Orchard Management Information System for Harvest Forecast

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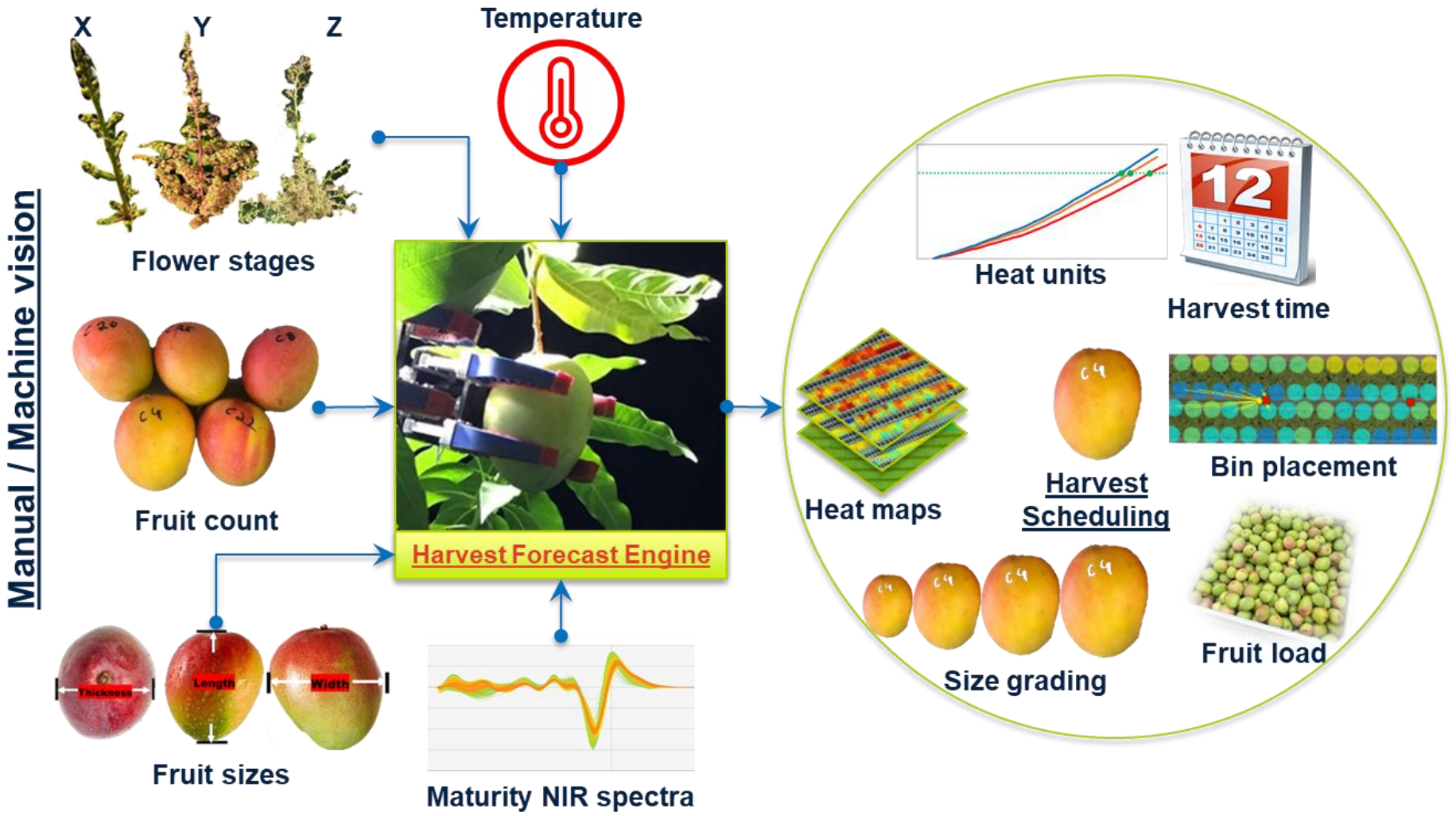
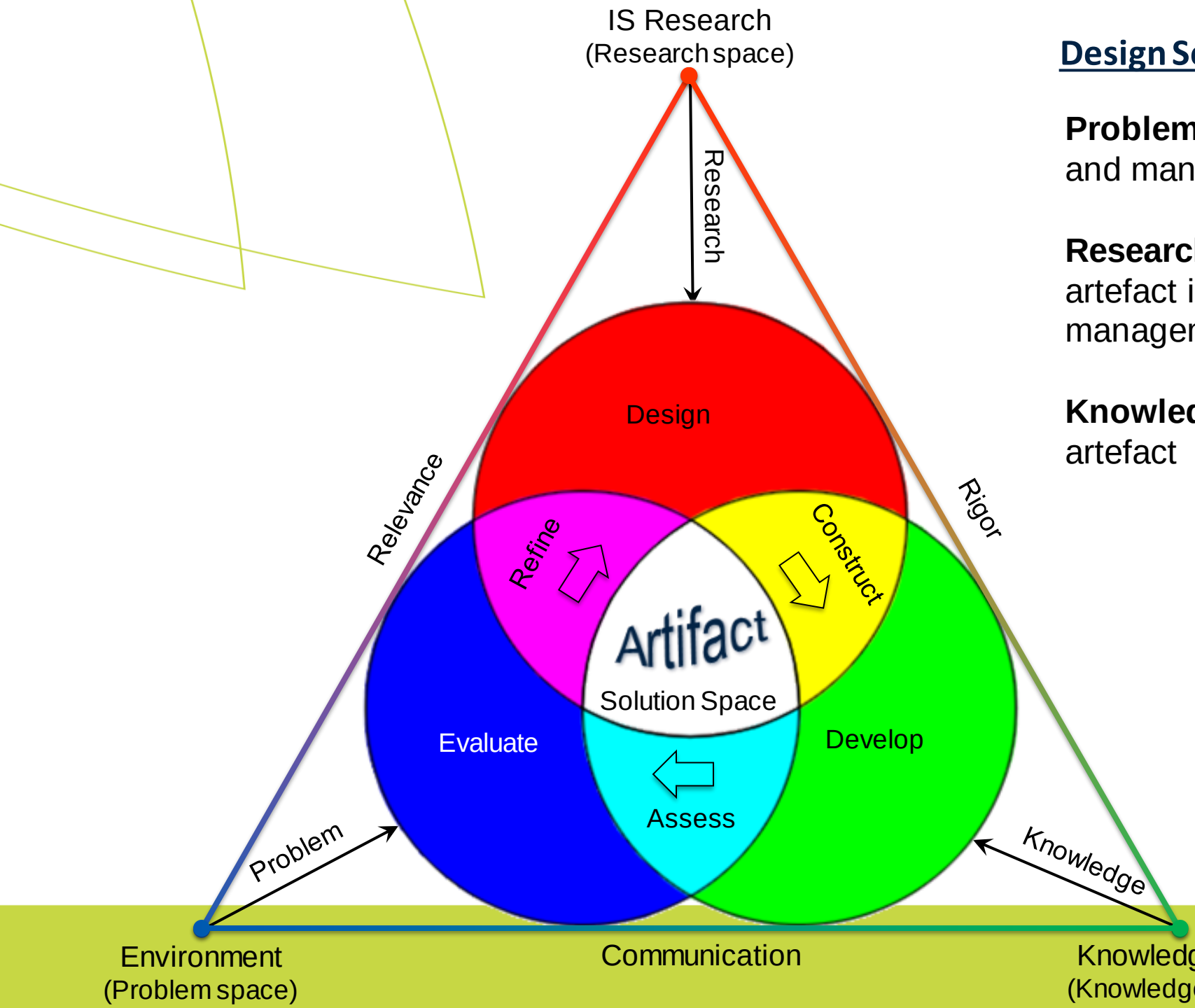
CRICOS Provider Code 00219C | RTO Code 40909

Contents

- A concept of a harvest forecast system
- DSR framework
- Three components of the system
  - Data Acquisition System
  - Harvest Forecast Engine
  - Management Information System
- Software development methodology
- Data flow
- User Interfaces
- Evaluation
- Recommendation

Harvest forecast engine: concept





Design Science Research (DSR) Framework

Problem: Forecast of harvest timing and mango fruit load

Research: Development of a software artefact i.e., mango harvest management information system

Knowledge: Use of the software artefact

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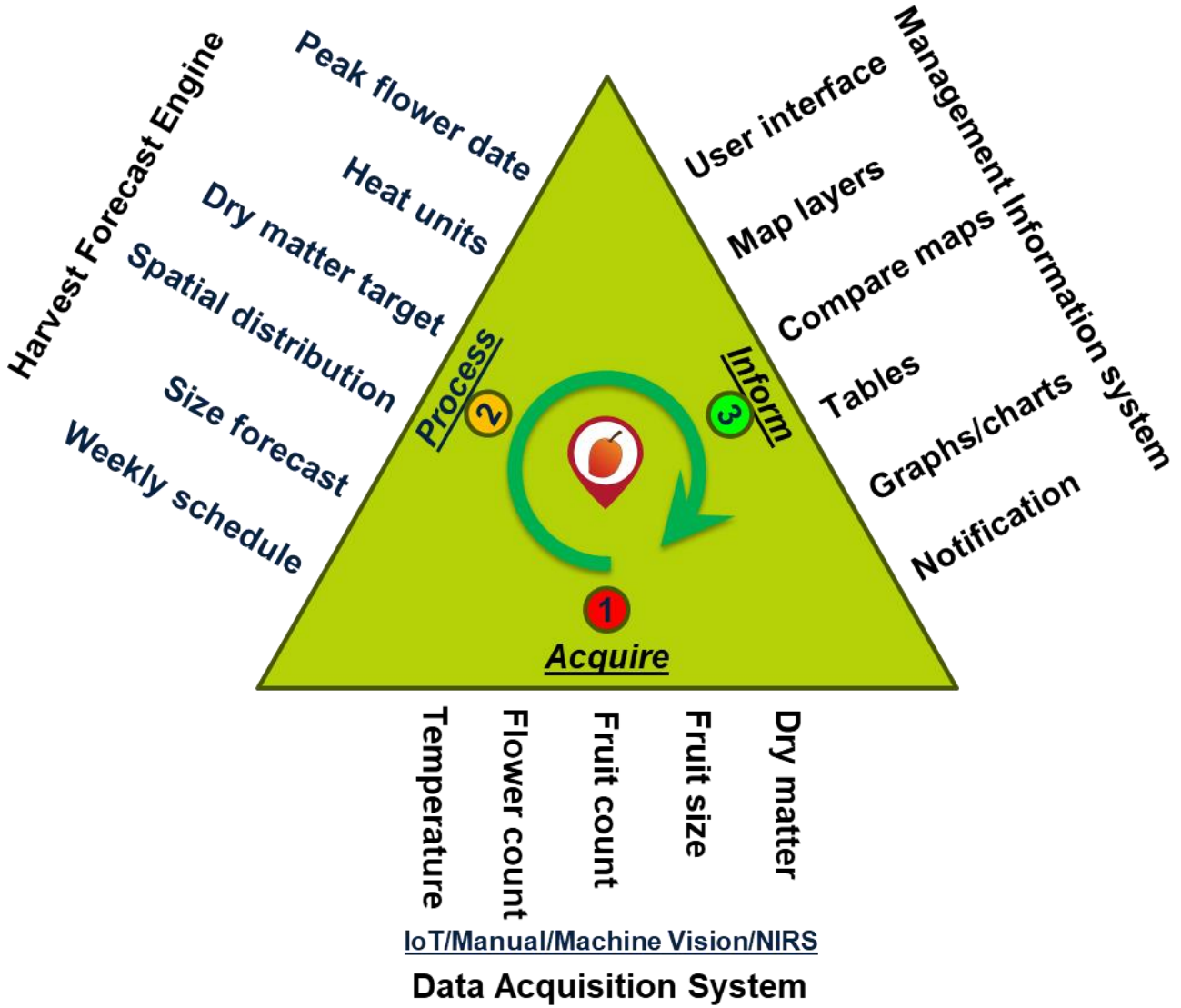
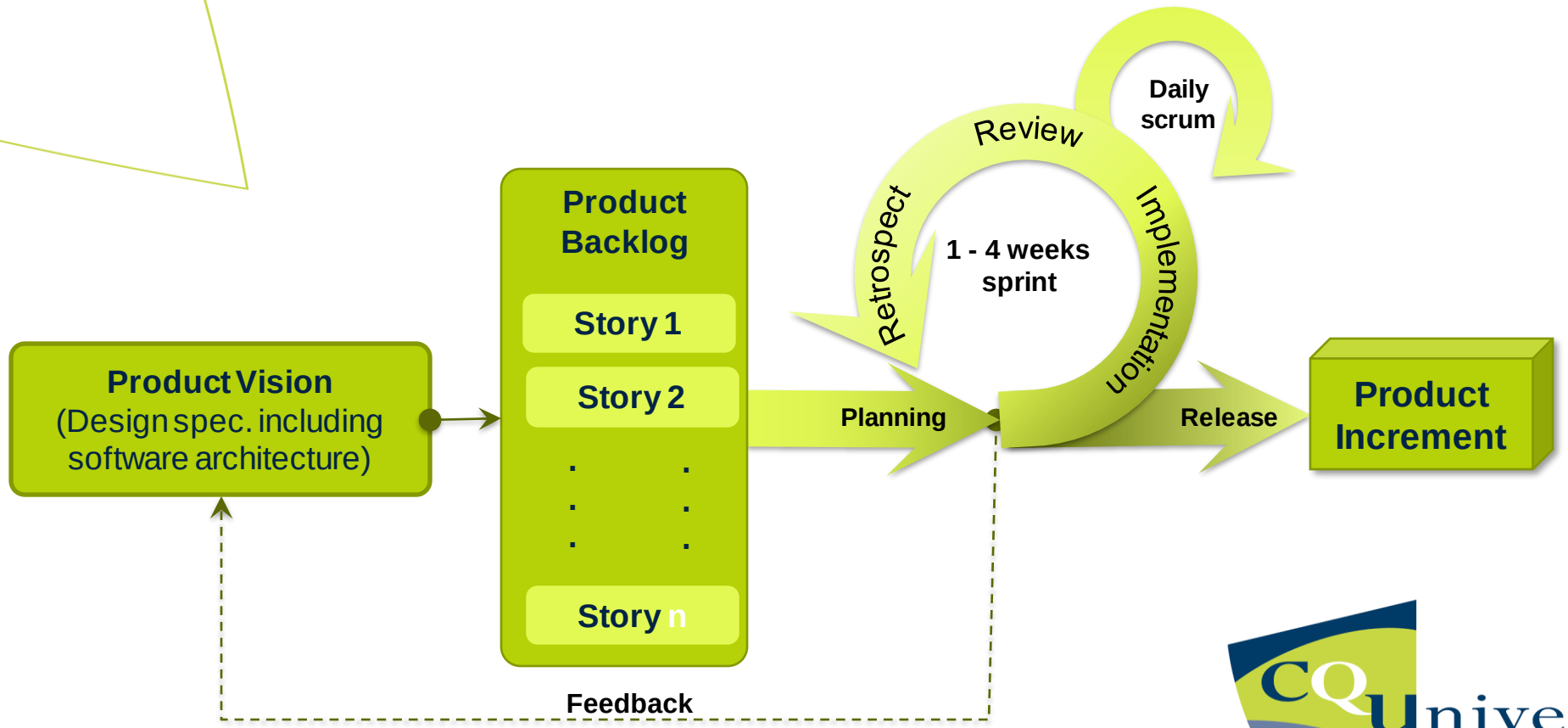
The three components of the system



Work flow in software development



Development period: 2+ seasons

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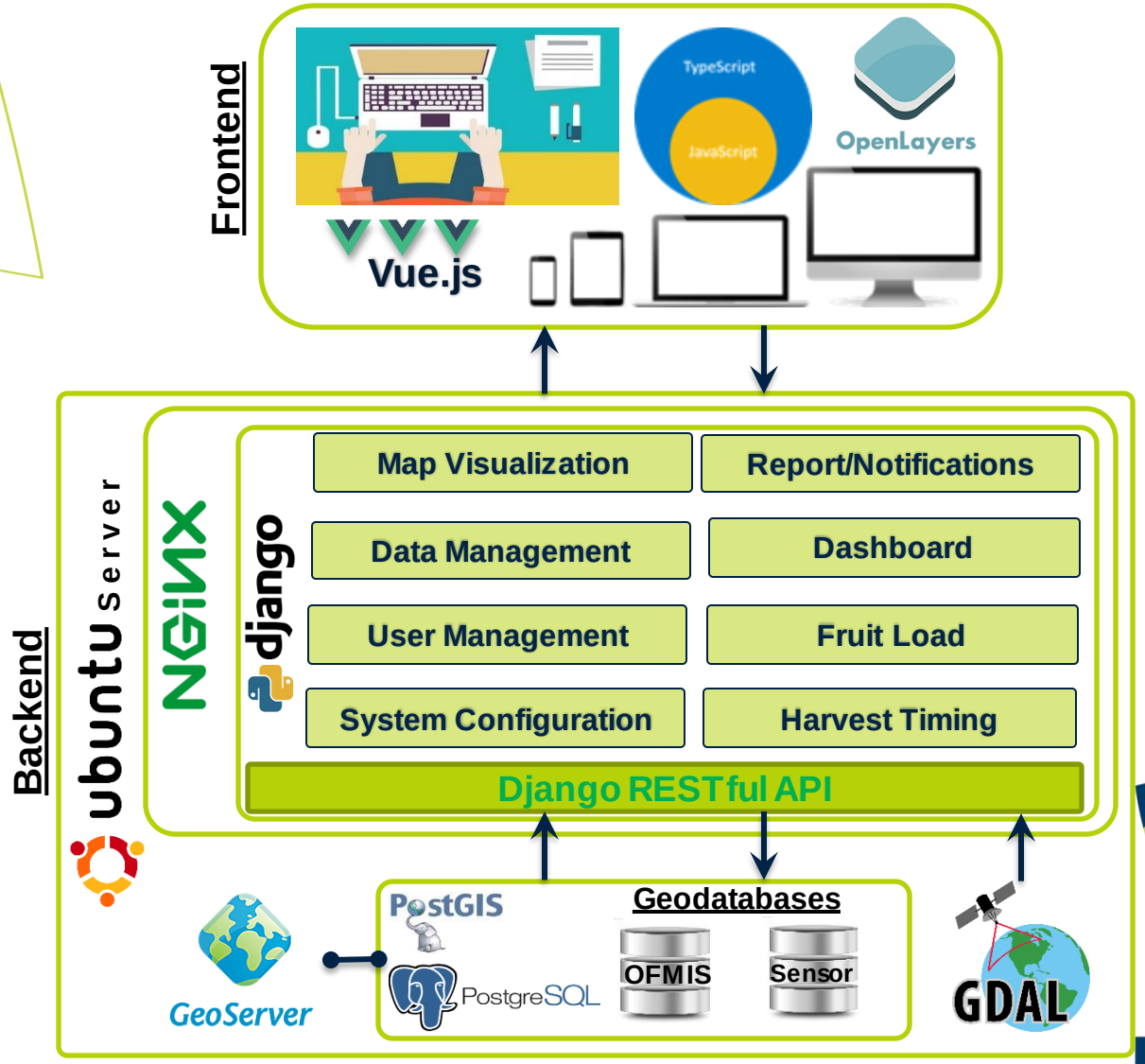
Development Framework



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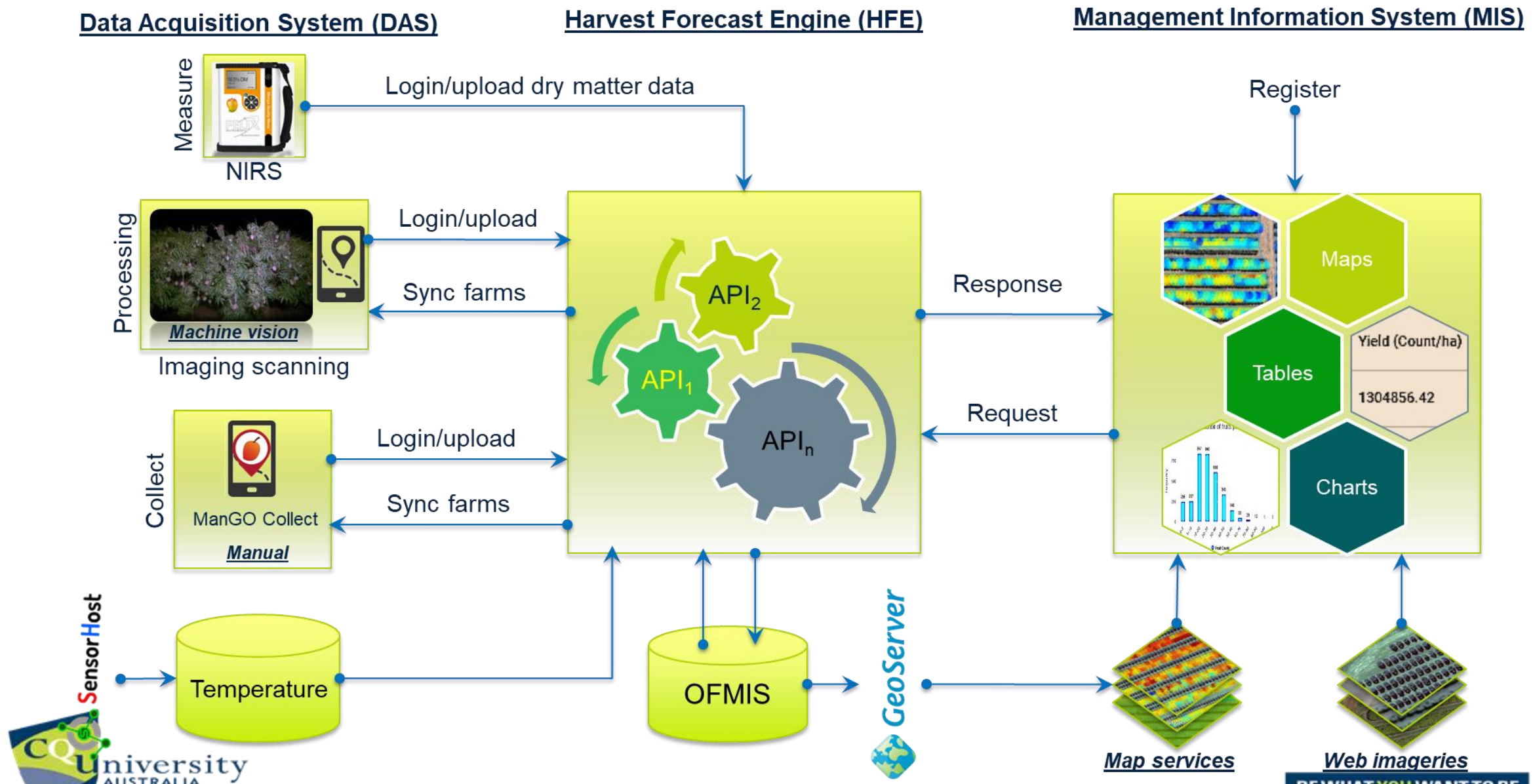
Harvest forecast engine: Data flow



Map view

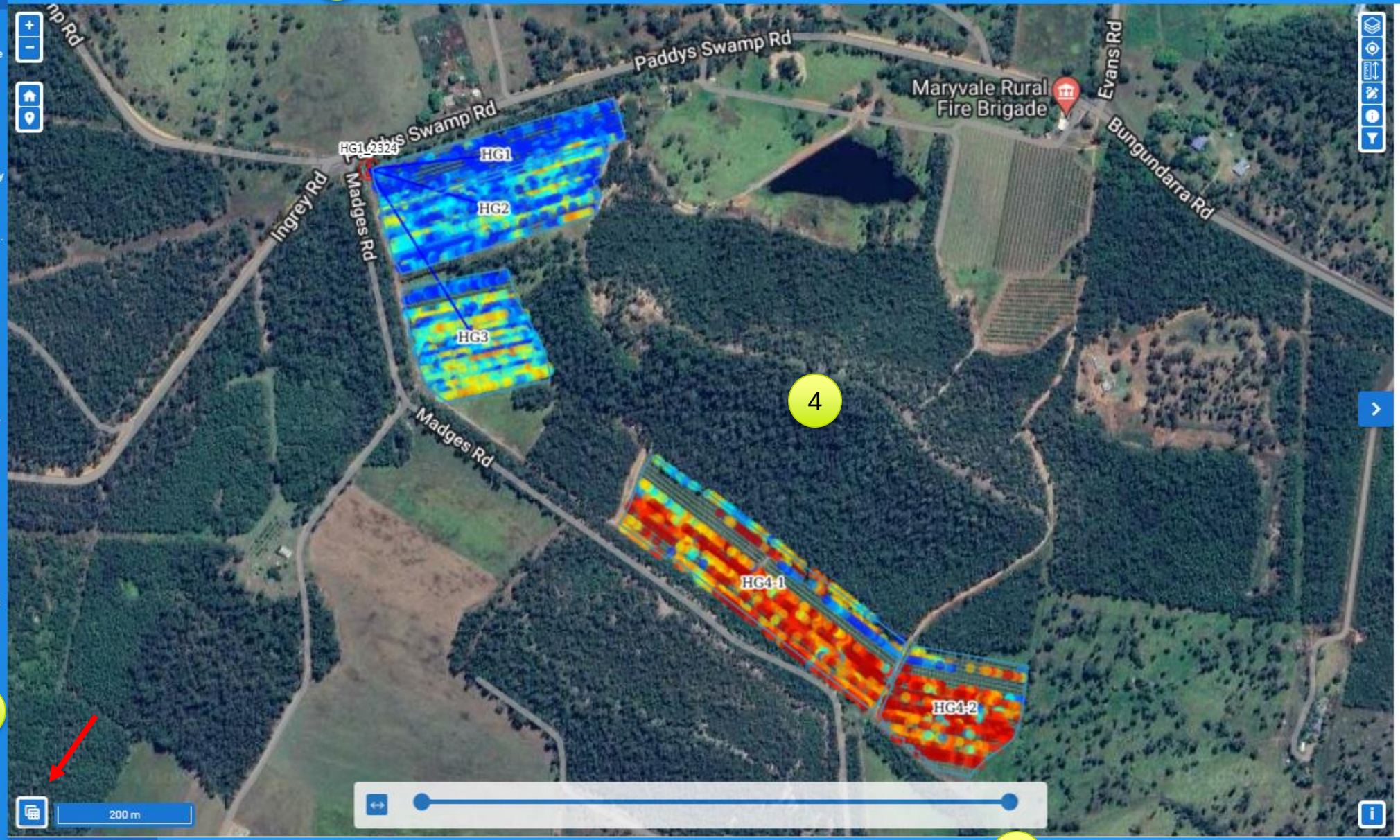
FruitMaps

1

Map
Compare
Swipe
Summary
Dashbo...
Load
Charts
Manage
Email
Forum
Settings
Help

Farm: GrovesGrown
Crop: All
Season: All
From Date: 2024-04-01
To Date: 2025-03-31

5



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Layers

- Tree
- Block
- Sensor
  - Sensors
- Met Station
  - Met Station
- Sensor Block Linkage
  - Sensor Block Linkage
- Fruit
  - Elongation (X)
  - Christmas tree (Y)
  - Flower drop (Z)
  - Flowering XY
  - Flowering YZ
  - Flowering XYZ

0-5
5-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
>100

3

6

FLOWER COUNT | FRUIT COUNT | FRUIT SIZE | DRY MATTER

2

FruitMaps

Harvest load calculator

Map
Compare
Swipe
Summary
Dashbo...
Load
Charts
Up/Down
Email
Forum
Settings
Help

Farm: GrovesGrown | Crop: Mango - HoneyGold | Season: 2021 - 2022 | From Date: 2021-04-01 | To Date: 2022-03-31

Harvest Load Calculation

Method *: Manual

Fruit Weight: 0.47 **Harvest Capacity/Week:** 200000 ± 10% Search EXPORT

FLOWERING DATA (% terminals flowered) EDIT

Date	07-23	07-30	08-06	08-13	08-20	08-27
Harvest	12-24	12-27	12-30	01-01	01-04	01-07
Block	W29	W30	W31	W32	W33	W34
HG1	10	50	70			100
HG2	0	20			60	90
HG3	0	20		40		
HG4-1	20	20			50	
HG4-2	50	50			100	

FLOWERING CONDENSED TO FLOWERING EVENTS (FE) (MATURITY ZONES) EDIT

Flower Event	07-23	07-30	08-06	08-13	08-20	08-27
Harvest	12-24	12-27	12-30	01-01	01-04	01-07
Block	W29	W30	W31	W32	W33	W34
HG1		60				40
HG2		20				70
HG3			20	20		
HG4-1						
HG4-2						

FRUIT COUNT AND WEIGHT

Block	Count	Weight	Y_{POT}
Total	1854935	871819	36395
HG1	464675	218397	7275
HG2	444808	209060	9112.5
HG3	424841	199675	3620
HG4-1	349205	164126	7662.5
HG4-2	171406	80561	8725

YIELD ESTI

Harvest	12-24	12-27
Harvest Week	W51	W52
Total	0	377651
HG1		278805
HG2		98846
HG3		
HG4-1		
HG4-2		

1 2 3 4

Chart visualization – 1

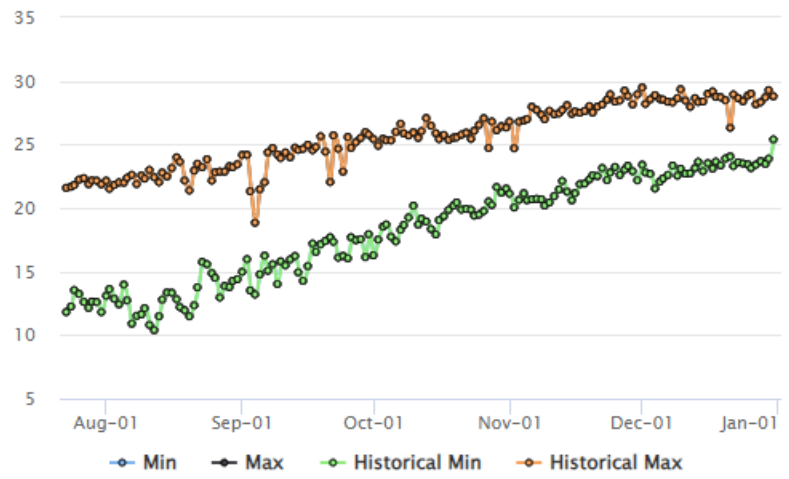
Farm: GrovesGrown | Crop: Mango - HoneyGold | Season: 2020 - 2021 | From Date: 2020-04-01 | To Date: 2021-03-31

Chart Reports for Selected Block

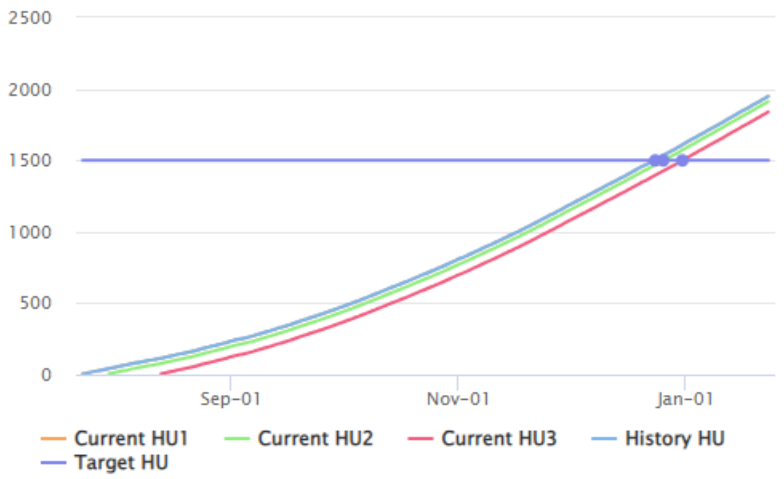
Select Block: HG1 | Select Heat Unit Method: Standard Method

Flower Date: 2020-07-23 | **Target Heat Unit:** 1500 | **Estimated Harvest Date:** 2020-12-24

Temperature time course

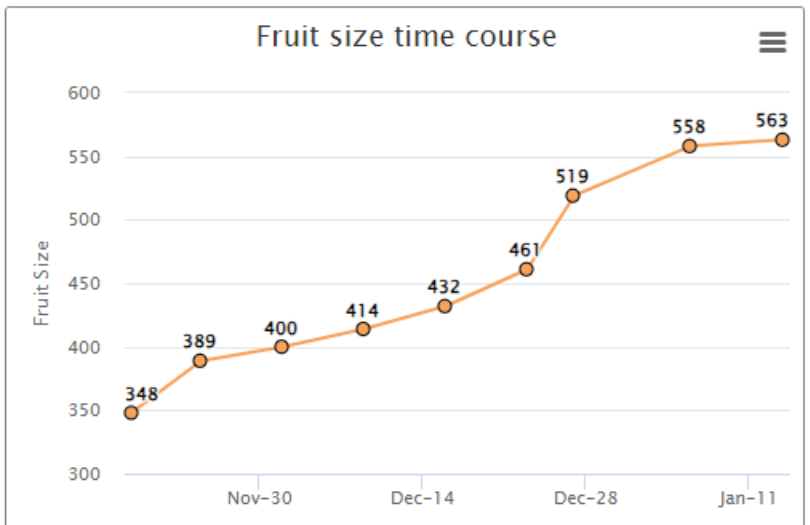


Heat units time course

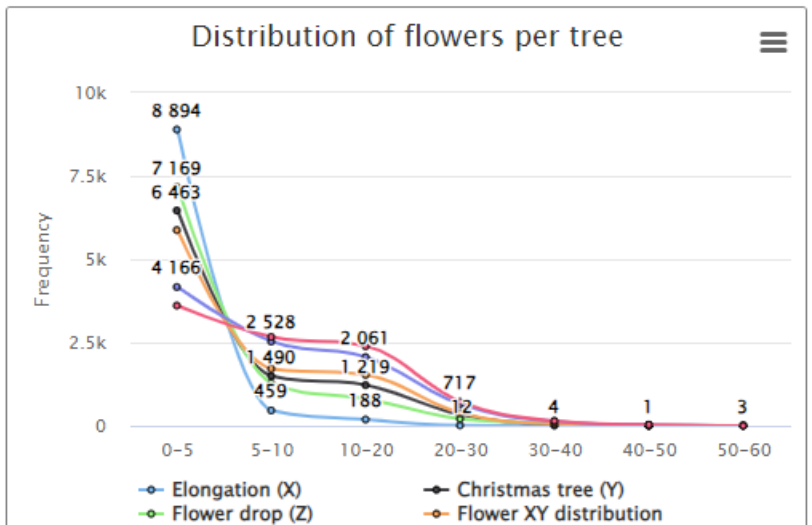


Distribution of fruits by fruit size

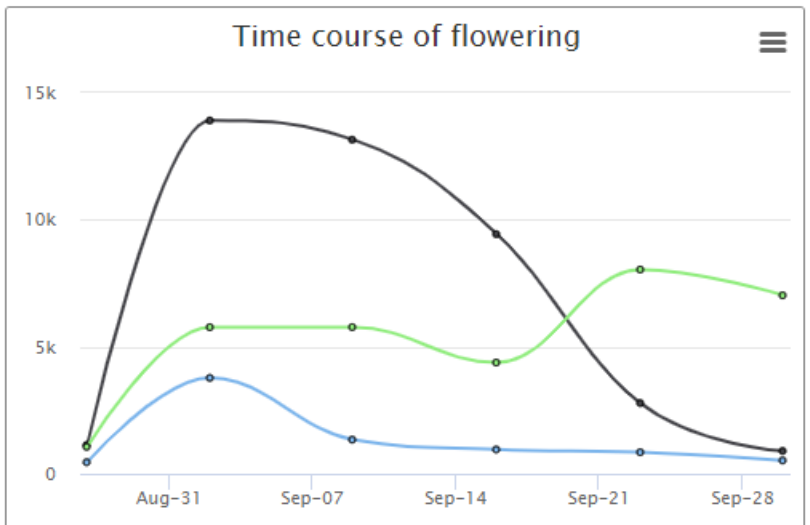
Fruit size time course



Distribution of flowers per tree



Time course of flowering



Harvest bin location plan

FruitMaps

Map
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Farm: GrovesGrown
Crop: Mango - HoneyGold
Season: 2021 - 2022
From Date: 2021-04-01
To Date: 2022-03-31

Layers

- [x] Tree
- [x] Block
- [x] Sensor
  - Sensors
- [ ] Met Station
  - Met Station
- [ ] Sensor Block Linkage
  - Sensor Block Linkage
- [x] Fruit
  - ( ) Fruit Count
  - (•) Field Bins
  - ( ) Fruit Photo
- [ ] Diary
  - Diary Layer

FLOWER COUNT | FRUIT COUNT | FRUIT SIZE | DRY MATTER

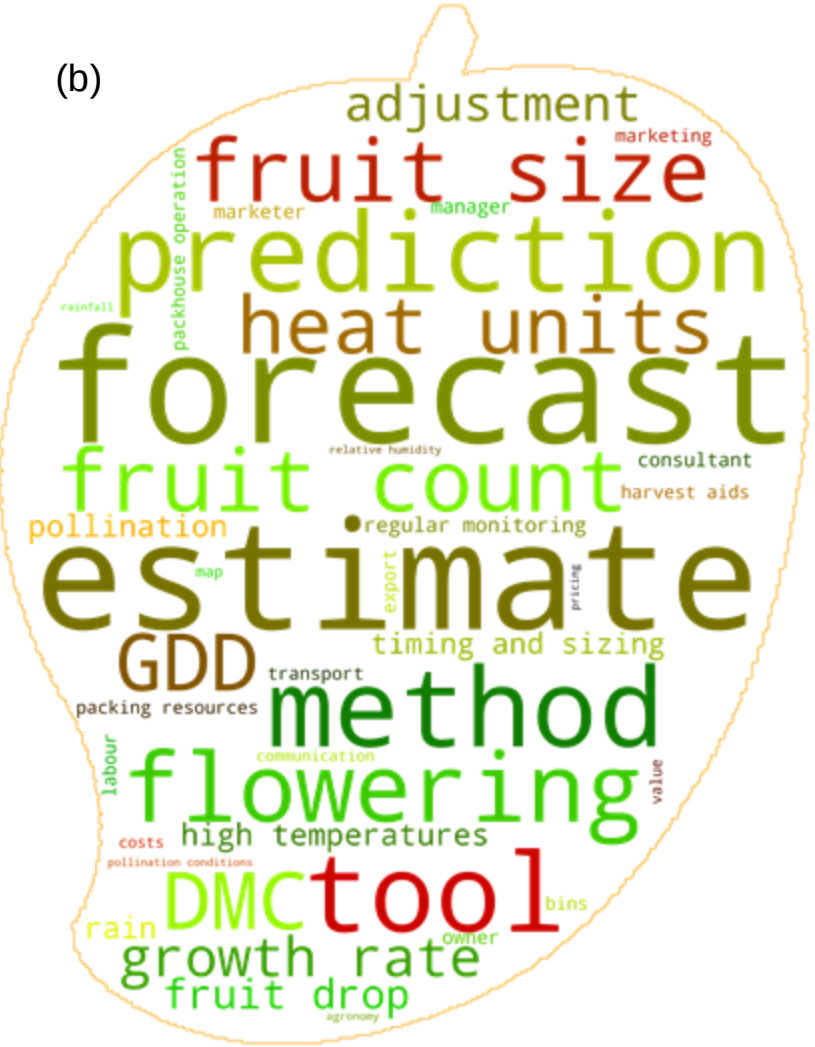
Evaluation: quantitative

Feature	Test case	Old system	New system
Data upload	Upload of ten thousand records of fruit count data.	4 min 39.57 seconds.	0.912 seconds including csv upload time of 0.295 seconds.
Rendering	Map rendering of 23,080 records of fruit count data across several blocks.	7 min 12.73 seconds, including data reading/processing time of 38 seconds.	All map rendering was completed within 1.26 seconds.
	Map rendering of 98,438 records of fruit count data spread in all farm area of 258.53 ha.		All map rendering was completed within 6.10 seconds.

Evaluation: Qualitative with an interview

(a)

(b)



(c)

Recommendations

- RS method for regional level forecast
- Data capture, local or global datum?
- GPS accuracy of <2 m for data capture
- Visualization data over online imagery
- Manual vs machine
- Operationalization
- Data privacy