

ILR03: Progress Review 2

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ILR03

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1. Individual Progress

1.1. Power Distribution Schematic

Using the initial circuit diagram drawn by Logan Wan (as shown in Fig 1) and after discussing the requirement of a wall adapter input for the Gigabyte BRIX [1] on-board computer, I designed the power distribution schematic as shown in Fig 2.

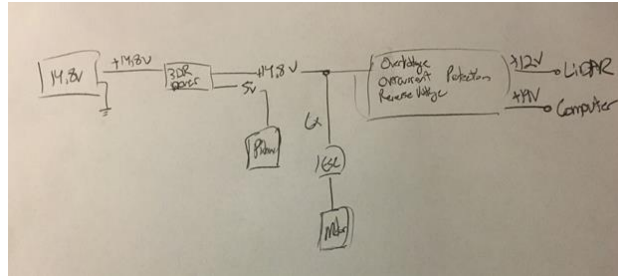


Fig 1: Power distribution circuit diagram [by Logan Wan]

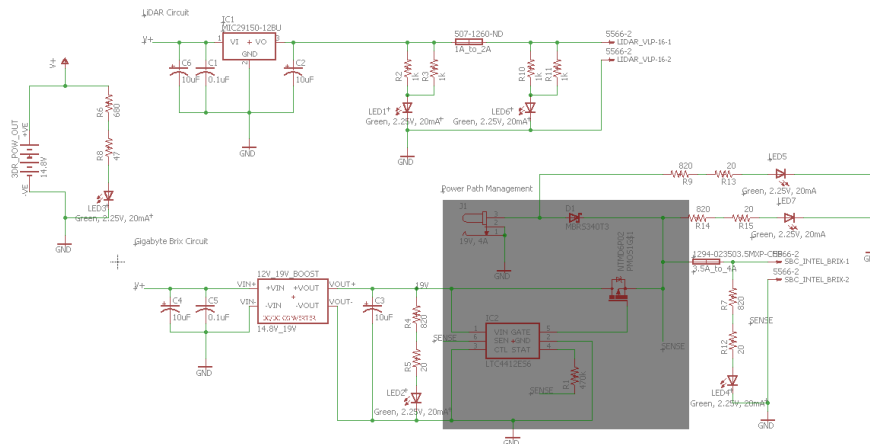


Fig 2: Power Distribution Schematic

The addition of a wall adapter input was required to power on our on-board computer earlier than the rest of the system. This is required because the GPS lock takes about 5 minutes to acquire. Hence, it would be judicious to switch to battery power once the computer acquires a GPS lock. This is done using a power path management IC from linear-technologies (LTC4412ES6 [2]).

While designing the schematic, I carried out the thermal and electrical analysis to select appropriate electronics currently available through Digikey or Mouser. The devices in the schematic are named according to the device models. I also created packages for the 19V boost converter, the Power P-MOS, and the XT60 battery connector using the appropriate dimensions from their datasheets or web pages.

A schematic design was required only for the LiDAR [3] and the BRIX [1], since the power distribution for the PixHawk Flight controller [4] is handled by 3DR's power module which has a terminal to access the input battery voltage directly from the power module as shown in Figure 3. The power to the ESCs [5] is also provided using a battery terminal splitter.



Fig 3: 3DR Power Module [6]

2. Challenges

Challenges faced included finding an appropriate boost converter for the computer requirement. The computer requires a 19V input with a 3.42A current. Considering the current sink by the LEDs and the PowerPath controller IC, a fuse and converter to accommodate 3.5-4A was required. The converter also had to be light to not affect the robot payload. Hence, that took a while. Looking for an appropriate Power PMOS to accommodate the same voltage and current requirements was also a task as the power required is quite higher than usual DC applications.

The schematic was also simplified from an earlier form which contained protection elements like a Power NMOS for reverse voltage protection on the input, and a TVS diode for reverse voltage protection on the output. This was simplified because close inspection of the regulator datasheet and web page revealed that they accomplished these protection features including overcurrent protection, and overvoltage protection themselves.

3. Teamwork

Throughout the last week, Clare Cui and Logan Wan designed and sourced CAD models of the robot parts for volumetric and force analysis of the system.

Angad Sidhu primarily worked on solving loop closure issues in BLAM! [7] and used GDB [8] to debug the same. He came across a bug that made loop closures impossible and is currently trying to solve the same. He also wrote a script to compare the BLAM! [7] Pose estimate with GPS ground truth.

The team also spent some time customizing the work schedule leading up to the Fall Validation Experiment to accommodate for the delay in sensor calibration that was supposed to be done this week.

4. Plan

By the next Progress Review, Clare and I will be aiming to complete the intrinsic calibration of the camera, and extrinsic calibration of the IMU-Camera pair. Since the IMU comes with intrinsic calibrations stored in an attached flash memory and accommodates an extended

Kalman Filter using an attached microcontroller, to provide attitude estimates, we are only required to acquire these details from the IMU. An HSI calibration of the magnetometer will be performed once the IMU is mounted on the robot.

I will also be responsible for processing the IMU data and integrating the IMU transforms into the BLAM! [7] State estimate sections.

Meanwhile, the whole team will CAD the full robot under Clare and Logan's supervision. The two of them will then proceed to fabricate the parts and mount the sensors

Logan will be designing the circuit layout based on the schematic, and proceed to integrate the mapping framework into BLAM! [7].

Ricky will continue to work on fixing the loop closures and getting familiarized with the full BLAM! [7] code package while writing a boot script for the on-board computer to start up as soon as power is connected.

References

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