Modular designed Apps – an opportunity to standardize data collection methods and to encourage the reuse of software

AgriSens DEMMIN 4.0

Sina C. Truckenbrodt[1,2], Maximilian Enderling[2,3], Carsten Pathe[1,2], Erik Borg[4,5], Christiane C. Schmullius[1] & Friederike Klan[2]

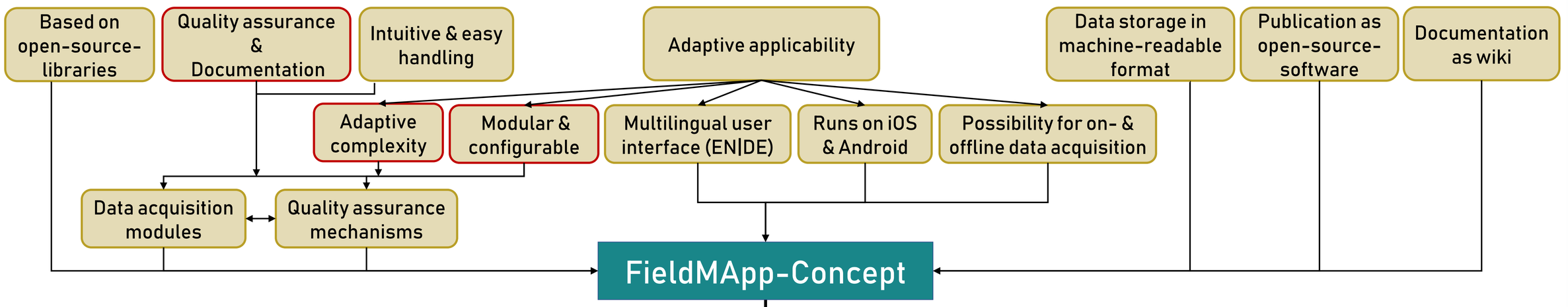
1 Friedrich Schiller University Jena (FSU), Institute of Geography, Earth Observation, Grietgasse 6, 07743 Jena (Germany), sina.truckenbrodt@uni-jena.de | 2 German Aerospace Center (DLR), Institute of Data Science, Citizen Science, Jena (Germany)
3 FSU Jena, Faculty of Mathematics and Computer Science, Jena (Germany) | 4 DLR, German Remote Sensing Data Center, National Ground Segment, Neustrelitz (Germany) | 5 University of Applied Sciences Neubrandenburg, Geodesy and Geoinformatics, Neubrandenburg (Germany)

Motivation

Data collection strategies and the quality of the collection vary for parameters that are measured or observed in different citizen science projects. This makes it difficult to merge data of the same kind from different projects and thus hampers the reuse of data. Modular designed and customizable applications for mobile devices (Apps) represent a framework that can help to foster the standardization of data sampling methods and strategies. At the same time, they provide enough flexibility to be adjusted for the use in various scenarios. In this contribution, a corresponding framework is presented by the concept and the structure of the FieldMApp.

Requirements

The aim is to develop a universal basic concept for the data collection by citizens. This concept should be deployable in a wide range of (scientific) fields and its core should be retained during future developments.



Aims

Configuration possibilities

- Tool that is applicable for a wide variety of questions from diverse scientific fields
- Tool for standardizing the data collection by citizens

Adaptive complexity

- The complexity of the data collection method can be adapted depending on the research question

Quality assurance

- Estimation of the total data collection error = combination of the estimated accuracies for all systematic and random errors

Structure

Modular design of the FieldMApp

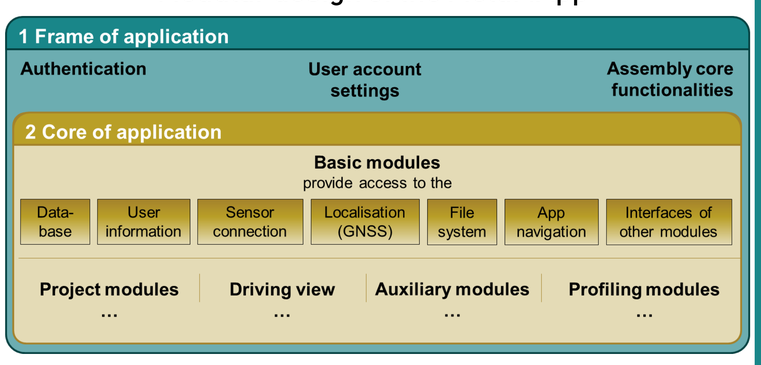


Fig. 1: Modular design of the FieldMApp that is structured by (1) a fixed frame and (2) modules in the core. Core modules (like project modules, driving view, auxiliary modules and profiling modules) can be arranged in accordance with the task they should fulfill and can be built upon the fixed basic modules that provide basic functionalities.

Data collection method

simple

- ODK-based projects
- Form elements, e.g.:
  - Selection lists
  - Numerical/ textual answers

complex

- Self programming
- Integration of auxiliary modules, e.g.:
  - Speech recognition
  - External dGNSS

Complexity of the task

Implementation effort

Complexity of the App

Concepts for the estimation of …

(1) errors that are inherent in the system:
   a. Estimation of software inherent accuracies
   b. Calibration of integrated measurement devices

(2) the user accuracy:
   a. Competence assessment based on reference data sets (profiling part 1)
   b. Self-assessment (profiling part 2)
   c. Verification of the skills of the user based on secondary data sets that are recorded by the user (immediately prior to or after the data collection)

Examples for realisations

Various application scenarios

Fig. 2: Collection of biophysical field crop characteristics and management information (Photo: S. Truckenbrodt)
Projects:
Biophys DEMMIN
Radar-Crop-Monitor

Fig. 3: Mapping of the understorey in forests exemplified by ferns (Photo: C. Pathe)
Project:
Ökosystem Wald/Roda

Fig. 4: Mapping of low yield areas (aerial image: Google Earth 2021)
Project:
AgriSens-DEMMIN 4.0

Mapping of low yield areas

simple

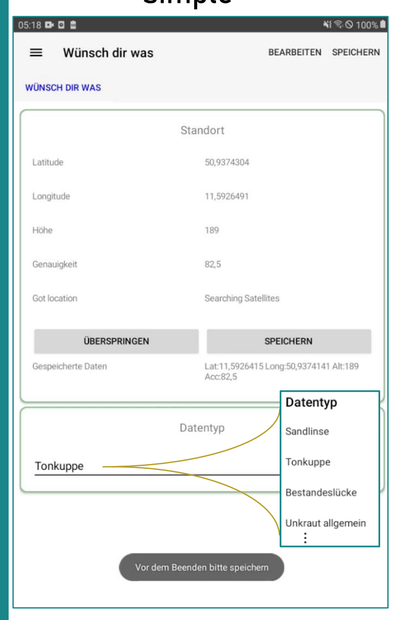


Fig. 5: Screenshot of data collection form

complex

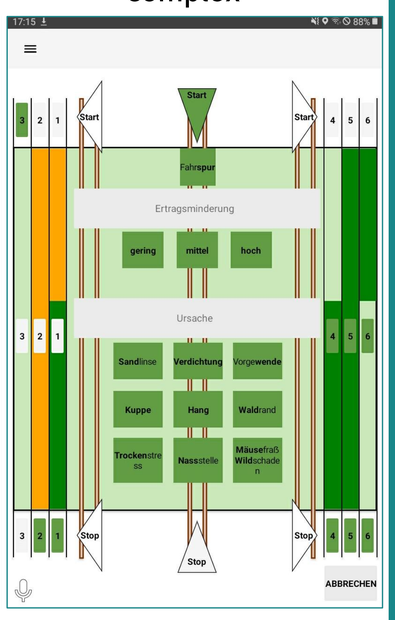
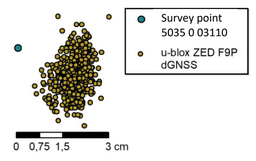


Fig. 6: Screenshot of driving view

(1a): Analysis of the accuracy of the speech recognition : Determination of the editing distance of keywords for a weighted keyword recognition test
→ recognition rate: 99.4 % (N = 1072)

(1b): Calibration of the low cost dGNSS sensor ZED F9P at a survey point (TLBG 2021):

	Northing [cm]	Easting [cm]
Accuracy (RMSE)	1,1	1,9
Precision (SD)	0,6	0,4



(2a): Profiling

Fig. 7: Screenshot of profiling (part 1)

Potentials for further development

- Which other aspects should be taken into account by the FieldMApp concept from your point of view?
- Which other quality assurance mechanisms should be integrated into the FieldMApp concept?
- Which (further) information should be considered in the wiki?
- …

References

Google Earth (2021): Broock. (Acquisition date: 2018-08-06).
Landesamt für Bodenmanagement und Geoinformation (TLBG) (2021): Auszug aus dem amtlichen Festpunktinformationssytem. Einzelnachweis Lagefestpunkt 5035 0 03110.

Acknowledgements

The project 'AgriSens - DEMMIN 4.0' is funded by the German Federal Ministry of Food and Agriculture (BMEL; grant no.: 28-D-E1.14B-18) and the projects 'Biophys DEMMIN' (grant no.: D7943/67250243) and 'Ökosystem Wald/Roda' (grant no.: D7943/67250303) are financed by DLR. The authors cordially thank Dr. Anja Heßelbarth (TU Dresden) and Thoralf Noack (DLR Neustrelitz) for their extensive support during the integration of the low-cost dGNSS sensor. We express our gratiude to Jan Füsting, Maya Köhn, Max Moebius and Henning Woydt for their contributions to the implemention of the application „FieldMApp“.

DLR
FRIEDRICH-SCHILLER-UNIVERSITÄT JENA
With support from Federal Ministry of Food and Agriculture by decision of the German Bundestag
ptble Projektträger Bundesanstalt für Landwirtschaft und Ernährung