Robot Safety Module Experience

James H Phelan
Project Lead
2019.10.20+

Original presentation see: Robot Safety Module.pptx
Original RFP see: RFP Robot Safety Module Circuit.pdf

R&D,
Would you please e-mail blast this out to our core 100+ members you've collected?…

From: Karl Schleicher <k_schleicher@hotmail.com>
Sent: Monday, November 11, 2019 5:52 AM

All,
I am on vacation and cannot fully participate, but I thought I would start a discussion. I'll share my first investigation and initial poor design. A quick internet search produced tutorial videos with either Arduino or components on a bread board. I thought I would scope out an Arduino solution:

An Arduino nano is 18mm x 43 mm or .8" x 1.7", requires 5 to 12 volts, costs $20. Clones are available for $12 for 3 units. This is a possible approach.

How can I drive an Arduino with a power source that can be up to 48V? I recently used a buck voltage converter. I heard they were efficient and thought that sounded good (see video "buck converter vs linear voltage regulator"). I searched amazon and found "eBestrade DC voltage regulator buck converter dc 48 to 12v". There are not many that will input 48v. It outputs 20A, weighs 5 oz, and costs $21. The killer is size, 4" x 3.2" x 1.3". Our limit is 2" square.

20A is much more power than needed and a linear voltage regulator or even a voltage splitter may be a solution. The Arduino specs say 20 mA and each pin can draw 40 mA. My first heat output estimate from a linear voltage regulator with 48V in, 12V, 60 mA out is (48V-12V) .06 = 2.2W. The video says we will "need a big heat sink", but this may be a solution.

I hope this starts some discussion. I look forward to your comments.

Karl

On 11/12/2019 1:41 AM, David Williams wrote:

Due to size requirement, it might be better to create two modules:

one input < 24v, one input < 48v

For the one with input voltage up to 24 volts, I've purchased, used, and recommended the following 12 for $13 buck converters to Roberto that do their magic in such a small package via PWM, so they don't get very hot and are quite stable, converting down to 3 volts:

eBoot 12 Pack Mini MP1584EN DC-DC Buck Converter Adjustable Power Step Down Module 24V to 12V 9V 5V 3V (12 Pack)
https://www.amazon.com/dp/B07RVG34WR/ref=cm_sw_r_cp_apa_i_j9LYDb99DAM5D

David

11/12/2019, 6:34 AM
James H Phelan <jhphelan@hal-pc.org>

David, et al.,
The first design question is "what is the most practical maximum voltage?"
The rover fully charged runs just under 17V. 14.7V nominal.
How often do robots, specifically the motors / actuators, run > 24V?
Amazon suggested next to yours a module up to 40V:
https://www.amazon.com/eBoot-LM2596-Converter-3-0-40V-1-5-35V/dp/B07RT95J4Q/ref=pd_bxgy_263_img_2/146-7267777-5376557?_encoding=UTF8&pd_rd_i=B07RT95J4Q&pd_rd_r=b6c62e66-9b3b-4c45-8bb1-98d649a4781e&pd_rd_w=KdDD9&pd_rd_wg=L1ZEt&pf_rd_p=09627863-9889-4290-b90a-5e9f86682449&pf_rd_r=ZWE3SGB70FE037MWABWW&psc=1&refRID=ZWE3SGB70FE037MWABWW
So, team, is 24V a reasonable 95%ile voltage specification?
JHP

11/12/2019, 8:13 AM
Karl Schleicher <k_schleicher@hotmail.com>

Jim,
I thought about asking the buyer about modifying the request for proposal specs.

A quick internet search told me golf cars are 36 and 48 volts. Burg scooters are 36 volts. One site said most scooters are 24v, but I wondered if the site was created before popularity of urban scooter rentals.

David suggested a converter gift about $1, a great price. I decided a linear voltage regulator is a bad approach. More searches on amazon turned up $12 product that has max dimension of 1.8". I wonder about it because there are no reviews:
Autek DC Converter Buck Module 12V/24V/36V/48V Convert to 5V (10-60V Convert to 5V), 5V USB Output Power Adapter Mini USB Right
I do not know where the total cost of the product, but I am guessing a 24v solution might be $20. I may be surprised by cost of speaker, case, and misc, but unnecessarily adding $11 sounds like a mistake.

Scooters and golf carts may be a good secondary market. Maybe the regulator above can be an option. Maybe a separate base the convert 48 to 24 would also work.

Karl

11/12/2019, 12:41 PM
David Williams <ecom.advisor@live.com>

Ah, yes, Jim,

...those < 40V buck converters are fine as well, are rated/reviewed well, and cover a wider range of input and output voltages.

If 48V input is a must-have and only 5V output is needed, then Karl's find (or similar) might be the way to go.

Have you considered this also as an emergency STOP module, with a sizable red "STOP" button that physically breaks all motor circuits until reset?

David

2019.11.13 08:32
Jim Phelan

Team,

Seems like 40V is a convenient upper limit to input voltage with special adaptation for 48V golf carts, etc.
I, naively?, thought that just a simple voltage regulator would work. Am I wrong?

<<Have you considered this also as an emergency STOP module, with a sizable red "STOP" button that physically breaks all motor circuits until reset?>>
Yes, David. That's a later consideration. The industrial versions are EXPENSIVE ~$50 range for a mushroom head "bop to stop" button.
I have in mind a "remote kill switch". Attached is the original Power Point presentation for those who weren't at the Meetup.

We should also find a way to create a special mailing list for this project so those members who aren't interested can drop out of this thread.

Jim

Bill Carson william.carsonjr@gmail.com 2019.11.13 14:37

Hello all, an electrical engineer friend of mine said to give a look at this component from TI
http://www.ti.com/lit/ds/symlink/lmz35003.pdf
Hope this helps
[shop here: Texas Instruments Digi-Key Mouser]

Bill,
Thanks to you and your EE friend!
A bit pricey in the $11.00+ range for our purposes + needed support components compared to $1-2 buck convertors.
The QFN packaging also a bit sophisticated for us.
But keep us on your radar! We need outside ideas like this!
JHP