Hackathon Report

House of Apps
Create great apps for citizens

Organisers contact
Rob Lemmens (r.l.g.lemmens@utwente.nl)
and Vyron Antoniou (v.antoniou@ucl.ac.uk)

Funded by the Horizon 2020 Framework Programme of the European Union

1. Introduction

Citizen Science is largely realized today through either mobile or web applications. What is largely missing is a fertile environment where future developers will turn to, so to find the basic building blocks for creating such applications. As most applications currently are isolated it would be beneficial to the entire community if modular and reusable components could be created which could be used by app developers; more or less similar to a lego-like house of apps.

2. Objectives of Hackathon

Thus, the objectives of the Hackathon was to make the first steps so to ease the creation, findability, and re-use of mobile apps for Citizen Scientists. These apps need small software components that focus either on interfacing mobile sensors or on geodata import (e.g., satellite images, in-situ sensor data).

Newly created software was welcomed as well as the reuse and recombination of lots of open software libraries that are already available as open software. The challenges listed in Annex A were published on the COST website so that participants will get ideas about expected problems that their components could solve.

3. Organisation (timeline)

The 5th open source geospatial research and education symposium (OGRS 2018) http://2018.ogrs-community.org/ 9-11 October, 2018 in Lugano, Switzerland was the end-activity of hackathon which was prepared and held along the activity schema below:

1. 17 Oct 2017 MC Meeting Tartu: Creation of challenges by COST project members
2. June-August 2018 Hack period
3. 9-11 Oct 2018: COST event at OGRS symposium

4. OGRS program of session

The WG Meeting included the following sessions:

Introduction to COST project and House of Apps **Abstract** EU COST Action CA15212. A brief presentation of the COST CA15212 Action, its Working Groups, events and aims. **House of Apps.** Citizen Science is largely realized today through either mobile or web applications. Let's create a fertile environment where future developers will turn to, so to find the basic building blocks for creating such applications. As most applications currently are isolated, we want to create modular reusable components which can be used by app developers…. think of it like a lego-like house of apps.	Rob Lemmens - University of Twente, ITC Vyron Antoniou - Hellenic Army Geographical Directorate
Mobile apps for Citizen Science - considerations for design and development **Abstract**	Sven Schade - European Commission, Joint Research

Mobile applications play a prominent role for engaging citizen in scientific research. Over the past decade we witness an increasing number of such Citizen Science apps - some extremely successful, others with a very limited lifetime. Based on own hands-on experiences and previous workshops about the possible re-use of Citizen Science apps and platforms, this talk will reflect about the different possibilities that apps can provide for Citizen Science. It will also reflect on past developments and highlight a few existing challenges. The talk will conclude with a few recommendations for app design and development.	Centre
Mobile application development - demand and supply in the Copernicus App lab **Abstract** This presentation will explore how to use Distributed data access in Web-semantically enriched processing workflows [https://analytics.ramani.ujuizi.com] to facilitate access and exploitation of multivariate EO data sets and publish value-added-products to native mobile and web applications.	Valentijn Venus, Firman Wahyudi, Wilberforce Chege - RAMANI B.V.
Mobile application development for non-literate citizen scientists in the Congo-Basin **Abstract** ExCiteS has investigated and developed open-source technologies that facilitate data collection across language or literacy barriers through highly configurable icon-driven user interfaces. These tools can be used to enable communities to capture and share their local environmental conditions. In this presentation, we explore the best practices for developing mobile apps for similar challenging environments.	Michalis Vitos - ExCiteS group, University College London (UCL)
Presentation of the winning app: What does riding a bicycle feels like? Your phone can say it. **Abstract** Many cities are asking this more often. As part of the Geo-C project, first, we explored how a gamified app could change the perception of urban cycling and, second, identified the frictions inhibiting bicycle commuting by analysing the data collected through the app. We present the lessons learned deploying our experiment at three European cities, our research outcomes, and how we conceive the re-use of the app components as tools of the GEO-C open city toolkit.	Diego Fabian Pajarito Grajales - Universitat Jaume I de Castellón
Open Discussion and Q&A Session	Vyron Antoniou & Rob Lemmens
Creating a small inventory of apps and their characteristics: Follow-up with questionnaire	Vyron Antoniou & Rob Lemmens

5. Outcome of mini-survey, lessons learnt from hackathon and OGRS workshop session

During the meeting OGRS participants were asked to participate in an online survey regarding the use of mobile apps for CS projects. The responses may be used primarily to shape a more elaborate questionnaire that will help to better document the use of mobile apps for CS, reveal any gaps in app usability, the actual reuse of existing apps and the drivers behind the development of new mobile apps instead of using existing ones.

The survey can be found in the following link:
https://goo.gl/forms/rOIrHlsn0Yat8Oah2

The following observations follow from the survey:

1. All respondents have participated in a CS project.
2. The CS projects show a wide diversity of purposes, ranging from water surveys to noise capturing, with a project duration ranging from 1 month to 3 years.
3. Most CS project involve the use of a (fully functional) mobile app, capturing a variety of location-based media, including images and sounds.
4. Implemented app components include Login, Camera access, GPS logging, Tagging, Forms and Help.

6. Follow-up

The main lesson learnt from the hackathon and its preparation is that there are many mobile apps out there with a high potential for Citizen Science, but they commonly lack the ability to be utilised fully in specific Citizen Science projects and so need a lot of effort to be customised for the specific purpose. By creating an overview of and insight into existing mobile applications and underlying software libraries, it seems more likely that software developers will be able to reuse these and spend less time on fine tuning them for making them fit for purpose.

Setting up a new questionnaire during a forthcoming MC meeting and WG meetings will get more input on other apps. The responses of the previous questionnaire may be used primarily to shape a more elaborate second version. The aim is to formulate a start for a catalog of apps which are relevant for Citizen Science in general and for the COST project in specific. With the new questionnaire a broader community will be reached out aiming to reveal any gaps in app usability, the actual reuse of existing apps and the drivers behind the development of new mobile apps instead of using existing ones. The findings can provide help to the Actions WGs, such as to WG 1 as they can be associated with the quality of crowdsourced data and how this can be achieved through the primary mean of data collection, i.e. mobile devices. Similarly the findings can be used from WG 5 so to begin the standardization and interoperability of CS project right from the outset, i.e. the mobile applications themselves.

Funded by the Horizon 2020 Framework Programme of the European Union

ANNEX A. Software Component Challenges.

The challenges below were created by participants of the Management Committee meeting in Tartu.

The networking citizen

CHALLENGE 1

Title
How unusual is it?

Objective
To provide immediate feedback to a citizen scientist whether his/her observation is common or not.

Possible functionality and needs
An app that explores whether an observation is unusual (out of the normal range of measurement) or common. Provide an immediate feedback that should reinforce participation.
Phenomenon: for example, a plant that is flowering, a fish dying in a river, (unusual) heavy rain shower… Should be described by a participant in as many details as possible. Some should be parameters

Parameters:
Optional: Intensity of the phenomenon (ex., fish size, fish number, rain high mm)
Compulsory: time stamp (date in the year); (automatic)
Compulsory: location, space (geographic); (automatic)
Optional: some space attributes (e.g., land use)

The app would gather data from social networks (Twitter, Instagram, Google analytic (?)) and calculate the frequency of occurrence of similar phenomenon, and normal range in space and time, and score the observation on a 0-1 likelihood scale (i.e., is it common or uncommon, for example: a plant flowering in December when the normal period is spring; a species outside of its normal distribution – outside its usual habitat; a fish larger than the largest known, etc.).

Intended users
People interested in their natural environment and its variation / participants in citizen science project

Funded by the Horizon 2020 Framework Programme of the European Union

CHALLENGE 2

Title
TRYCSO: TRacing Your Citizen Science Observations

Background and problem
Volunteer motivation in citizen science project is driven by a desire to make tangible impact on science. Unfortunately, feedback on how, where, and whether the data is used in a specific science project, or whether it supported specific scientific findings, is often lacking. Inability to trace one's data collection contributions is one of the main reasons for this lack of feedback, and consequently the lack of acknowledgment and the sense of inclusion for the volunteer.

Objective
TRYCSO enables automatic tagging of data volunteered in a citizen science project. Each data point is appended with a quasi-unique token, calculated via a hash function, that allows users to identify their contribution in a broader dataset. One component of the project will be implemented as a mobile programming library that streamlines the process of collecting and tagging the data. The other component resides on a server and searches for possible uses of the data, so that a user can be notified whenever her data are used.

Possible functionality needs

- Hashing data; ideally, hash functions should be tailored to a particular data type (e.g. photo, sound, etc.)
- Save data locally on a device and append with the metadata (including the calculated hash)
- Export the data locally to a SD card and remotely via a network
- Interface with different data repositories (where APIs are available) and efficiently search through them for the given hashes. Search space should be reduced by other metadata parameters (e.g. time of creation, location, data type, etc.)
- Notify the user when their data is used
- OPTIONALLY: ensure that the hash is not lost in the process of data transfer/processing

Intended users
Citizen scientists who would like to trace the impact of the data they have collected

Software guidelines
As a proof of concept, we focus on mobile device camera photos:

- Construct a hash function that summarizes a photo; the function should be tailored to "disperse" hashes in the hash space as much as possible and maximise uniqueness.
- Build a mobile (Android/iOS) library that allows:
    - A developer to request a camera photo and that returns a photo appended with the metadata, including the calculated hash.
    - Stores the calculated hash (optionally with a photo thumbnail) on a user device (or in a cloud storage assigned to this user)
    - Connection with a server component for tracing the data
- Build a server component that periodically searches for the hashes provided by the mobile app and notifies the user where and when their data was used.
- OPTIONALLY: embed the calculated hash in the data, so to ensure it is not lost in the processing (e.g. embed it in the photo).

CHALLENGE 3

Title
Science to go

Background and problem
In many cases there is a lack of adequate mobilization of scientists (and of citizens), and doing it cross-borders. One of the major threats of Citizen Science is that Scientists are often isolated from the public (Ivory tower problem). This prevents the addressing of multidisciplinary scientific knowledge and the broad diffusion of Citizen Science.

Objective
Develop an app to help scientists and citizens find each other. Amongst other things this will enable the formulation of competent teams and facilitate the distribution of workload. As a secondary result, it can lead to the generation of new ideas.

Possible functionality and needs
Provision of:

- profiles of citizens and scientists (expertise, interests)
- Calendar for availability
- Task distribution system
- Matchmaking system
- Workload balancing system
- Statistics, analytics of participants, matches, etc.

Intended users
Citizens, scientists and Citizen Scientists
Citizens asking questions to scientists.
Scientists and citizens trying to find each other (crowdsourcing, niche-sourcing).

Stay healthy

CHALLENGE 4

Title
Am I breathing what I think that I am breathing?

Short description
A software application that will inform citizens on the air quality levels they are exposed to and complement it with discomfort index value calculated on the basis of personalized measurements.

Background and problem
Air pollution (AP) levels affect quality of life especially if taking also into account local weather conditions and parameters like the discomfort index that presents the mean levels of discomfort as a function of air temperature and relative humidity. AP information is now available for the whole of Europe via the Copernicus atmospheric monitoring services-CAMS (link) in urban areas, while temperature and relative humidity readings are commonly available via sensors integrated to smart phones (the Android example). Combining this information taking into account personal profile of health status and preferences, while also incorporating green routing (routes with minimum environmental burden) will be of interest for many EU citizens.

Objective
To develop a small software component that guides a citizen scientist to record temperature and relative humidity via a smart phone, access AP forecasts from CAMS, take into account personal health profile data if possible, and provide with “color coded” quality of life information and advice.

Possible functionality needs
GPS awareness
Run an already available app to collect temperature and relative humidity readings
Web-based access to CAMS data downloads

Intended users
Citizens with respiratory or cardiovascular problems, elderly, those taking care of children, etc.

Software guidelines
- Trigger by a button click
- Download local AP forecast
- Get a set of measurements
- Combine data to show a simple color message to the user.

CHALLENGE 5

Title
Promoting sustainable traffic

Background and problem
Planning efficient "green" transportation network can promote people for moving from using vehicle to more environmental friendly means of transport (e.g., walking and cycling). While much effort is currently directed to monitor and plan road networks in cites, less effort is directed to improve sustainable network of pedestrian and cyclist. Pedestrians and cyclists often encounter obstacles that reduce the comfort and efficiency of their journey and this may influence their willingness to use more sustainable means of transport.

Objective
To develop an app that collects data about pedestrian and cyclist usage of roads, sidewalks and trails, with emphasis on understanding which elements disturb the flow along the path. The aim of this app is to provide data for planners to help design and manage sustainable transportation network for pedestrians and cyclists.

Possible functionality and needs:
- Path used (GPS location, elevation) and time
- Number of stops
- Number of accidents for bikes and pedestrians (if known)
- Subjective feeling of security and path efficiency
- Active reporting of obstacles, hazards
- Measuring of light conditions
- Parking places
- Time of years and weather
- Uploading photos of obstacles and nice places, views…
- Noise

Intended users
Citizen scientists interested in helping the city to create a more efficient sustainable transport network. The end users (who will get the data) will be planners and engineers that are responsible for the transport network in the city. Sharing the data with citizen scientists and others can help them to better plan their routes and share live info about obstacles. The app could also have a social element that could create a reporting community for sustainable transport network.

Software guidelines
- Trigger by record bottom
- Easy to activate and easy to report obstacles and other elements
- Can take photos of obstacles and other elements
- Create database for the use of planners
- Collect live secondary data from other resources (e.g., traffic info, weather info…)
- Ask participants questions about their experience during and after the use (e.g. when you have an unexpected stop).

Funded by the Horizon 2020 Framework Programme of the European Union

CHALLENGE 6

Title
Air quality estimation: Clean Window Day

Background and problem
Particulate matter (PM, suspended particles) in air, resulting from traffic, industries, heating, cause huge health problems and costs for the society. There are huge spatial variations in PM levels, and the quality of air can be an important factor for instance when choosing the residence area.

Objective
To engage citizens across Europe in the collection of data regarding the PM deposition. Procedure: Windows are washed and left for three weeks and wiped with a standardized tissue. Tissues (and a clean control tissue) are photographed using the mobile application, under standard conditions. Location (coordinates), orientation of the window and date of the measurement are recorded. The application will provide a map and a position of the submitted sample data on an indicative scale for PM levels as a direct feedback to the user. The application should also provide an interactive map for air quality in different regions.

Possible functionality needs
- camera usage
- GPS awareness
- resolution awareness
- orientation of the window
- frequency of the events
- map service

Intended users
Citizens, decision/policy makers, environmental agencies, scientists, urban planners, health care.

Software guidelines:
- Creating a user profile (location)
- Get a photograph
- Show and save the photo
- Detecting the grey level of two images (comparison of the clean and used tissue)
- Visual augmentation of the map service to describe the pollution level

Funded by the Horizon 2020 Framework Programme of the European Union

The land user

CHALLENGE 7

Title
Landuse camera function

Short description
A software library that will handle the smartphone's camera for Land Use/Land Cover (LU/LC) apps.

Background and problem
A lot of the LU/LC apps are taking advantage of the smartphone camera since they are based on the visual examination of geo-tagged photos. While in-situ and timely data is a great advantage for such applications, many times the photographs taken are not fit-for-purpose. Close-ups, too much sky, not enough land or misleading zoom levels of the photographs can hinder the photo-interpretation.

Objective
To develop a small software component that guides a citizen scientist to collect a geo-tagged photo with a smartphone. The software should help the user during the picture taking to align the picture to the horizon, indicate the amount of sky, remind the user that there should be no zoom in, that the gps should be active and there should not be any other obstacles in the view, etc.

Possible functionality needs
- GPS awareness
- Show the line of the horizon in a proper position
- Zoom level awareness
- Calculate sky percentage
- Flash awareness
- Provide Info/tips to the user before the photo capturing
- Panorama mode
- Resolution awareness

Intended users
Citizen scientists who want to map an area with landuse attributes and overlay this information with other geo-information such as infrastructure (transport, utilities, etc), agriculture, climate, health, etc, for research, planning and reporting purposes.

Software guidelines
- Triggered by a button click
- Get a photograph
- Show and save a photograph and auto-calculated metadata (geo-tagging, time, date, zoom level, tilt, etc.)
- Show a form for further action (e.g. enable user-created metadata, such as title, description, toponym, etc.)

Funded by the Horizon 2020 Framework Programme of the European Union