Development of a smartphone/tablet app for cereal stand counts

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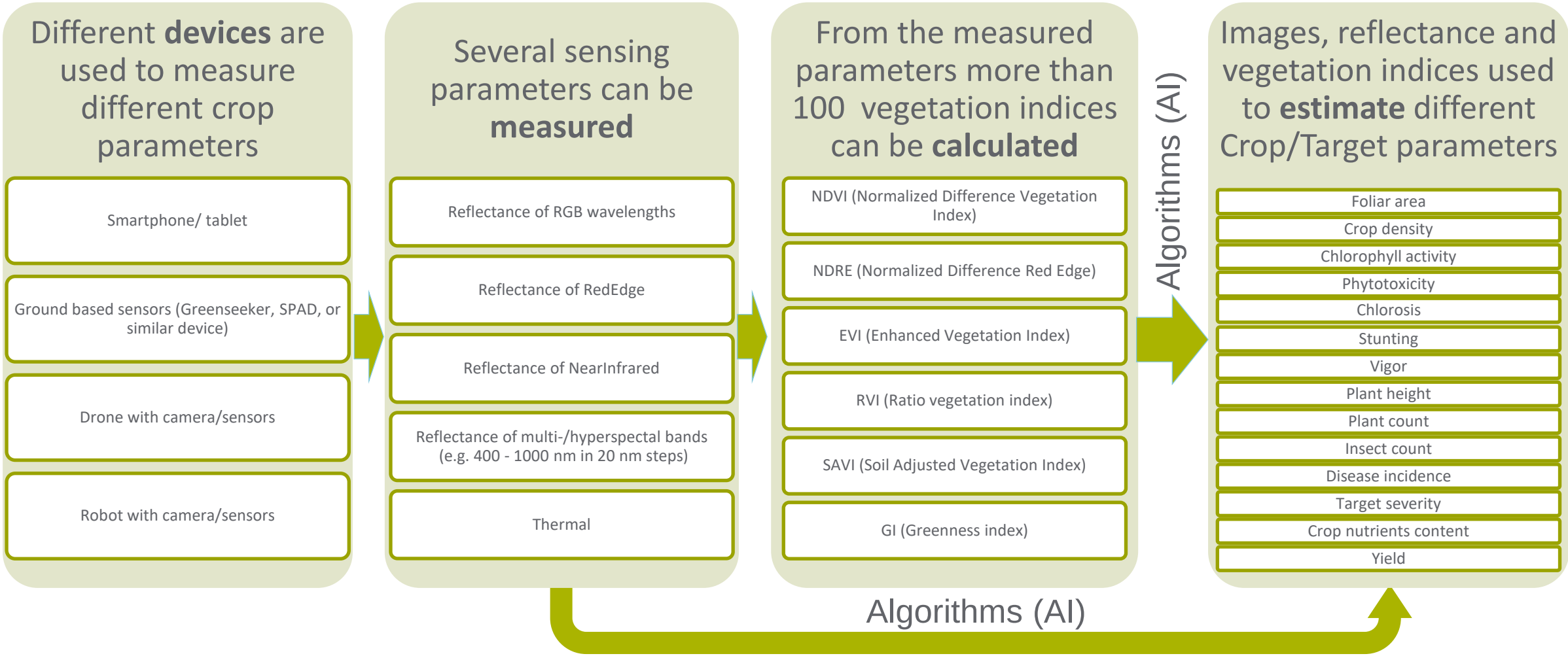
Remote/proximate sensing - The Basics



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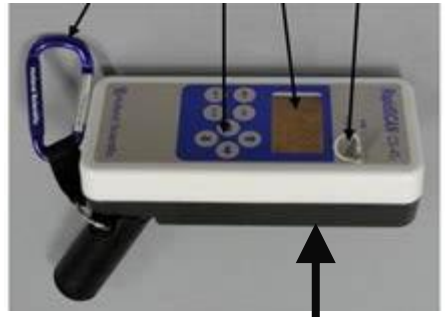
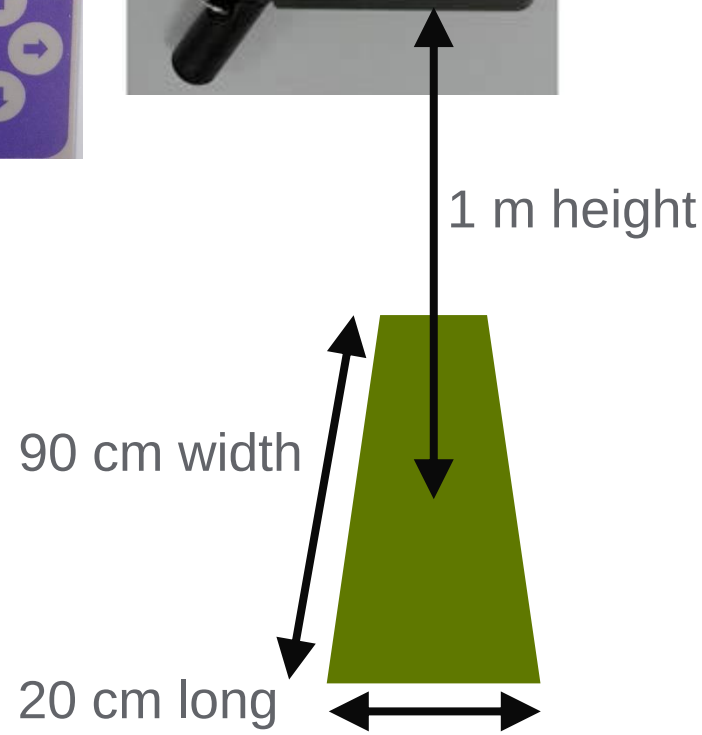
Example: Proximate canopy sensing with RapidSCAN

- Own light source (not sunlight dependent)
- Continuous scanning when moving (variable plot sizes)
- Measures %Reflection in Red, Red-Edge and Near-Infrared
- Calculates NDVI and NDRE (including standard deviation & coefficient of variation), more VIs can be done in Excel/ARM
- Additional site data (GPS)
- Records data and transfer to PC (Excel/ARM)





PLOT	NDRE	NDVI	RE	NIR	R	LATITUDE	LONGITUDE	ELEVATION	HDOP	FIXTYPE	DATE	TIME	N
1	0.2763	0.774	20.046	35.358	4.503	50.237274	8.5841973	228.9	2.54	GPS	280122	123011	29
2	0.2834	0.7824	19.954	35.741	4.362	50.2372925	8.5841763	217.6	0.91	GPS	280122	123015	24
3	0.2829	0.784	19.96	35.714	4.325	50.2372861	8.5841656	220.2	0.91	GPS	280122	123019	25
4	0.2873	0.7857	19.904	35.952	4.313	50.2372838	8.5841626	221.3	0.91	GPS	280122	123023	20
5	0.2829	0.7827	19.961	35.709	4.353	50.2372835	8.5841601	221.7	0.91	GPS	280122	123027	21
6	0.2824	0.7841	19.967	35.682	4.318	50.2372835	8.5841575	221.9	0.91	GPS	280122	123031	25
7	0.2826	0.7823	19.965	35.693	4.36	50.2372826	8.5841573	222.1	0.91	GPS	280122	123035	25
8	0.2848	0.7846	19.936	35.818	4.324	50.2372785	8.584161	223.1	0.91	GPS	280122	123039	20

Other digital tools used in Syngenta EAME

- **GreenSeeker**: handheld crop sensor used as measurement device for NDVI from the biomass and will present an average of the health or vigor of the crop
- **SPAD:** Soil Plant Analysis Development Device
- **Stenton FarmLab**: On-Field soil analysis
- In evaluation: App for greenness measurement, assessments using drones as platform

Cereal Counter app.

Background

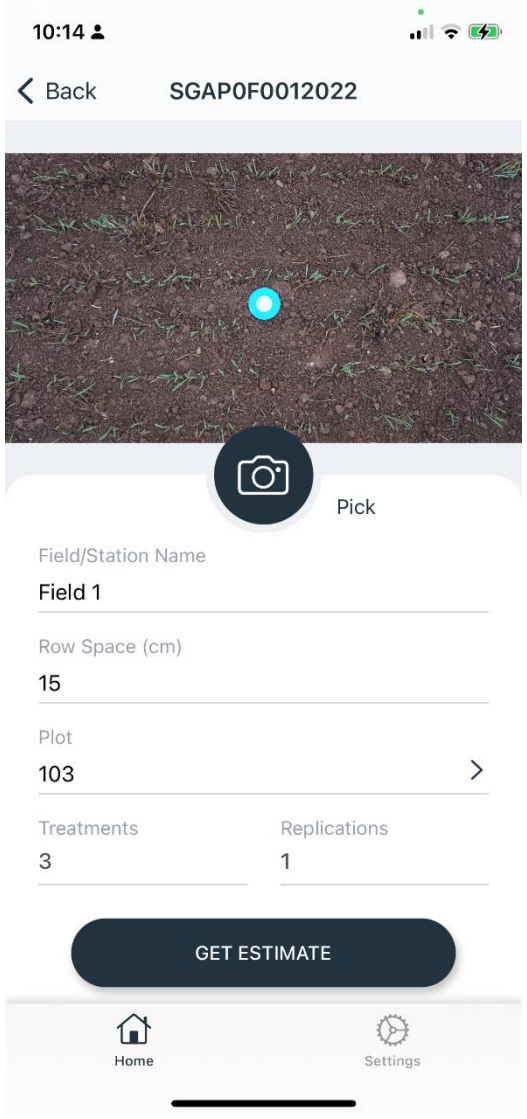
- Stand count or count of emerged plants is a common assessment done in seed care trials in cereals and other crops, however it is time consuming.
  - On average, it can take up to 90 minutes to do a stand count assessment

Goal

- An application that counts the number of emerged cereal plants (50% emergence & 1-2 leaf stage) without reduction in accuracy
  - Simple & monotonous assessment = can now be done within seconds

KPI

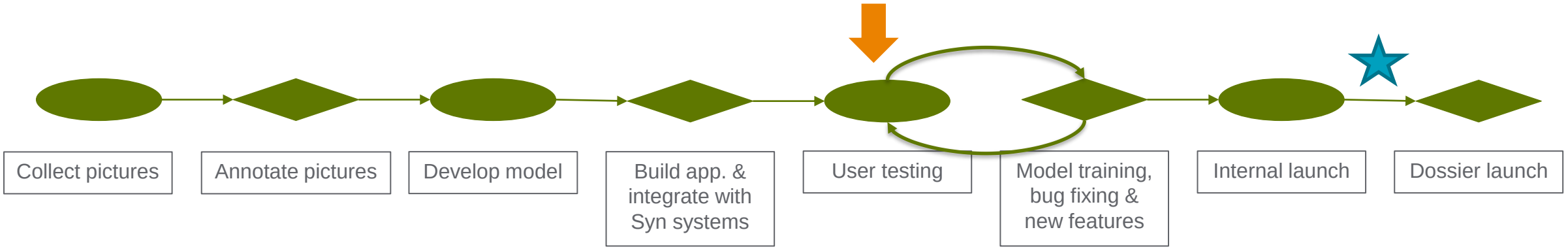
- <10% Deviation from manual assessment



Cereal Counter app.

Status

- Currently in Pilot phase
  - Refinement of model to take place during user testing



Current position

Reached KPI

Cereal Counter app.

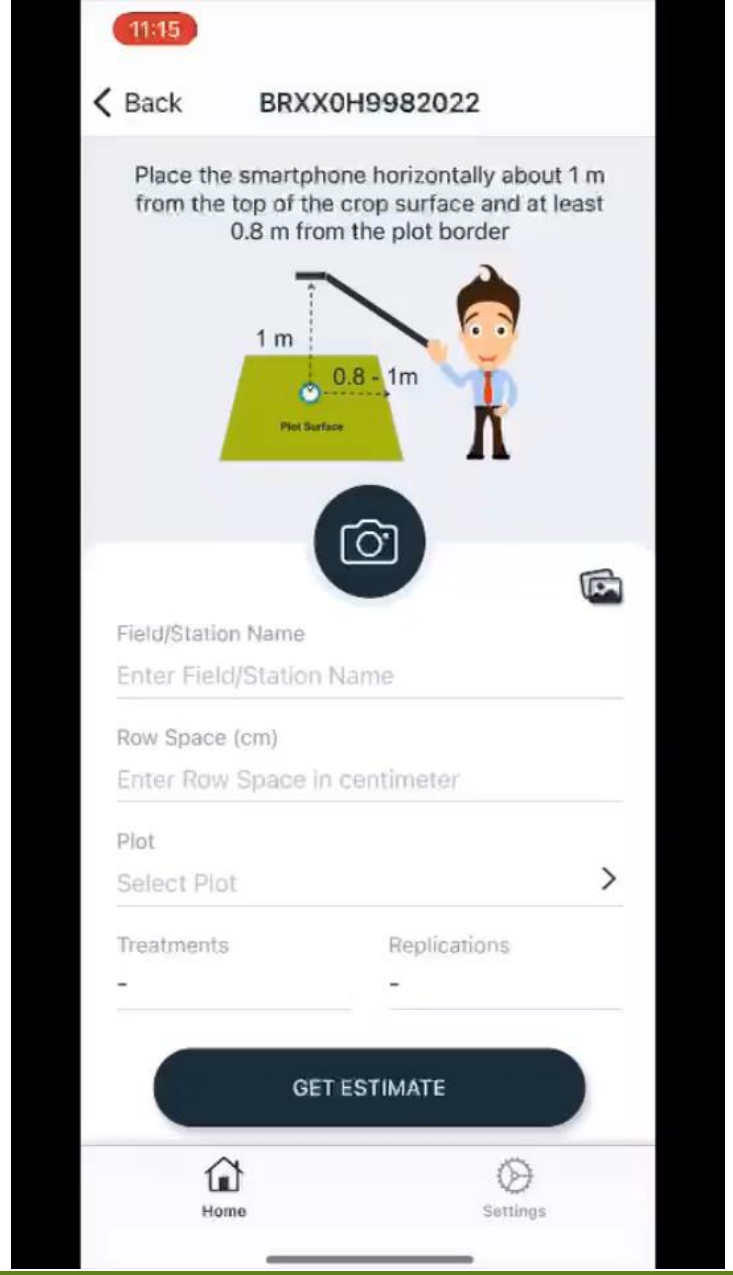
Model

- Blended model based on machine learning from a training dataset and synthetic images (predicted plant locations)
- The training dataset is comprised of annotated pictures taken under similar conditions expected in the field
  - The dataset is further enriched by applying data augmentation techniques typical for object recognition models (e.g., image rotation, image flipping etc.)

Cereal Counter app.

Results

- The output includes:
  - Count, Area, Plants per m2 and Count per row meter
- "row meter measured" per plot to be added
- Video speed 67%



Cereal Counter app.

Results

- Data comparison from test dataset