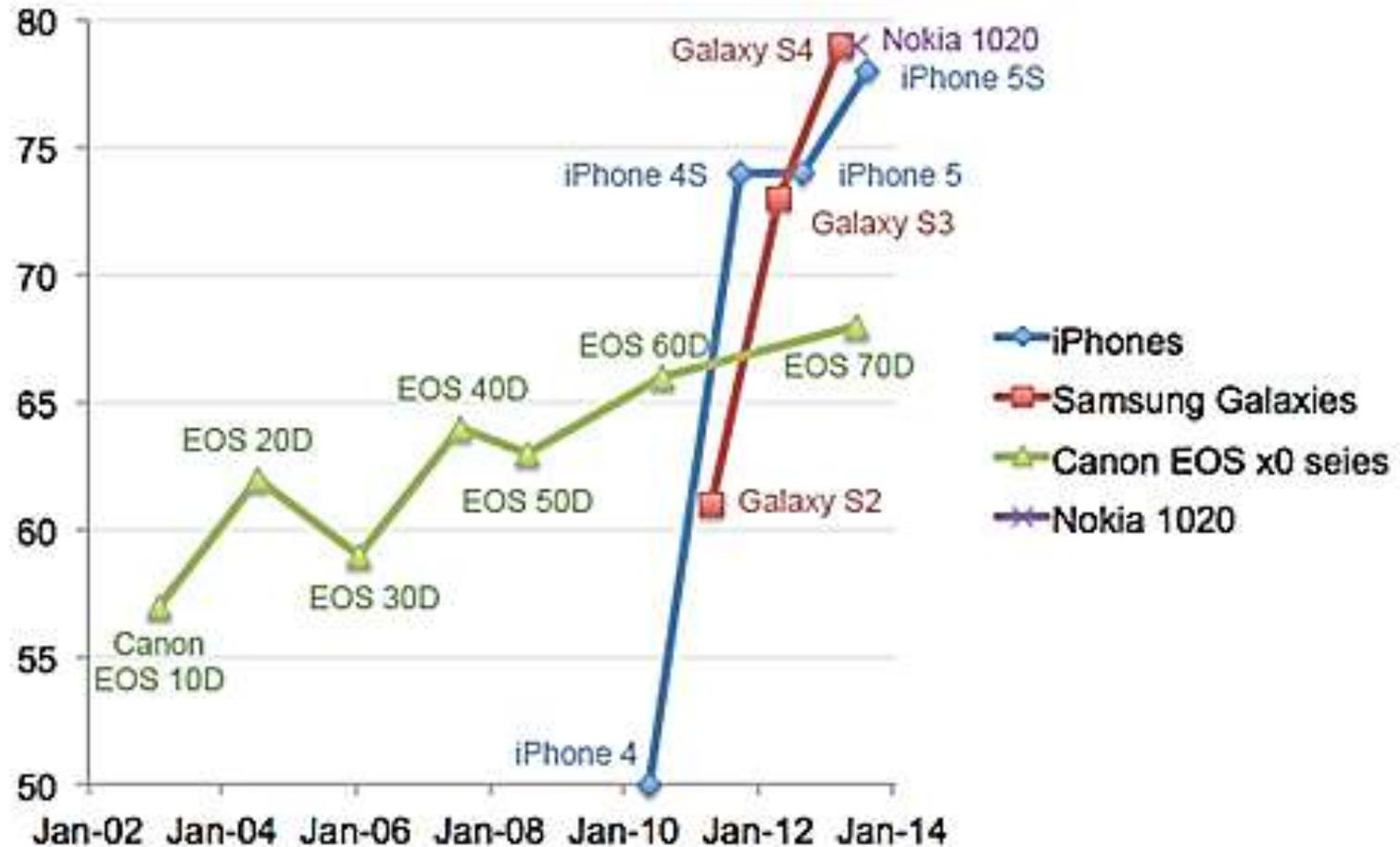
Remember me

Forgot your password?

How reliable are cameras and apps for research?



Smartphone cameras



Improvements over time in DXOMark and DXOMark Mobile scores for Canon EOS DSLRs and two ranges of smartphones.

Note that the scales for the DSLRs and the phones are different and not directly comparable.

Still limitations in low light photography



Canon EOS 30D (\$2k in 2006) 1/15s, f/2.8, ISO 3200, professional lens, jpeg



Canon EOS 40D (\$2k in 2007) 1/15s, f/2.8, ISO 3200, professional lens, jpeg



Canon EOS 40D (\$2k in 2007) 1/15s, f/2.8, ISO 3200, professional lens, raw



Nikon D800 (\$3.5k in 2012) 1/15s, f/2.8, ISO 3200, professional lens, jpeg



iPhone 5s 1/15s, f/2.2, ISO 1250, jpeg,



Nokia Lumia 1020 1/15s, f/2.2, ISO 3200, jpeg, +0.66 Exposure in Camera

Experimental evaluation of mobile phone sensors

- Ma et al. 2013
- Google Nexus 4
- Accelerometer, gyroscope, magnetometer and GPS
- Results: accelerometer and gyroscope sensors are very stable (0.1-0.8 unit deviation)
- Compass had larger deviations (3 degrees)
- GPS deviation $> 10\text{m}$

GPS

Research Article

Accuracy of iPhone Locations: A Comparison of Assisted GPS, WiFi and Cellular Positioning

Paul A Zandbergen
Department of Geography
University of New Mexico

iPhone 3

3G iPhone w/ A-GPS ~ 8 meters

3G iPhone w/ wifi ~ 74 meters

3G iPhone w/ Cellular positioning ~ 600 meters

Research Article

Positional Accuracy of Assisted GPS Data from High-Sensitivity GPS-enabled Mobile Phones

Paul A. Zandbergen^{a1 c1} and Sean J. Barbeau^{a2}

^{a1} (Department of Geography, University of New Mexico)

^{a2} (Center for Urban Transportation Research, University of South Florida)

Several Android phones
~ 5-8 meters accuracy



Dual 150S External GPS Receiver

2.5 m accuracy

Combining GPS, camera and cloud

Products Customers Jobs Company



Trestima™ forest inventory system

World's most accurate and efficient tool for measuring standing timber

This is how it works:

1. Forest is photographed with Trestima mobile application. Sample photos are automatically transferred to Trestima cloud for analysis.
2. Trunk widths and heights as well as tree species from each sample are measured in the cloud service. Machine vision is aided by a human operator when necessary. This ensures reliable results also in variant photographic conditions.
3. Reports of specie specific characteristics are calculated from the data extracted from samples. Reports are also transmitted to the mobile device. This makes it possible to follow the results and standard error in real time while carrying out the measuring task.

Basal area of trees calculated with images



Forest measurement is as fluent as taking pictures with a camera.

Forests 2015, 6, 1179-1194; doi:10.3390/f6041179

**App is not perfect, but well on its way
to replacing callipers, measuring tapes
and hypsometers**

Article

Evaluation of a Smartphone App for Forest Sample Plot Measurements

Mikko Vastaranta ^{1,2 *}, Eduardo González Latorre ¹, Ville Luoma ^{1,2}, Ninni Saarinen ^{1,2}, Markus Holopainen ^{1,2} and Juha Hyyppä ^{2,3}

OPEN ACCESS

forests

ISSN 1999-4907

www.mdpi.com/journal/forests

Forest inventory report: solkivuori



Plant identification

- Plant identification: man vs. machine LifeCLEF 2014 plant identification challenge (Pierre Bonnet et al., 2014) [Multimedia Tools and Applications](#)
- machines **could not outperform best expert botanists** at the image-based plant identification competition
- but are **competing with experienced botanists** and clearly outperform beginners and inexperienced test subjects

My verdict

- Apps shows lots and lots of promise as measuring tools in science
- Android does not force sensor specs on its device manufacturers, the **accuracy may vary a lot between different manufacturers**, as well as **between phones and tablets**
- Sensor chips are cheap therefore highly allergic to disturbances (compass to metal objects, GPS to urbanly-large buildings, accelerometer to sensor noise in general)
- Not all apps allow for sensor calibration

The challenge

- Let's design our own apps!