Requirements

Scenario1 – Hybrid engine fan

- R1.1: Device physically be a microPI HAT.
- R1.2: Device be small in size.
- R1.3: Can be attached to the 40 GPIO pins of the Pi.
- R1.4: Possible to track the instantaneous position of a Brushless DC Motor.
- R1.5: The instructions written on the Pi will be executed by this daughter board.
- R1.6: User should be able to connect the board directly to the mains
- R1.7: Support multiple applications & allow them to work with any standard Pi
- R1.8: Should have status LEDs to give feedback when the board has been powered and when the motor is running
- R1.9: Device be protected from overheating, dust and moisture.
- R1.10: Device provides audible feedback.

Scenario 2 - Linear actuator for solar tracking systems (solar tracker)

- R2.1: Device physically be a microPI HAT.
- R2.2: Device be small in size. (Should not be larger than the Pi)
- R2.3: Can be attached to the 40 GPIO pins of the Pi.
- R2.4: Possible to track the instantaneous position of a Brushless DC Motor.
- R2.5: The instructions written on the Pi will be executed by this daughter board.
- R2.6: User should be able to connect the board directly to the mains
- R2.7: Support multiple applications & allow them to work with any standard Pi ● R2.8: Should have status LEDs that connects to the motor IC and power circuitry.
- R2.9: Device be protected from overheating, dust and moisture.
- R2.10: Device is capable of operating over multiple days in the dessert.

Scenario 3 – Automatic sliding gate

- R3.1: Device physically be a microPI HAT.

- R3.2: Device be small in size.
- R3.3: Can be attached to the 40 GPIO pins of the Pi.
- R3.4: Possible to track the instantaneous position of a Brushless DC Motor.
- R3.5: The instructions written on the Pi will be executed by this daughter board.
- R3.6: Power supply circuitry board for motor and driver IC.
- R3.7: Support multiple applications & allow them to work with any standard Pi.
- R3.8: Should have status LEDs that connects to the motor IC and power circuitry.
- R3.9: Device be protected from overheating, dust and moisture.
- R3.10: Device provides audible feedback.
- R3.11: Device is capable of operating over multiple days in the dessert.

Specifications

Mechanical Specifications

Requirement	**Specification(s)**	**Acceptance Test Criteria**
R1.1: Device be small in size	**S1.1:** Have a small mechanical form factor (65mm by 30.5mm) **S1.2:** Weight limited to 15g	Final design weight is within limits.
R1.2: Should be possible to physically attach the board to Pi-Zero	**S1.3:** Should have 4 mounting holes that are adjacent to the mounting holes of the Pi	Mounting holes should have a diameter of 2.75mm
R1.4: The board should function normally in a dusty and moist environment	**S1.4:** Fittable to a MX410 Mesh-G RGB casing **S1.5:** As dust may cause poor contact of the pins from the encoder, use a screw terminal to connect the encoder pins the board **S1.6:** Have an NTC near the pins to protect the board from arcing	Final design fitted in specified fitting and products be AEC-Q100 qualified. The screw terminal should be made of a material that does not foul
R1.5: Should be possible for a non-technical staff to know when the board is faulty	**S1.7:** Board should have well labelled led indicators to show when board is on and when board is running	LED indicating the powering of the board should be near the power supply, should be red in colour LED indicating that the motor is running should be near the motor connection pins and should be green in colour.

Electrical Specification

Requirement	Specification(s)	Acceptance Test Criteria
R1.4, R2.4 & R3.4 Possible to track the instantaneous position of a Brushless DC Motor.	S1.9: Board should connect to the pins of the incremental encoder. Should be capable of receiving input from the encoder and send it to the Pi for processing. Should also be capable of receiving position control instructions from the Pi and executing it on the motoe	Track position of the motor. Signal output within the 0-3.3V required range
R1.6, R2.6 & R3.6: The Hat should not be dependent on the Pi for its power requirements	**S1.6, S2.6 & S3.6:** The board be powered by the mains through a 5mm Barrel Jack -Should have power supply circuitry board for motor and driver IC. -PSU should have an SMPS regulator, preferably an IC(eg LTC3638) -Vin = 12V from a Barrel Jack -Vout = 5V 2.5A to control the DC motor	The Hat is power independent
R1.7, R2.7 & R3.7 Support multiple applications & allow them to work with any standard Pi	**S1.7** Temperature & position sensors, Current and voltage sensing, Safety & glue logic and wired interface. **S2.7** Feedback position sensor, timer, sun detector sensors, Relays and limit switch. **S3.8** Feedback position TR sensor, motion detector sensors, Relays and limit switch.	Interface with position sensors, limit switches, TR sensors, relays and power supplies.
R2.10 & 3.11 Device is capable of operating over multiple days in the dessert	**S2.10 & S3.11** Operating Temperature Range of -40 to 50C	All components selected are rated for operation within given range Final design is chamber tested for 10hrs operation at -40, 0, and 50C
All: Should be possible to add other boards on top of the motor driver board that will also make use of the functionalities of the Pi	Should have 40 header pins adjacent to the 40 GPIO pins of the Pi	The other Pi GPIO pins not being used by the board should still be usable
All: The Pi should be protected from any spikes from the hat	**S1.3:** A ZVD circuit should be used to guard the inputs to the pi from the encoder	There should be a ZVD circuit for every Pi input from the Hat

Functional Specifications

Requirement	Specification(s)	Acceptance Test Criteria
R1.8, R2.8 & R 3.8: Should have status LEDs that connects to the motor IC and power circuitry.	**S1.8** Warning LED red display when faulty and green for health operation of fan. **S2.8** LEDs green when in operation visible over 5m **S3.8** LEDs green when opening and red when closed, visible over 5m	Status LEDs indicate motor power, motor direction, motor connected/not, high current draw warning. Pass SANSB compliance test AB789
R1.10 & R3.10 Device provides audible feedback	**S1.10** Feedback must be audible for faulty fan. **S3.10** Feedback must be audible over 20m during operation.	Pass SANSB audio compliance test AB789