PCB board with integrated microcontroller, temperature, humidity, and wireless communication in a yellow-billed hornbill's nest.

# Introduction

This subsection contains information about the PCB that will be placed into the bird's nest. This PCB will have a microcontroller, temperature and humidity sensors, a method of storing data, and a means of wirelessly transmitting that data to an external PCB. This report will encompass requirements, detailed specifications, along with further research on components that could be utilized and explanations for why they were disregarded or selected.

# Requirements

This section provides a brief description of the requirements for our board. It is important to remember that I am trying to build a PCB board that fits into a yellow-billed hornbill's nest, which will be in various locations around the Kalahari. Must be able to fit in a nest with space for birds.

* Must measure temperature.
* Must be able to measure humidity.
* Must not disturb the birds.
* Must have the necessary microcontroller as the main Brians of the pcb board
* Must be able to send data (preferably wirelessly)
* Must be able to store data on the pcb board insert
* Deal with the environment e.g. heat, sand.
* Must last a reasonable amount of time.
* There must be able to be powered from the solar panel system already provided.

# Specification

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Requirement from which the specification is derived | Information regarding the requirements | Values associated with the requirements | Numerical values that my design will need to meet. | What temperature the chip must be able to withstand in degrees Celsius | Accuracy of the component required. | Cost |
| Must measure temperature. | In order to track if our control system is working as well as use control feedback loops we need an accurate measure of temperature. | Temperatures in the Kalahari Desert can range from about -20 to 50 degrees Celsius (these values are higher than most values found online; I decided to increase the values to ensure I am within a realistic range). This means the nest could experience temperatures in the range of -20 to 60 degrees Celsius due to the closed environment. | This means my temperate senser must be able to masher temerities in the range of -20 to 60 degrees Celsius. | -20 to 60 | The temperature of the nest needs to remain below 50°C. This means I'll need an accuracy of about 1 decimal point to ensure we stay below 50°C. However, the more accurate this is, the better, as it will enable the researchers to have more precise data for their research. | Temperature sensors should be a very small part of this board and for that reason, should be inexpensive. I am allocating about 0.5% of my total budget to them. |
| Must be able to measure humidity. | Help get a better understanding of what's going on within the nurse humidity senses will be required | Can go from 20% to 80 % in the Kalahari.  The nest conditions may be worse due to the closed off environment. | The humidity sensor should be able to measure humidity between a range of 10 to 90% humidity. | -20 to 60 | For research purposes, greater accuracy is preferred; however, intervals changing every 1% would suffice. | allocating about 0.5% of my total budget to them. |
| Must not disturb the birds. | If the birds are disturbed either via noise or air flow, they will reject the nests | about 15 dB at their most sensitive frequencies (1,000 and 3,500 Hz); sounds must be about 39 dB at their least sensitive frequencies (250 and 8,000 Hz) (not for the yellow bold hornbill but does give a good indication of what kind of range we need to be operating within) | all commands should remain below 15 dB | N/A | N/B | N/A |
| Must have the necessary microcontroller as the main Brians of the pcb board. | require a microcontroller which can keep run the bour while not using to much power | Enough pins to support all items in the board will need SPI and ice grid C capabilities as well as a wireless data transfer in built or the capabilities to communicate with their wireless data transfer chip | (coming back) | -20 to 60 | N/A | 30 % |
| Must be able to send data (preferably wirelessly) | like the user to have the capability of pressing a button on a separate device and receiving all the temperature data from the PCB board in the nest. | The user has been able to reach the nest The user has been able to access the nest and retrieve data manually from it on a regular basis. However, we would only see a purpose in implementing this device if they can obtain the data from a distends greater than 7 m. |  | -20 to 60 | This device needs to be able to accurately send data to 1 decimal point worth of accuracy. | Up to 10% |
| Must be able to store data on the pcb board insert | the data must be able to be stored on the device as the researchers will only return to the nest on a weekly or monthly basis | the data must be able to store at least two-month worth of data on a storage device | two months | -20 to 60 | all data must be able to be stored to the create accuracy as stated for those previous sections | Up to 10% of bouget |
| Deal with the environment e.g. heat, sand. |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

# Sure, please provide the text selection that you would like me to format nicely.