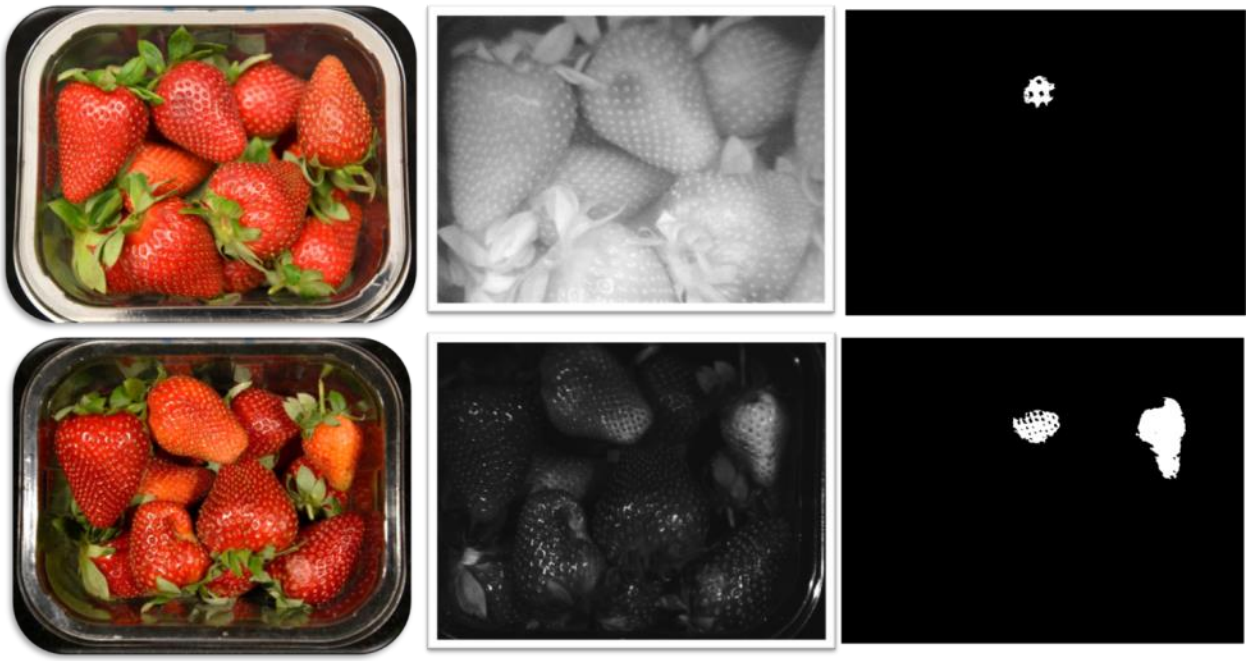
DRAFT High Level Requirements:

Punnet Quality Assurance



Abstract

This document serves to outline the high level requirements for the development of a machine vision system that will check that packed strawberries in an open transparent punnet meets customer requirements. This is a working document and is subject to change.

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Version Control

Ver	Date	Initial	Changes
0.1b	14/1/2016	RFB	First draft ONLY.

INDEX

1. INTRODUCTION

Strawberry prices have stagnated for more than 30 years yet labour costs continue to rise putting grower margins under increasing pressure. At the same time the supermarkets are imposing increasing stringent quality standards on strawberries sold to supermarkets (more than 90% of the market). With margins being squeezed, the labour cost required to carefully check that each punnet meets the customer's requirements is prohibitive which makes it extremely challenging for growers to meet the quality requirements of their customers.

The machine vision based quality assurance system (QAS) for checking strawberry punnets that is under development will enable cost-effective, repeatable and accurate quality control of packed punnets versus the grower requirements.

This document is the master document from which more detailed designs will be developed as illustrated in Figure 1.

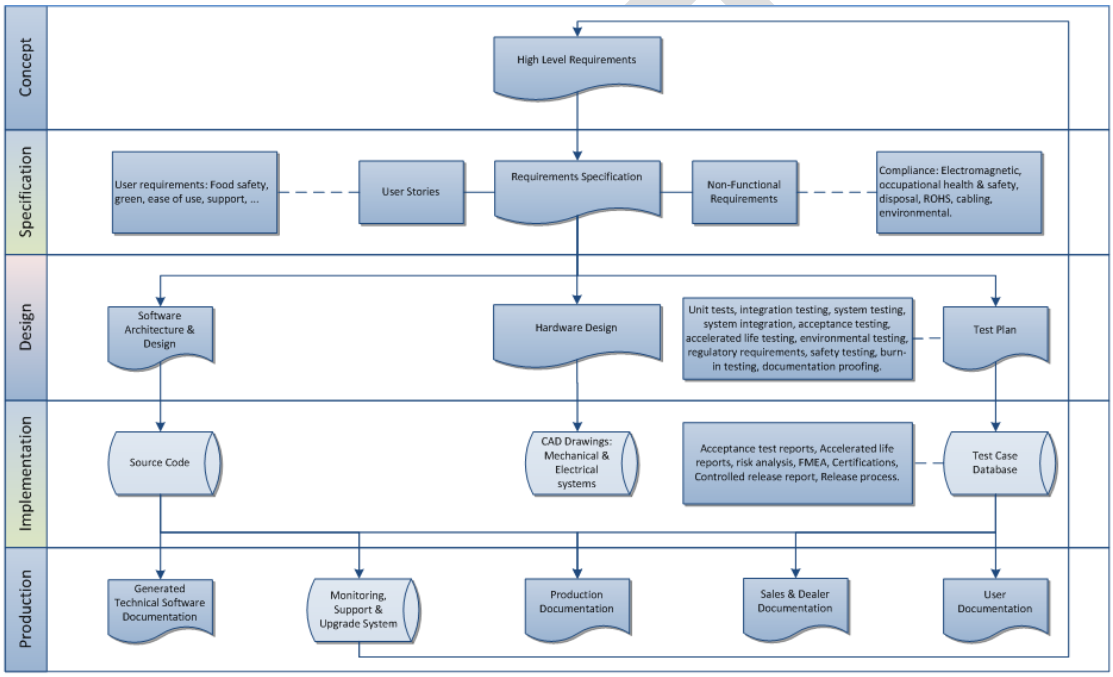

Figure 1: Guide to technical documentation.

2. PERFORMANCE & FUNCTIONALITY

2.1. GRADING

a. The QAS must be configurable to specific customer requirements including the maximum:

i. Number of over-ripe fruit area and number exceeding darkest acceptable colour).
ii. Number of unripe fruit (area lighter than the lightest acceptable colour).
iii. Number of green tips (area and number of green tips).
iv. Number of white shoulders (area and number of white shoulder).
v. Number of puncture wounds detected.
vi. Number of misshapen fruit.
vii. Fruit count (based on estimate from counting calyxes).
viii. Area of soiling or other foreign objects.
ix. **Area/number of bruises.**
x. Strawberries above temperature limit??
xi. Brix??

REFER to Coles specifications??

2.2. OPERATOR INTERFACE

a. The QAS must allow for easy operation by unskilled operators, including:

i. Easy calibration and maintenance.
ii. Ability to select preconfigured customer requirements.
iii. Report on rejected punnets highlighting in an image of the punnet why the rejection occurred.
iv. Daily statistics.
v. Weekly Statistics.
vi. History.

2.3. SAFE OPERATION

a. The QAS must be safe and simple to operate such that an unskilled operator can intuitively and quickly activate an emergency stop.

b. Signage that may impact on safety of operation must use clear unambiguous universally recognizable symbols.

2.4. RELIABILITY

a. Failure mode and effects analysis is required to identify and mitigate likely failure modes.

b. Demonstrate Mean Time between Failure of better than 1,000.

2.5. DESIGN LIFE

a. The design life for all components of the Harvester must be at least 5 years.

2.6. SERVICABILITY

a. An Operator Manual is required.

3. SOFTWARE IMPLEMENTATION REQUIREMENTS

To help ensure the long-term maintainability of the code base the following architectures, platforms, development environment and version system have been:

3.1. PRIMARY PLATFORM

The primary platform for software development will be:

a.

3.2. DEVELOPMENT ENVIRONMENT

The development environment will consist of the following:

a.

4. COMPLIANCE REQUIREMENTS

As a minimum requirement, the QAS must:

4.1. ELECTROMAGNETIC COMPLIANCE

a. Demonstrate electromagnetic emissions compliance to the required standards for Australia.

4.2. OCCUPATIONAL HEALTH & SAFETY

a. Pass a safety audit that compliance with occupational health and safety regulations.

4.3. FOOD SAFETY

a. Adherence to DAFF (Department of Agriculture, Forestry & Fisheries) Guidelines for On-Farm Food Safety for Fresh Produce:

http://www.daff.gov.au/__data/assets/pdf_file/0003/183171/guidelines_onfarm_food_safety_fresh_produce_2004.pdf

b. Adherence to Coles, Woolworths, Costco and Aldi Produce Category Requirements.

http://www.wowlink.com.au/cmgt/wcm/connect/8bce5e004f02cc6a96a29f64aa8be21f/WQA_Category_ProduceJune09.pdf?MOD=AJPERES

4.4. ENVIRONMENTAL RATINGS

a. All components must be rated to operate in the temperature range from 0°C to 40°C.

b. Components must be rated for a higher temperature range where they may be subject to other non-environmental sources of temperature extremes such as radiant heat or the build-up of heat inside an enclosure.

c. Electronic components in enclosures must be rated to operate at up to 60°C unless acceptable heat dissipation strategies are implemented that will keep the internal temperature to below the rated temperature when the outside temperature is 40°C.

4.5. ENVIRONMENTAL TESTING

Compliance with the following tests is highly desirable. If budget limitations limit the scope of testing then alternative testing and or assessment of the expected reliability should be made:

a. Pass damp heat, steady state test to IEC 68-2-3, test Ca.

b. Pass damp heat, cyclic to IEC 68-2-30, test Db, variant 1.

c. Pass dry heat test according to IEC 68-2-2, test Bb.

d. Pass cold test shall be performed according to IEC 68-2-1, test Ab.

e. Pass thermal shock according to IEC 68-2-14, test Na.

f. Pass thermal cycling test according to IEC 68-2-14, test Nb.

5. PROCUREMENT

To facilitate continuous cost reduction, ease pressures on procurement, support and manufacturing the following guidelines to the design and sourcing of components have been adopted:

a. The supply risk of each component must be assessed and where there are no alternative suppliers with components that can directly replace the current supplier an assessment must be made of the supply risk that the single supplier poses. Appropriate measures must be taken to address the supply.

b. COTS (Commercial-Off-The-Shelf) components are preferred so as to reduce the time to market. It is highly desirable that custom components are kept to a minimum.

c. It is highly desirable that the number of individual suppliers of components or sub-assemblies are kept to a minimum.

a. Longest lead time for any component should be no more than 4 weeks.

b. Target cost of goods should be no more than $8000???

6. APPENDIX: TYPICAL CUSTOMER REQUIREMENTS

Basic Requirements:

1. Texture soft to firm
2. Brix >6
3. Fresh Produce - K: Size XXL: 14-18 pieces
4. Fruit colour bright red to deep red. >90% colour.
5. Calyx appearance to be green and fresh
6. 10 to 18 fruit in a 250 g punnet (XXL)

No major defects (defects that effect shelf life):

1. Wounds
2. Splits
3. Cuts
4. Cracks
5. Punctures
6. Rots
7. Moulds
8. Unhealed hail damage
9. Bird and insect damage
10. White Shoulder Greater than 2nd row of seeds
11. Soiling

<10% minor defects (not affecting shelf life)

1. Healed weather mark
2. Skin marks
3. Superficial/dry bruising
4. White shoulder greater than 3rd row of seeds
5. Misshapen fruit
6. White tip