P9204 – 1kg Robotic Platform

System level Design
Engineering Analysis – Concept Selection

• Processor
  – BDmicro ATmega128
    • *unrestrictive IDE*
    • *open source / open architecture*
      – This aspect ruled out the existing Freescale board that the 10kg platform uses
    • *expandable memory*
      – This aspect ruled out the Arduino Nano since it does not support expandable memory for future development
  • existing gcc
  • existing codebase
  • support for RS-232, SPI, I2C
Engineering Analysis – Concept Selection

• Bus
  – I²C
    • Modularity
    • Minimal hardware needed for implementation
      – This aspect ruled out CAM since each device connected to the bus requires a CAM controller
    • Slower than SPI but more modular
    • IC compatibility
    • Only 2 signals to drive many devices
    • Risk! – slowest of available buses
Engineering Analysis – Concept Selection

• Motor
  – Stepper
    • *Extremely precise*
      – The most important point for choosing stepper over DC brushed. Crucially important for accurate dead reckoning
    • Superior torque per Watt
    • Power efficient
    • Risk! - System no longer uses PWM signals. Control logic will be more complex.
Engineering Analysis – Concept Selection

• Modularity
  – H-Bridge on individual Modules
    • Since H-bridges are variable dependant on motor type, these should not be hard-wired to the logic board
    • Reduces size of “box”
  – Single PCB Controller
    • Reduces wiring chaos!
    • Smaller size
    • Risk! – less modular than multiple PCB boards
Engineering Analysis – Concept Selection

• Wireless
  – Crossbow
    • *Existing codebase*
    • *Existing hardware* (from 10kg platform)
    • Long range (30 meters)
    • Low power
    • Small size
Engineering Analysis – Concept Selection

• Battery
  – Type still not finalized since maximum current draw has not been calculated.
    • Ni / Li
      – Lead acid ruled out since it is too large
    • 12 V
    • Custom built battery module from 10kg platform will be re-used and tweaked
Risk Assessment

• Possible Risks
  – Not receiving parts on time (i.e. PCBs, Motors, μC)
  – Motor team unfinished with motor module at time of testing
  – Unable to get all code working properly with hardware

• Possible Solutions
  – Reuse existing PCBs & motors, Order Early
  – Test control software with 1st Gen. RP1
  – Concentrate on software that is most important to motor controller
  – Proof of Concept Works to test Design Concepts Early
System Block Diagram

Processing Subsystem
(Lead: John Corleto, Jason Jack)

- μC
- Serial Comms
- Bus Controller

Motor Module Controller Subsystem
(Lead: Jason Jack, Ryan Schmitt)
(PCB Layout: Jeffery Howe)

- Motor Module
- Motor
- Encoder
- H-Bridge
- Bus Controller
- Motor Control Logic
- Encoder Feedback Logic

Wireless Communication Subsystem
(Lead: Ryan Schmitt)

Power Monitor Subsystem
(Lead: Emily Phillips, Nandini Vemuri)
(PCB Layout: Jeffery Howe)

Power Distribution Subsystem
(Lead: Emily Phillips, Nandini Vemuri)
(PCB Layout: Jeffery Howe)

Graphical User Interface
(Lead: Jason Jack)