Requirements Specifications

Group 19

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1 Requirements and Specifications

1.1 Microcontroller and sensing:

Requirements

1. The sensors should be able to operate with the temperature conditions in the Karoo
2. There should be enough sensors in the sensor array to provide a range of data for the nest
3. The MCU should have sufficient processing power
4. The MCU should have sufficient storage
5. The MCU should have efficient power management
6. The MCU should be able to retrieve sensor data throughout the day at specified time periods, where the time periods may be programmable
7. The MCU should have some sort of communication to make data retrieval easier
8. The MCU and sensors should be durable and reliable over an extended period of time

Specifications

1. The sensors should be able to operate from 0 to 100°C.
2. There must be 14 sensors (1 for each side and 1 for each corner).
3. The MCU will have a clock speed of at least 2GHz.
4. The MCU must have external storage of 100mb.
5. The MCU will have a sleep mode when not processing

6. The MCU will retrieve data from the sensors every 5 minutes nominally, this period is programmable. The MCU must have UART, I2C, SPI.
7. The MCU must be able to have on board Wi-Fi or bluetooth and must be able to interface with LoRa communication
8. The subsystem should be able to last at least 2 years without replacement

1.2 Power:

Requirements:

1. The system should be constantly powered without switching off
2. The circuit must be protected against voltage spikes and current spikes
3. System should be protected against reserve polarity, undercurrent and undervoltage
4. The system must be able to display the temperature of the battery
5. The correct voltage must be supplied to the sensing and processing electronics
6. The user must be able to sample the battery health
7. System must use at least one renewable power source
8. The system must comprise of fundamental components, not off-the-shelf components.

Specifications:

1. There must be a power source powering the electronics, and another power source charging. The system must have at least two rechargeable Lithium batteries.
2. The circuit must utilize a circuit breaker
3. The system should use a power electronic converter circuits
4. The system must have a temperature sensor to reach the temperature of the battery and use an ADC to display the temperature
5. The system must utilize voltage regulation techniques to supply rated voltage to the sensing and processing electronics
6. The system must use an ADC to display battery health
7. The system must utilize solar power
8. The power electronic converters must be made up from passive components such as inductors, capacitors and resistors.

1.3 Physical design:

1.3.1 Requirements

Cooling:

1. The boxes should be on the best side of the tree to attain minimal sunlight
2. The boxes should be able to to keep the temperature under 50.6 degrees Celsius by using insulating materials

Environmental Factors outside nest box:

1. Nest box should be easily accessible as the the nests get visited every 14 days
2. Nest box need to withstand weight of the Hornbill as well as weights of battery and devices
3. Nest box needs to withstand wind and be rigid
4. Nest box needs to be protected against predators
5. Nest box needs to be able to attract Hornbills inside nest box
6. Nest box needs to be protected from heavy rain and harmful UV sunlight

Casing of Temperature Sensor and Battery:

1. Casing should prevent Hornbills from damaging device
2. Casing must be secure and rigid
3. Casing of battery and sensor should be waterproof and dust proof

1.3.2 Specifications

1. Boxes need to be designed so that when the boxes are orientating on the South side
2. Materials such as Plywood can be used for insulation. This panel is 0.2cm thick and supported onto the nest box which will have a 2cm gap between them to reduce compactness
3. Nest box can be designed at the base of the tree or built into the tree for easy accessibility
4. Nest box must be able to withstand 132-140g for the mother yellow billed hornbill with extra weight of device(weight) and battery(weight)
5. Nest box must be able to withstand wind and be rigid using wooden panels. 1 panel per side so 4 panels.

6. Front and back support the nest and protect it from predators having wooden panels 50cm tall and 25cm wide
7. Sides are 50cm tall and 28cm wide
8. High vegetation cover on the outside of the nest important for attraction and camouflage of nest box using leafs and painted with UV varnish
9. Waterproof layering on the front of the nest box
10. Casing of battery should be rigid using wooden casing that is adjustable
11. Casing of battery should be UV varnished and dust proof
12. Casing of the device should be protected using tape and waterproofed layering

1.4 User Interface

1.4.1 Requirements

1. There should be a user-friendly interface for researchers to easily access and view the temperature data.
2. It should be easy to connect to the interface.
3. The interface should be accessible through a range of different platforms, operating systems and devices.
4. The interface should be easy to navigate.
5. The temperature data should be arranged in an informative manner.
6. There should be alerts and notifications when certain temperature thresholds and conditions are met

1.4.2 Specifications

1. The user interface will adhere to the accessibility standards set in the WCAG (Web Content Accessibility Guidelines)
2. The interface will be accessible through a Wi-Fi hotspot connection
3. The user interface will be made available through a webpage, that can be accessed on any standard modern browser that is available on modern devices
4. Temperature data will be graphically represented through interactive visual elements, charts and graphs using Javascript libraries.
5. There will be visual indicators (colour-coded according the priority level) that will be used to draw the user's attention to critical events, such as very high temperatures detected, when viewing the user interface.