SCE

Systems Operational Requirement

Team documentation

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11-9-2017

Table of Contents

Figures

1. System Operational Requirements (Team)

1.1 Functional Analysis – Operational Level Architecture and Behaviour

The Functional Analysis is used to help break the project down into manageable sizes, below is the architecture and functional flow of the project.

1.1.1 System Operational Architecture (Operational Layout Diagram)

The operational layout diagram can be seen below in the Figure 1 below where the upper layout of the system can be seen.

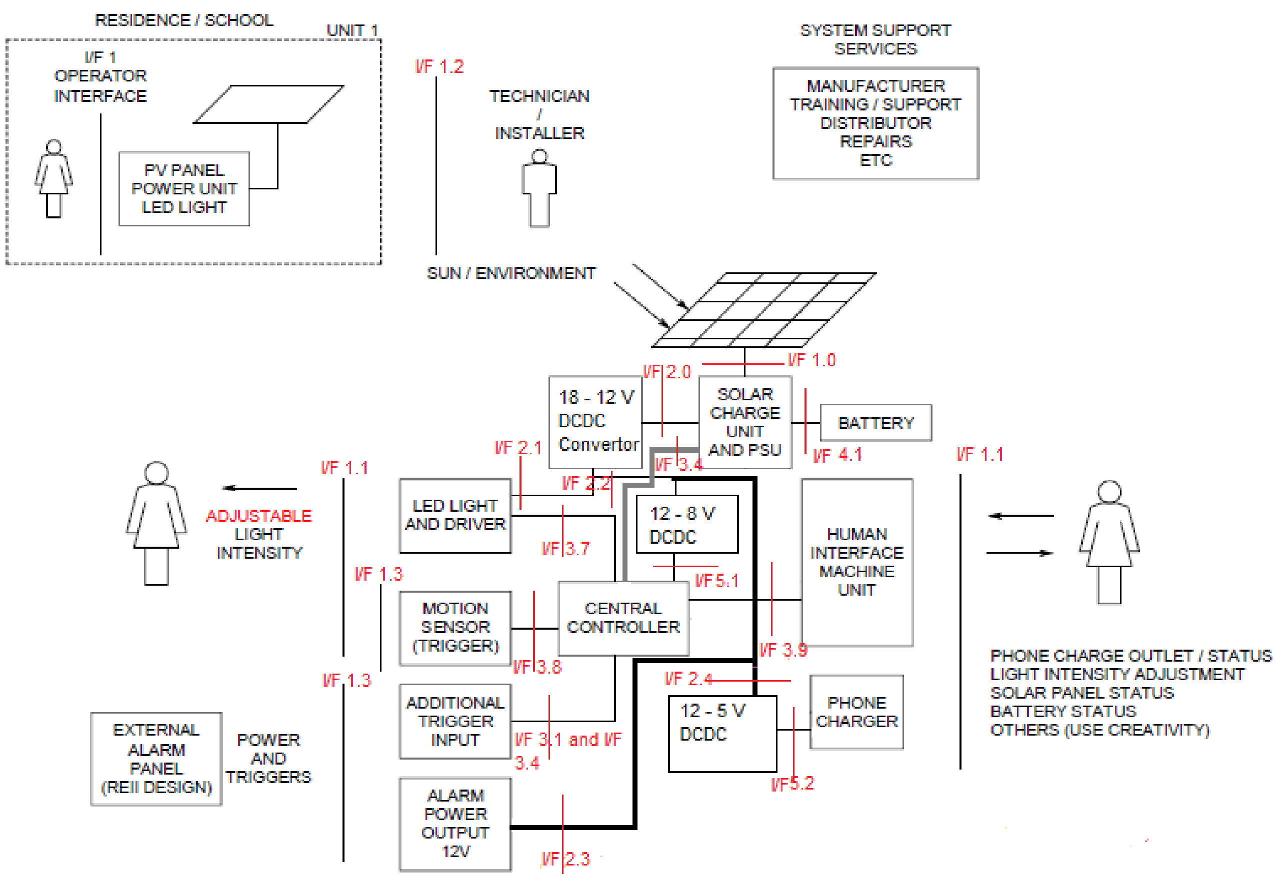

Figure 1: Systems operational architecture level 1

The system represented in the operational architecture is broken down into subsection in each member's personal section. The Systems operations architecture is divided between the members in the Figure 2 below.

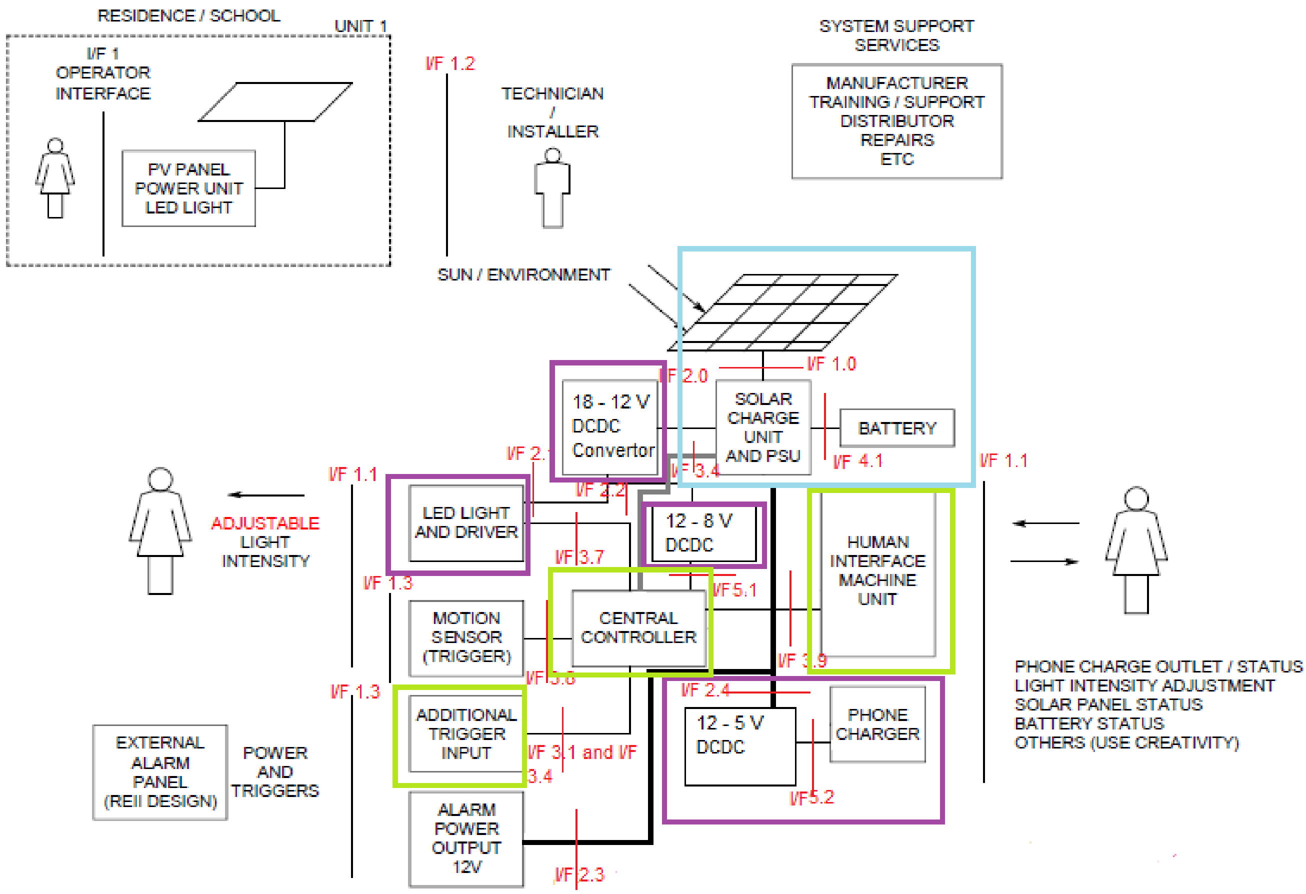

Figure 2: Operational architecture with blocks representing members

In this architecture the Purple blocks represent TE Carter's part of the project, the green represents SJ du Plessis' section and the blue represents CF Greyling's responsibility, as shown in the Figure 3 (take note that red represents the interface that exists between each element and the system).

(red)	Is the Inteface for each element
(purple)	TE Carter work
(green)	SJ du Plessis work
(blue)	CF Greyling work

Figure 3: Colour coordination

From this operational interface a simple block diagram can then be added as follows in Figure 4.

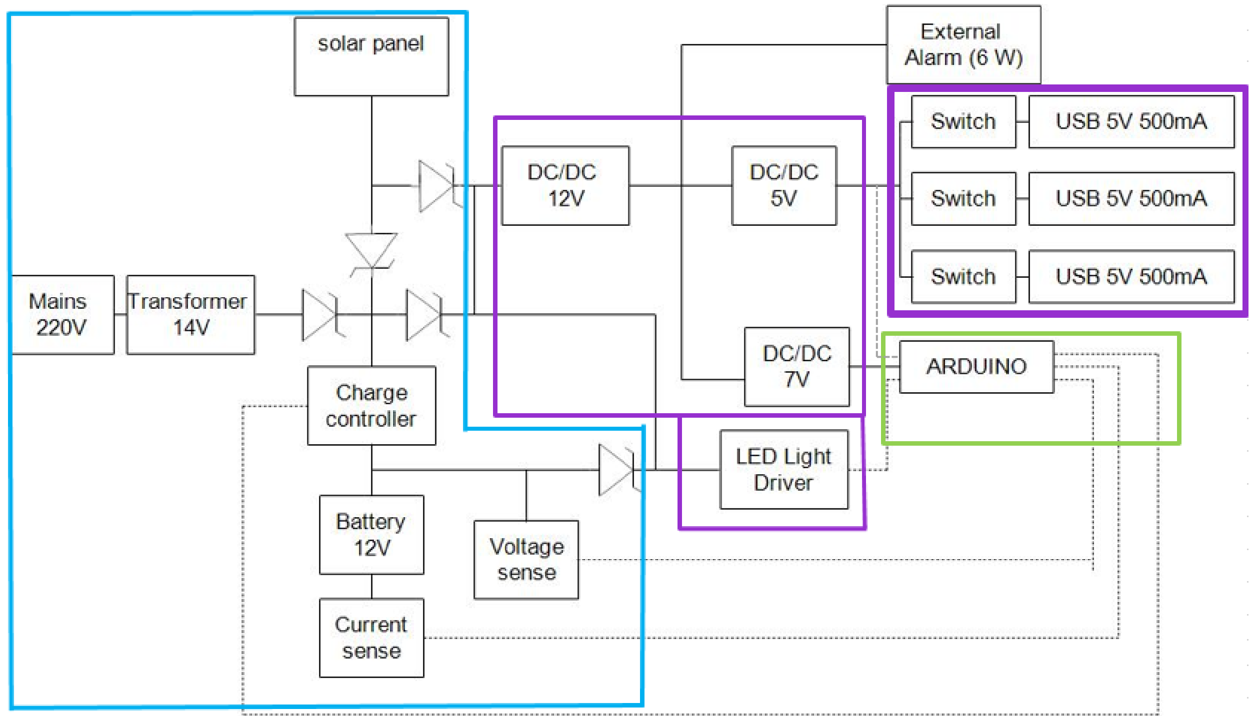

Figure 4: Block diagram

Where there the Mains 220V power supply was optional addition to the design. Which there was not enough money left in the financial budget for therefore we could not include the mains transformer in the final design of the project. The Figure 5 below is the operational architecture that includes the subsystem of the project including the interfaces and the main units of the system.

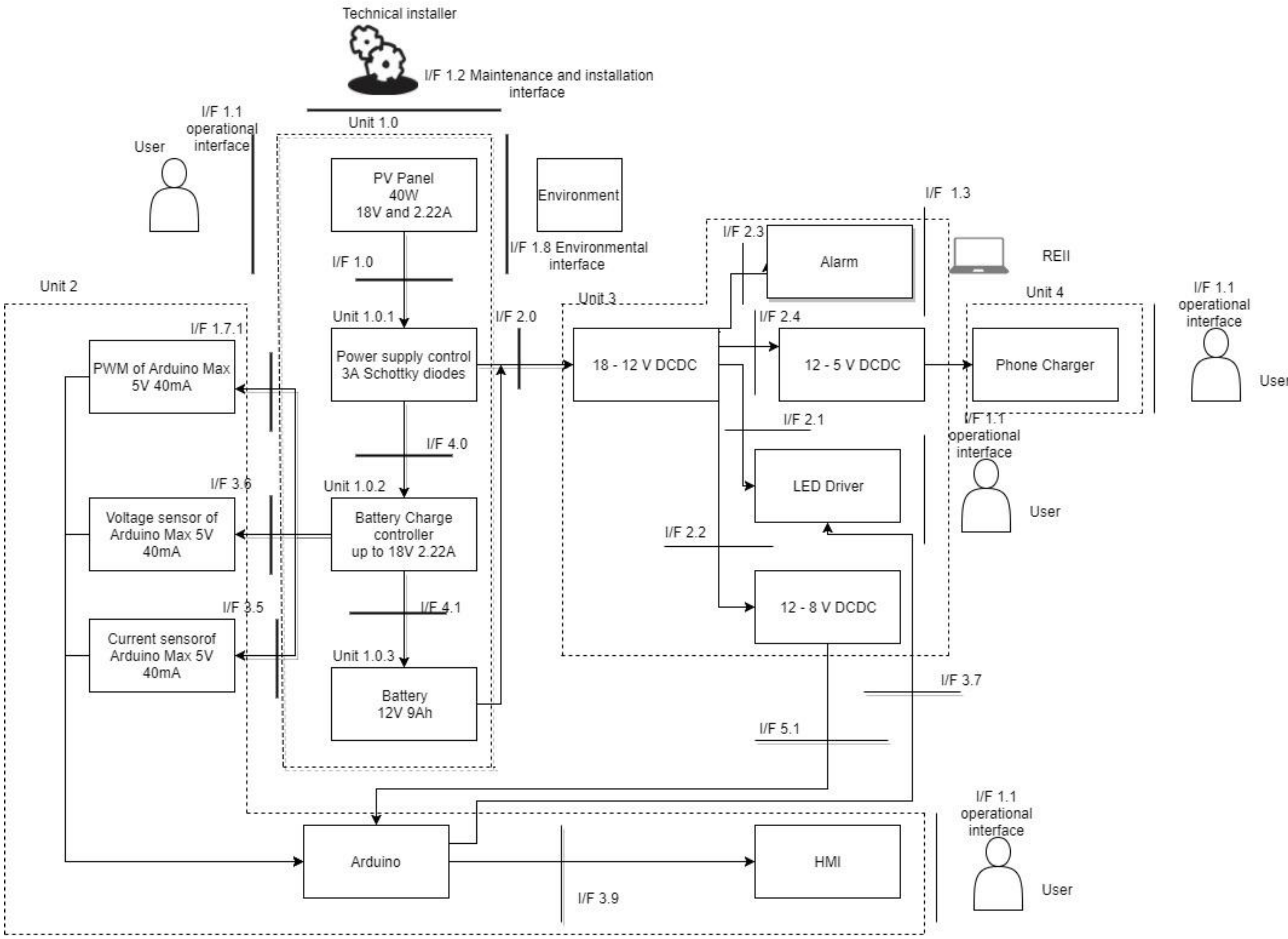

Figure 5: Architecture of operational system

1.1.2 System Operational Flow (Functional Flow Diagram – Life Cycle)

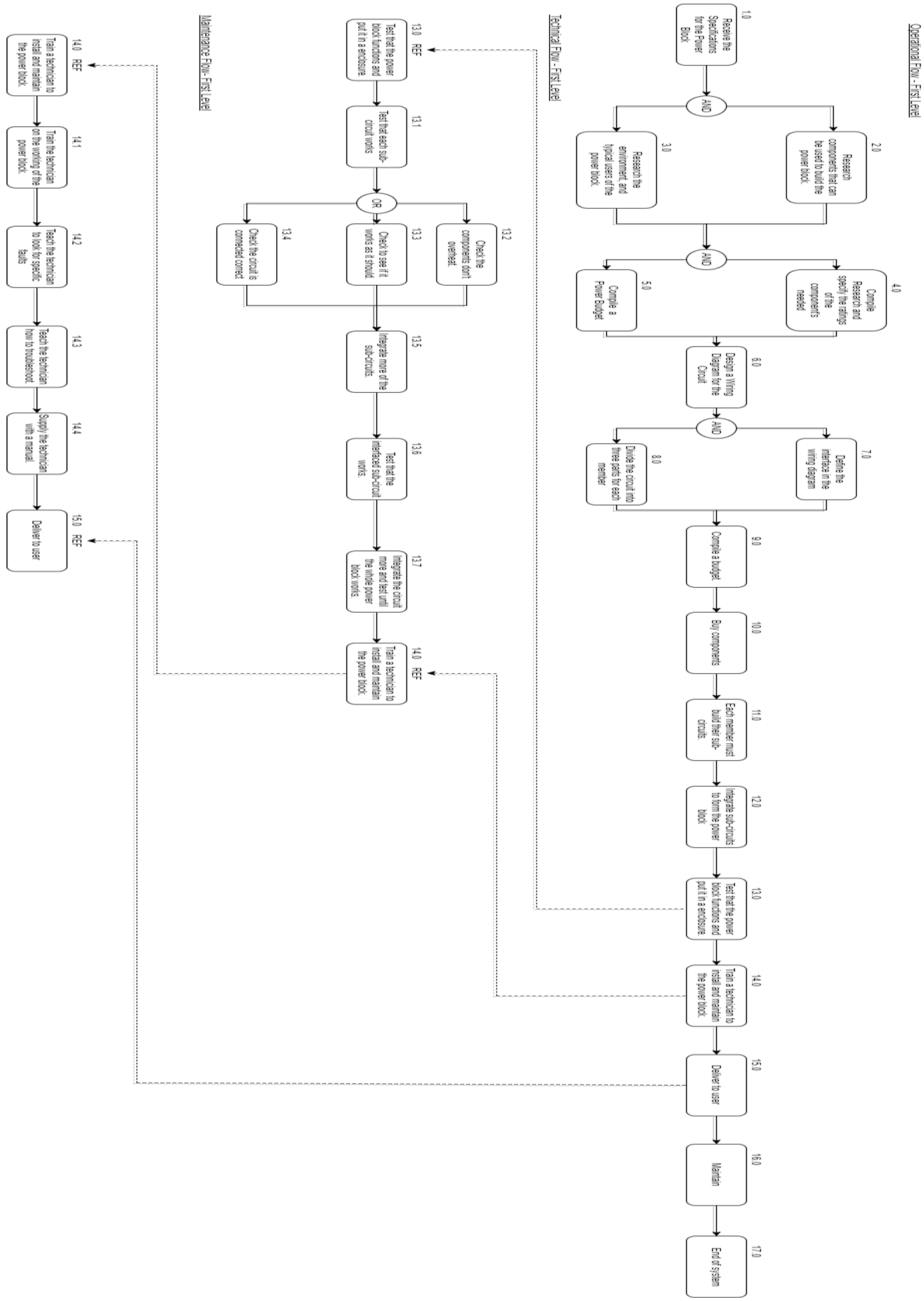

Figure 6: System operational flow diagram

Since the quality of Figure 5 is not pristine, refer to Appendix A, there is a better quality picture of Figure 5. Take note that there are no sub-sections for 8 as it is required that each member do their own functional flow for their sub-circuit, thus by referring to section 4 the sub-sections for 8 can be seen.

1.2 Physical Requirements (Form)

1) Weight
   a) Control Box
      i) Allocation
         (1) Subdivided by each members
         (2) I/F 6
            (i) CF Greyling
            (ii) SJ du Plessis
            (iii) TE Carter
      ii) Constrictions
         (1) Weight of control box may not exceed 15kg
      iii) Parameters
         (1) It would make installation difficult if weight exceeds restrictions
         (2) It will be mounted to the wall, therefore if it exceeds the constraints the wall mounting will cause damage to the wall and thin walls will not be able to bear the excess weight.
      iv) Material
         (1) If the control panel weighs less than 5kg lightweight metal plating can be used as control box
         (2) For heavier control box the material
            (a) Thicker steel
            (b) Harden polymer
   b) Battery
      i) Allocation
         (1) I/F 4.1
         (2) CF Greyling
      ii) Constriction
         (1) weight must be kept between 2-6kg

(2) reasonably small

iii) Parameters

(1) If it exceeds the weight restriction it will cause the control box to exceed its weight restriction

(2) If it exceeds the weight restriction it will cause the control box to warp in places from the weight

iv) Material

(1) Lead-acid battery

a) Display and Arduino

i) Allocation

(1) I/F 3.9

(2) SJ du Plessis

(3) User

ii) constriction

(1) weight must not exceed 1 kg

iii) Parameters

(1) If exceeds weight limitation will cause the control panel to exceed weight limitation

iv) Material

(1) Mounted on a basic single sided perf-board

2) Size requirements

a) Aspects to consider

i) Small houses will not have space for a large bulky system.

ii) Must not be in the way of the user; and

iii) Therefore should not protrude profusely out of the wall.

b) Control panel

i) Allocation

(1) Interface

(a) I/F 6.0

(i) CF Greyling

(b) I/F 6.0

(i) SJ du Plessis

(c) I/F 6.0

(i) TE Carter

ii) Restrictions

(1) Protrude no more than 30cm from the wall

(2) No larger than 1m x 1m

c) Charge controller

i) Allocation

(1) Unit 1.2.1

(2) CF Greyling

ii) Restriction

(1) Must be able to fit in the control panel

(2) No larger than 15cm x15cm

d) LED and LED driver

i) Allocation

(1) I/F 3.7

(2) Unit 3.2

(3) TE Carter

ii) Restriction

(1) For practicality must not exceed 20cm x 20cm x20cm

3) Shape

a) Control panel

i) Allocation

(1) I/F 5

(2) SJ Du Plessis

ii) Functional shape that will fit into any home without inconvenience

iii) Should not protrude at strange angles that will cause harm to people passing by

4) Positioning

a) PV panel

i) Allocation

(1) I/F 1.2

(2) Technician or Installer

ii) Cells faced north towards the sun

iii) For better efficiency move position during seasons to face the Cells more directly at the sun.

1.3 Interface Requirements (Fit)

1. Placement
   1.1. Allocation
      1.1.1. I/F 1.2
      1.1.2. Technician
   1.2. Around 1.4m above the floor against the wall by the PV panel
      1.2.1. The placement on the wall cannot be too high as it will make it difficult for users to access the panels
      1.2.2. The placement cannot be to low either as it may become a risk for small children
      1.2.3. Care should be taken to make the placement on the wall as close to the PV panel as possible
      1.2.4. The placement should not be over pre-existing water pipes or wiring in the wall
      1.2.5. Placement should not be near water or a stove or fireplace
2. User
   2.1. Simple easy to understand Control panel
      2.1.1. I/F 1.1
      2.1.2. CF Greyling
   2.2. Easy to use buttons and switches
      2.2.1. I/F 1.1
      2.2.2. SJ du Plessis
   2.3. Should not be complex or daunting looking
      2.3.1. I/F 1.1
      2.3.2. CF Greyling

1.4 Additional requirements

1.4.1 Environmental Requirements

1. Will be made reasonably tamper proof
   1.1. I/F 1.2
   1.2. Technician installing

2. Control box will be made from strong material to endure some wear
    2.1. I/F 6
    2.2. SJ du Plessis
3. Durable components that will last for a longer period
    3.1. Will be expanded on in later sections
    3.2. Applicable to
        3.2.1. TE Carter
        3.2.2. SJ du Plessis
        3.2.3. CF Greyling
4. Be able to withstand temperatures between -10ºC and 50ºC
    4.1. Allocation
        4.1.1. CF Greyling
            4.1.1.1. I/F 1.0 PV panel
            4.1.1.2. I/F 4.1 Battery
            4.1.1.3. Unit 1.2.1 Charge controller
5. The wiring will be able to withstand the sun
    5.1. I/F 1.0 Wire connected to PV panel
    5.2. CF Greyling
6. PV panel sealed to protect against rain
    6.1. I/F 1.3
    6.2. Manufacturer of PV panel and connectors
7. Solar panel fittings must be reasonably corrosion proof
    7.1. I/F 1.2
    7.2. Technical installer
8. Will have basic EMC
    8.1. I/F 3.7
    8.2. TE Carter
9. Solar panel fastening will be able to withstands reasonable wind speeds
    9.1. I/F 1.2
    9.2. Technical installer
10. Compensation will be made for lightning strikes via a transorb in the circuit.

1.4.2 Safety Requirements

1. No open wires
    1.1. Allocation will be expanded on later
        1.1.1. TE Carter
        1.1.2. SJ du Plessis
        1.1.3. CF Greyling
2. Not accessible to children
    2.1. I/F 1.2
    2.2. Technical installer
3. No open connections where people can get shocked
    3.1. I/F 1.2
    3.2. Technical installer
4. Closed box so that people who do not understand the device cannot tamper with it
    4.1. I/F 6
    4.2. SJ du Plessis
5. PV panel secured to the system
    5.1. I/F 1.2
    5.2. Technical installer
6. Reasonably tamper proof
    6.1. Description:
        6.1.1. Attached to the roof with bracketing
        6.1.2. Placed high enough to deter people from trying to steel it.
    6.2. I/F 1.2
    6.3. Technical installer

1.4.3 Legislative Requirements (SAIDSA Bylaw 25)

According to the SAIDSA Bylaw 25 the following requirements must be met with.

1. Control equipment
    1.1. Control panel installed min of 1.5 m form ceiling
    1.2. Digital keypads must be of the data transfer technology type
    1.3. Disarming delay no more than 30 seconds
2. Power supply equipment

2.1. Mains transformer must be a minimum of 30 VA
2.2. Control panel must provide a low battery cut-off of a minimum of 10.2 V
2.3. Car battery use is not permitted
2.4. Transformer will conform to SABS standards
2.5. Thermal fuses for protection against shorting in the transformers.

3. Signalling equipment
    3.1. Signalling equipment will be positioned within the protected area
    3.2. Not placed where telephone lines are vulnerable
4. Maintenance
    4.1. Inspect and test each detection device back to control panel
    4.2. Inspecting alarm panel and transmitter
    4.3. Measure output of charging circuit
    4.4. Inspect cables for visible damage
    4.5. Perform load test on the battery

Thither SAIDSA bylaws can be seen in Appendix A

1.4.4 Usability Requirements

1. The control box will be easy to understand
    1.1. I/F 5
    1.2. SJ du Plessis
2. Removable subdivisions for easy testing
    2.1. TE Carter
        2.1.1. I/F 2.1
            2.1.1.1. LED driver
        2.1.2. I/F 3.7
            2.1.2.1. DC to DC converter
        2.1.3. I/F 5.2
            2.1.3.1. USB charger
    2.2. CF Greyling
        2.2.1. I/F 4.1
            2.2.1.1. Connection between battery and the battery charger
        2.2.2. I/F 1.0

2.2.2.1. Connection between the charger and the PV panel

2.3. SJ Du Plessis

2.3.1. I/F 3.4

2.3.1.1. Arduino

3. Compensation for mounting will be made to the control box
   3.1. I/F 6
   3.2. SJ du Plessis
4. Diagrams will be added on the control panel in order that anyone can understand the function of LED's
   4.1. I/F 6
   4.2. SJ du Plessis

1.4.5 Additional Technical requirements

1. A wire will be run from the solar panel to the control box
   1.1. Interface
      1.1.1. I/F 6.0
      1.1.2. Between CF Greyling and SJ du Plessis
2. A connection will be set up from the control box to the alarm system
   2.1. Interface
      2.1.1. I/F 1.3
      2.1.2. Between Power block and alarm panel
3. The solar panel will be fastened to the roof
   3.1. Interface
      3.1.1. I/F 1.2
      3.1.2. Installer or technician