



Three Phase Motor Controller

An ELE480 Capstone Design Project with BCA

Company

Bay Computer Associates, Inc. (BCA) is a full-service software and electronics contract design firm. Our permanent staff of over 24 engineers has been designing products for our customers for 26 years. While we currently have no products of our own, we have significant design experience from websites to electron beam microscopes. It is our hope that a relationship with students will allow us to move closer to having some products of our own.

We are located in Cranston, RI. We anticipate a number of face to face meetings. While face to face meetings are preferred we do recognize you are on a university schedule so we suspect due to the distance to campus that we will skype and will allow VPN access to our facilities for some of the required activities as long as a non-disclosure is signed.

Introduction

BCA has invested a significant amount of design time into a three phase AC motor controller. In addition, we have had students from the last two year's capstone class work on this project. All six students found it quite interesting and they felt that they learned a lot. (Also they enjoyed the ride on the power assisted bicycle that was driven by the controller at the end of the project.)

Our goals is to increase the motor torque/speed that the controller can support. The problem that they solved first year was that device only operated quite well for relatively low motor currents. The isolated the root cause of the flaw in the design that, at high motor currents, noise caused the output driver chip to disable itself resulting in reduced current output.

Last year, the team updated the schematics and, after significant debugging, determined that the system was limited in its current drive due to noise on the processor power supply. They wrote code to allow easier configuration of the controller by the user as well. They suggested a fix and provided guidance on how to move forward with the design.

We would like to further this project by correcting this problem and creating a new circuit board that would be more appropriate for an "off the shelf" application. This would require designing and testing a new controller board that would be appropriate for sale as a subsystem in mobility devices. This would include increased output current capabilities so that this controller might be used for a significantly sized vehicle. It would also require significant updates to the user interface code. While some effort was put into the software, it is not yet "friendly" enough to allow us to

ph 401.461.1484

fax 401.461.1218

web www.baycomp.com

email info@baycomp.com

Bay Computer Associates, Inc.

136 Frances Avenue ▶ Cranston, RI 02910



sell this as an “off the shelf” product. The user cannot easily configure the device to operate with the user’s motor.

Tasks to be completed

Hardware

- Review and understand last year’s team’s evaluation of present hardware and their suggestions for improvement.
- Review the proposed solution to the “noise’ problem described above
- See if we can increase the output drive capability to the maximum expected for the driver chips.
- Redesign the circuit board to include the “fixes” and a new form factor.
- Test the above.

Software

- Any firmware changes needed for the motor drive
- Updating the PC software to configure the system from a user point of view.

Minimum System Specifications

- An updated electronics system that provides the theoretical current drive system. (testing will likely be done on power assisted bike motor).
- A software system that allows easy modification of parameters and tuning for use with other motors.

Stretch goals

NOTE that we consider this design to require significant skill to make good progress. It is likely that the above system will be challenging by itself. If the above can be achieved, a vehicle system using three or four coordinated motor controllers would be exciting to see.

Engineering Skills required

Schematic capture
Digital Design
Analog design
Embedded systems programming (“C” language)
Windows programming

Engineering Skills to be learned

Motor control methods
Schematic capture
Circuit board layout
Debugging techniques



Interfacing with mechanical systems
Documentation

Preferred Team Composition

1 CPE major and 1 ELE majors

Technical Contact

Dr. David A. Durfee
Bay Computer Associates, Inc.
136 Frances Ave.
Cranston, RI 02910
ddurfee@baycomp.com