Motion Tracking HMD

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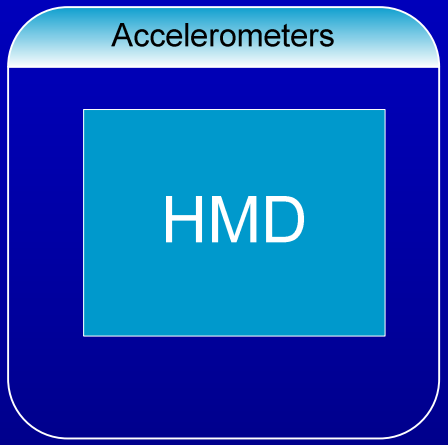
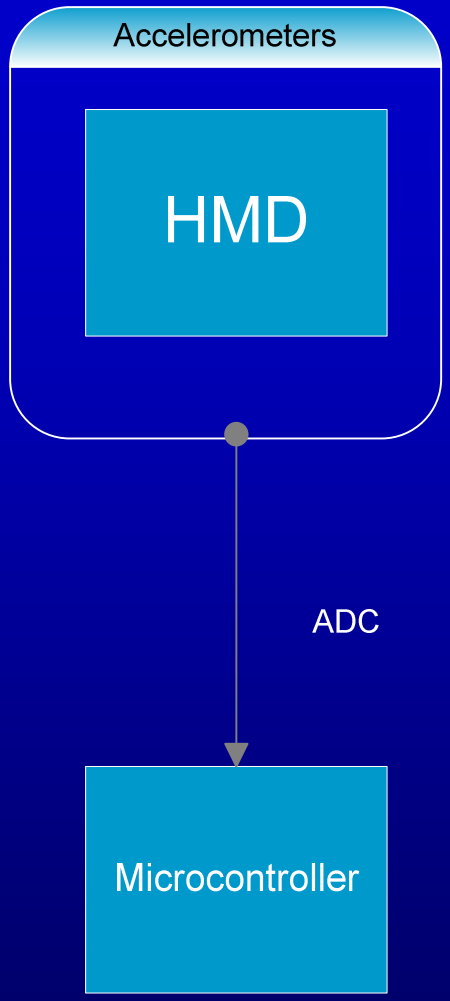

Accelerometers
HMD

Milestones

Accelerometers

- Mount to Visor
- Measure outputs that match what we'd expect


Accelerometers
HMD
ADC
Microcontroller

Milestones

Microcontroller

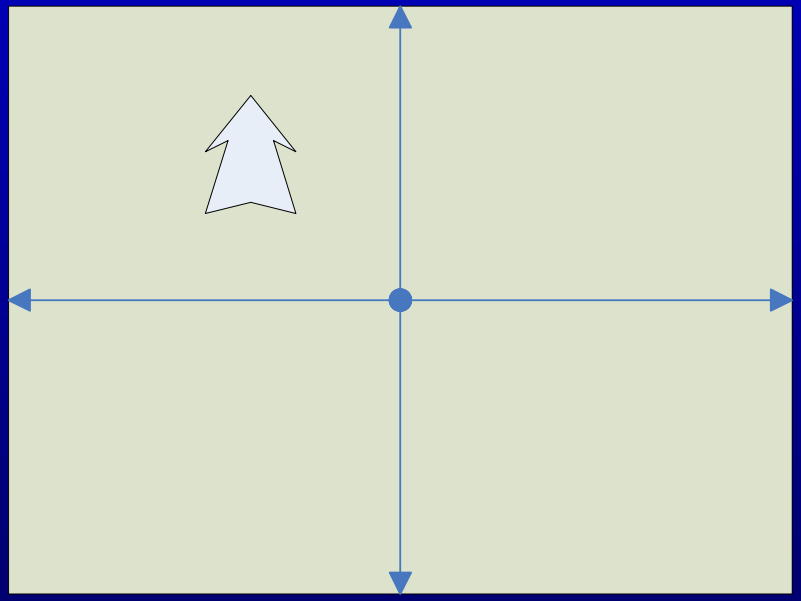
- Take in and perform computations on input signals
- Apply signals to Microcontroller and get the appropriate outputs
- Calibrate Microcontroller output limits with buttons

Software

- Microcontroller
- Device Driver

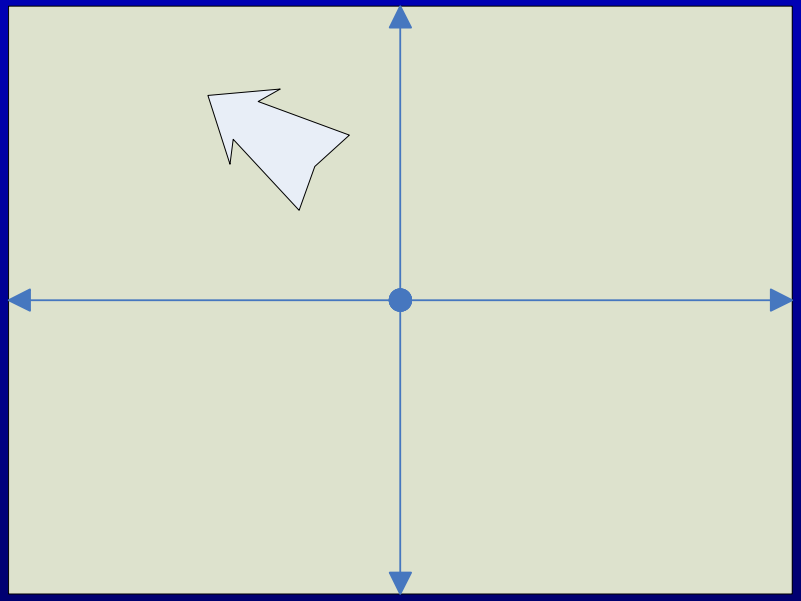
Range of Motion

Baseline



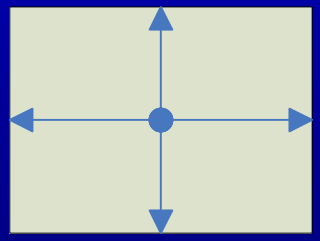
Range of Motion

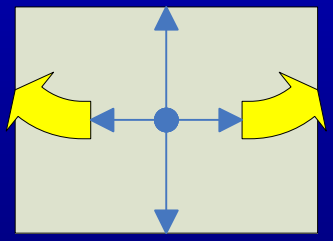
Baseline++

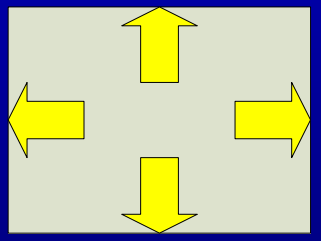


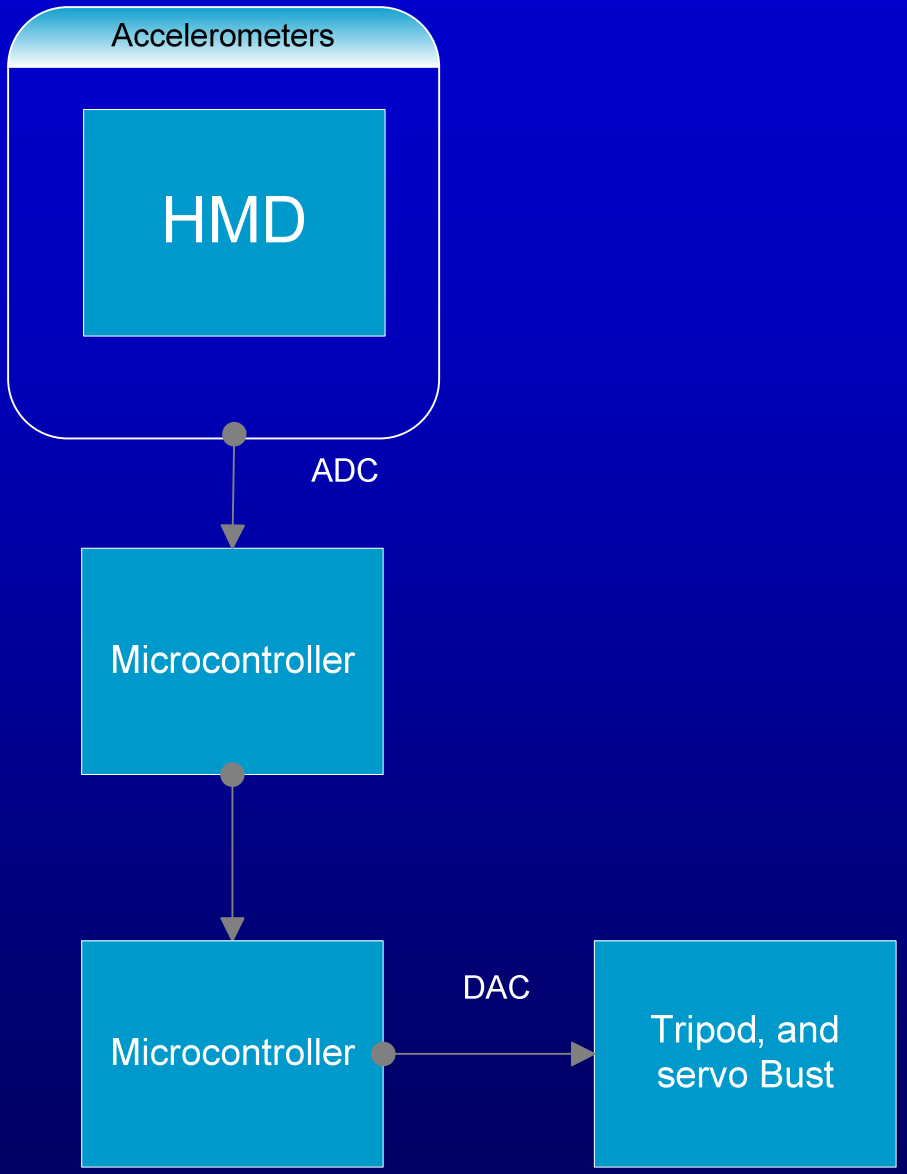
Range of Motion

Advanced





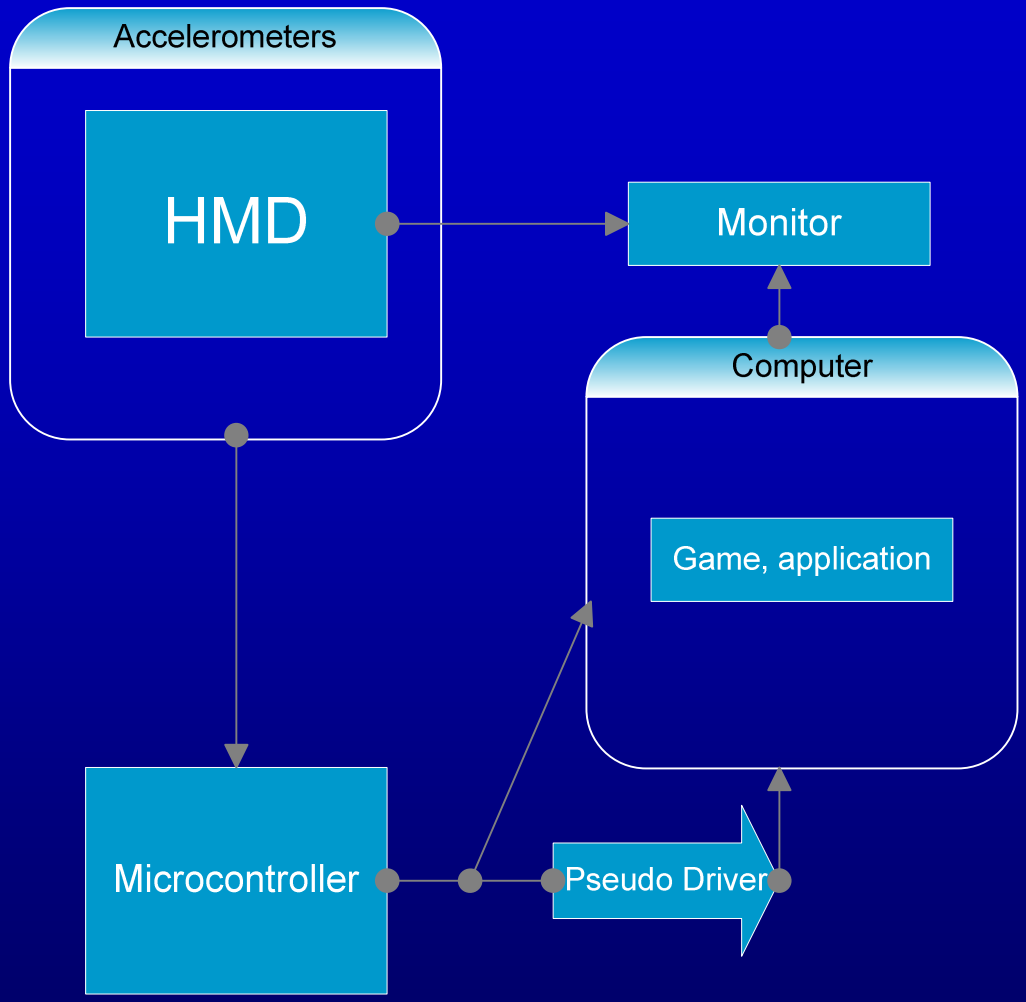



Accelerometers
HMD
ADC
Microcontroller
Microcontroller
DAC
Tripod, and servo Bust

Milestones

Tripod/Servos

- Bust mounted to tripod
- Servos attached to tripod
- Move the tripod by applying various inputs


Accelerometers
HMD
Monitor
Computer
Game, application
Microcontroller
Pseudo Driver

Milestones

Integration

- Attach Servos to Microcontroller output
- Move servos by applying various signals to Microcontroller
- Attach Accelerometer to Microcontroller and measure appropriate outputs
- Connect Microcontroller to Computer
- Additional Wow steps
- Test : Test : Test!

WOW

- Real Device Driver
- Wireless
- Pitch and Yaw
- Re-Centering
- Extra Function Buttons
- Range of Motion

BOM

LCD Glasses-INNOVATEK V-490

Accelerometer-ADXL330

Microcontroller-M68HC11x2

Servos-36G Servo

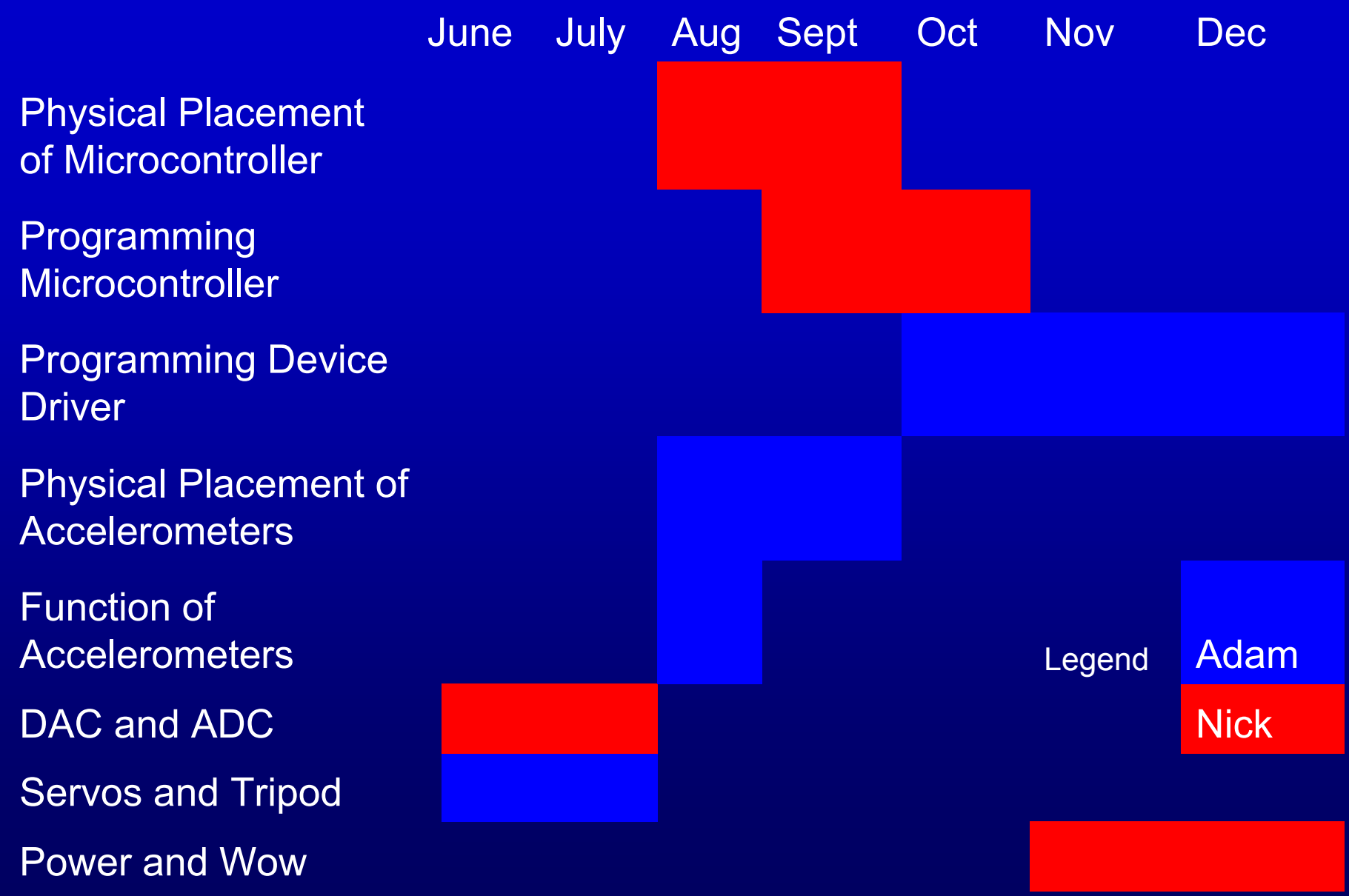
DAC and Misc. Circuitry

Power Supply

Accelerometer Data Sheet

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
SENSOR INPUT	Each axis				
Measurement Range		±3	±3.6		*g*
Nonlinearity	% of full scale		±0.3		%
Package Alignment Error			±1		Degrees
Inter-Axis Alignment Error			±0.1		Degrees
Cross Axis Sensitivity[1]			±1		%
SENSITIVITY (RATIOMETRIC)[2]	Each axis				
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 3 V	270	300	330	mV/*g*
Sensitivity Change Due to Temperature[3]	V_S = 3 V		±0.015		%/°C
ZERO *g* BIAS LEVEL (RATIOMETRIC)	Each axis				
0 *g* Voltage at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 3 V	1.2	1.5	1.8	V
0 *g* Offset vs. Temperature			±1		m*g*/°C
NOISE PERFORMANCE					
Noise Density X_{OUT}, Y_{OUT}			280		µ*g*/√Hz rms
Noise Density Z_{OUT}			350		µ*g*/√Hz rms
FREQUENCY RESPONSE[4]					
Bandwidth X_{OUT}, Y_{OUT}[5]	No external filter		1600		Hz
Bandwidth Z_{OUT}[5]	No external filter		550		Hz
R_{FILT} Tolerance			32 ± 15%		kΩ
Sensor Resonant Frequency			5.5		kHz
SELF-TEST[6]					
Logic Input Low			+0.6		V
Logic Input High			+2.4		V
ST Actuation Current			+60		µA
Output Change at X_{OUT}	Self-test 0 to 1		−150		mV
Output Change at Y_{OUT}	Self-test 0 to 1		+150		mV
Output Change at Z_{OUT}	Self-test 0 to 1		−60		mV
OUTPUT AMPLIFIER					
Output Swing Low	No load		0.1		V
Output Swing High	No load		2.8		V
POWER SUPPLY					
Operating Voltage Range		2.0		3.6	V
Supply Current	V_S = 3 V		320		µA
Turn-On Time[7]	No external filter		1		ms
TEMPERATURE					
Operating Temperature Range		−25		+70	°C


June
July
Aug
Sept
Oct
Nov
Dec
Physical Placement of Microcontroller
Programming Microcontroller
Programming Device Driver
Physical Placement of Accelerometers
Function of Accelerometers
DAC and ADC
Servos and Tripod
Power and Wow
Legend
Adam
Nick

Reality Check Dates

- 31 July; Parts are in, DAC understood and ready; tripod built
- 30 Sept; Parts mounted, hardware check of accelerometers, and microcontroller.
- 31 Oct; Final microcontroller program (either to emulate or to act as separate device)
- End of Class; ☺

Questions?

Details at
http://www.cs.utah.edu/~adamt/hmd.html