

TART 2003-2004

Camera Control System

4th Year Project
Presentation

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(Group 1)



Duration: 9mins

Question period following presentation

Presentation Agenda

- Introduction ✓
- Project Background
- Accomplishments to Date
- Problems Encountered
- Future Work
- Schedule
- Summary
- Question Period

Project Background

Objectives

- Expand functionality of TART
- Future testbed for Computer Vision projects and Autonomous operation of TART
- Gain experience with:
 - embedded systems
 - control
 - hands-on electronics

Starting Point

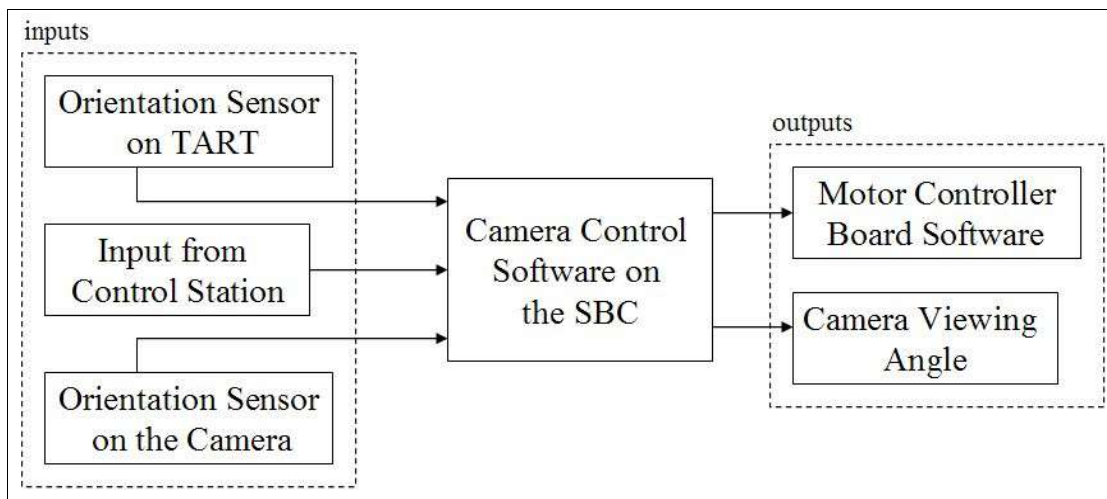
- Video camera mounted on TART, wireless video feed to control station

Requirements

- Interface and control the video camera for remote operation of TART
 - Pan, tilt, zoom, focus, iris, light on/off
 - Make use of embedded systems → minimize computing resource usage
 - Camera viewing angle control

Accomplishments to Date

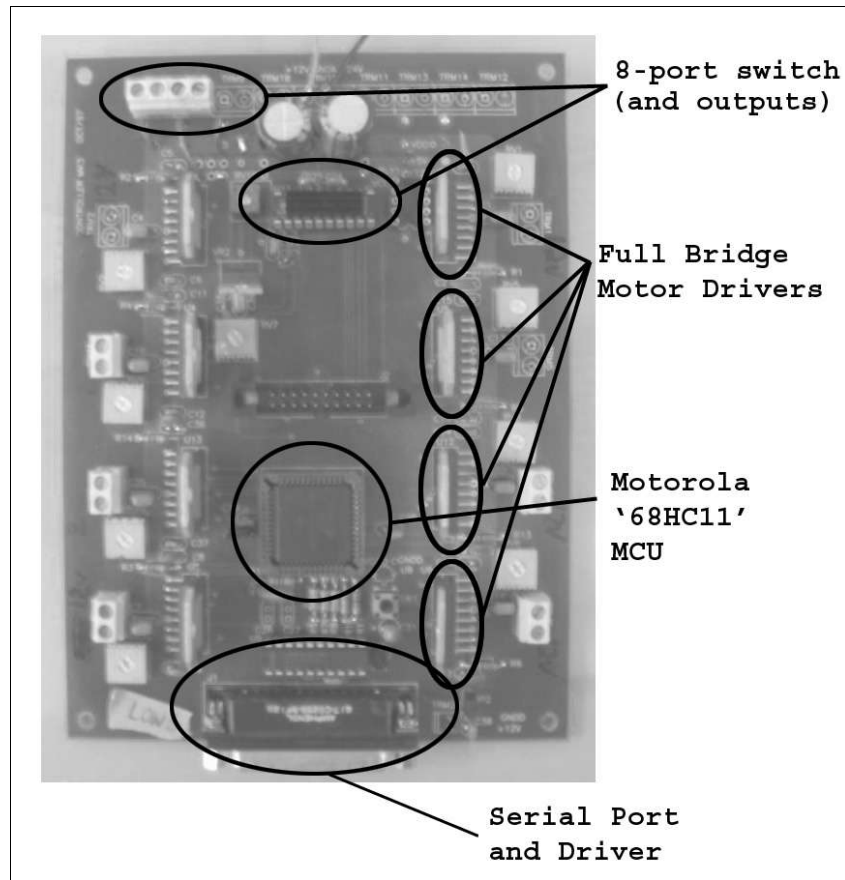
- Understanding work from previous year
 - 400+ pages, multi-year
- Defined system to be developed



System Components

- Understanding of individual components
 - MCB: '68HC11', octal switch, motor drivers
 - QNX and the SBC
 - Orientation sensors

Motor Controller Board (MCB)



- 8-port Switch
- Full-Bridge Motor Drivers
- Serial Port Driver

Key Software Challenge

- Motorola '68HC11' MCU properties
 - 2 KB program storage (EEPROM)
 - 256 Bytes of RAM
 - 2 MHz system clock
 - Asynchronous serial communications interface (SCI)

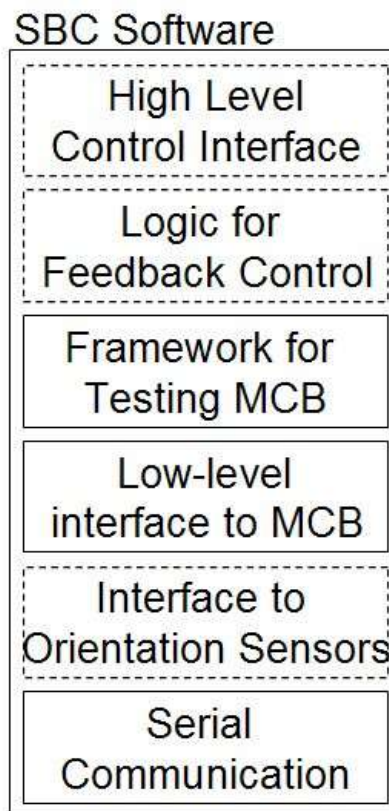
- Challenge: minimize program size, memory usage, CPU load

- Resulting Software for MCB
 - Defined low-level command interface
 - Operation:
 - 1) ISR moves new data from the serial communications buffer to instruction queue
 - 2) Main logic monitors queue for valid instructions
 - 3) Interprets instructions: sets velocity of individual motor drivers or toggles switches

 - Developed in C and Motorola assembly
 - Occupies <1KB EEPROM on MCU

Single Board Computer Software

- Software for SBC needs to be low on resource consumption
- Components:
 - Serial communication
 - Low-level camera command interface to MCB
 - Framework for testing of MCB software
- Developed in C, separating classes of operation into modules

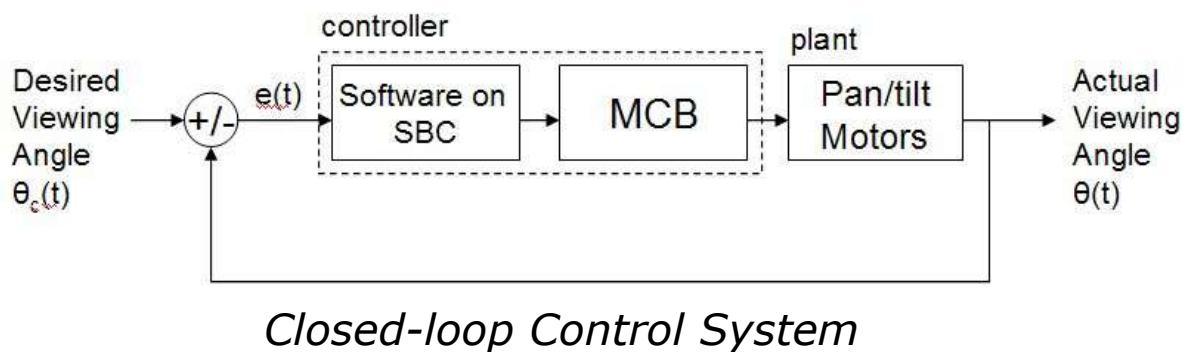


Problems Encountered

- Understanding the '68HC11'
 - Overcome by limiting scope of understanding
- Development environment
 - Decided on commercial package over unix-based open-source option by trade-off analysis
 - Collaborated with a '68HC11' tool developer
- Understanding the MCB
 - Created library of small programs to test functionality of the board
- Time management
 - Dedicated time slots for project work

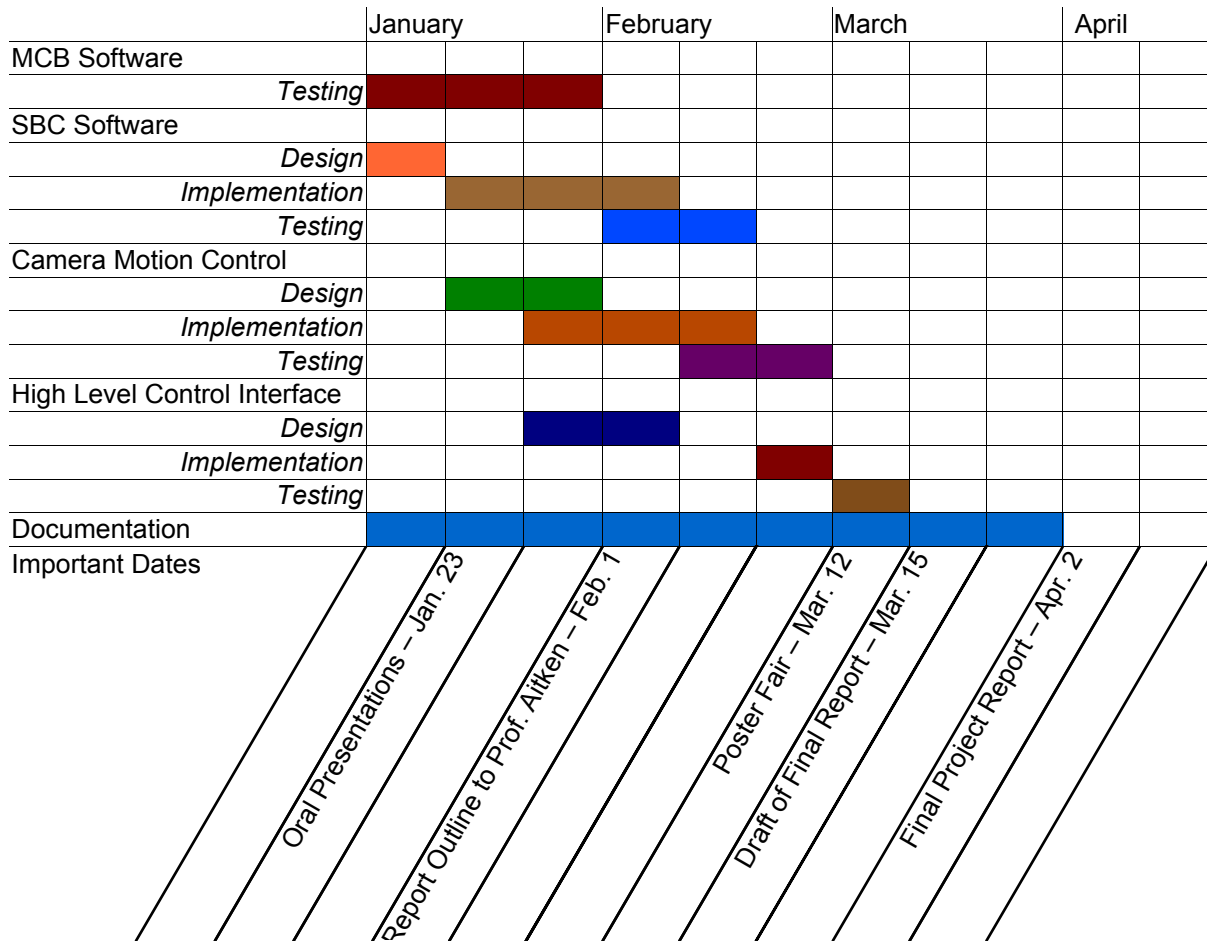
Future Work

- Control Camera Motion
 - Interface orientation sensors for feedback control
 - Determine relative camera viewing angle (camera with respect to TART)
 - Implementation and testing



- Create a High level interface for control via remote operating station
 - `pan_tilt(pan angle, tilt angle);`
 - `light_on();`
 - `zoom_in();`

Schedule



- Overlapping items are closely related

Summary

- Educational project
- Project deals with embedded systems and control
- High learning curve due to donated hardware – little documentation
- Application of Engineering principles
- Significant progress made
- Overcame many obstacles
- Much work yet to be completed
- Project to be completed on schedule