NOSTRADAMUS TECHNOLOGIES

Robotic Arm Control Via EMG Signal

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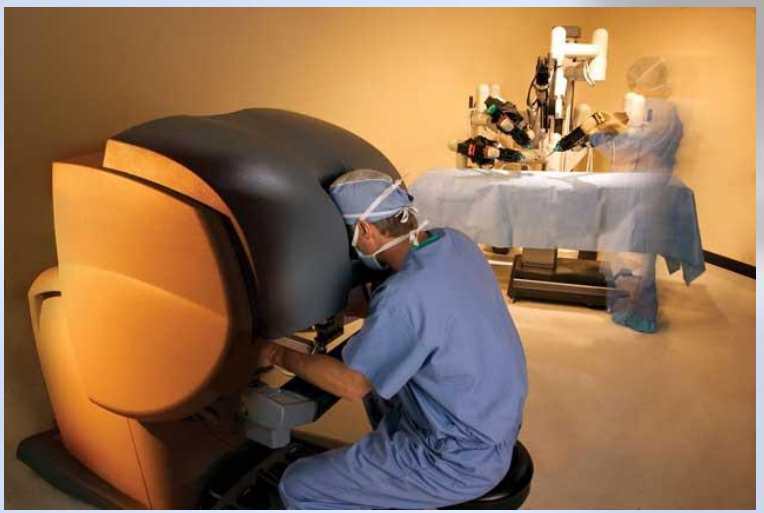
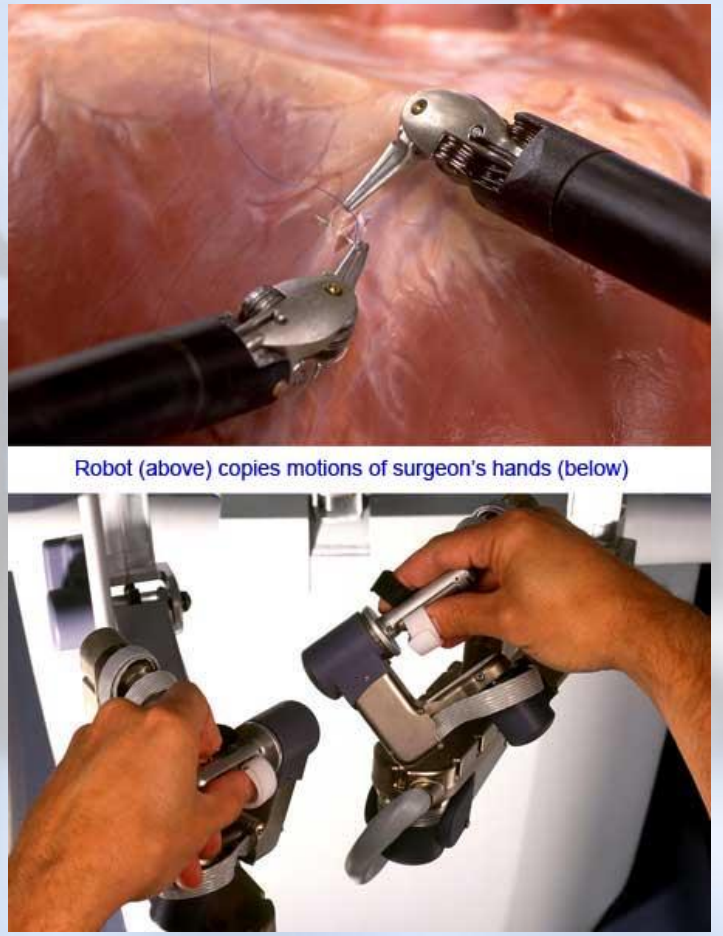
Problem Definition

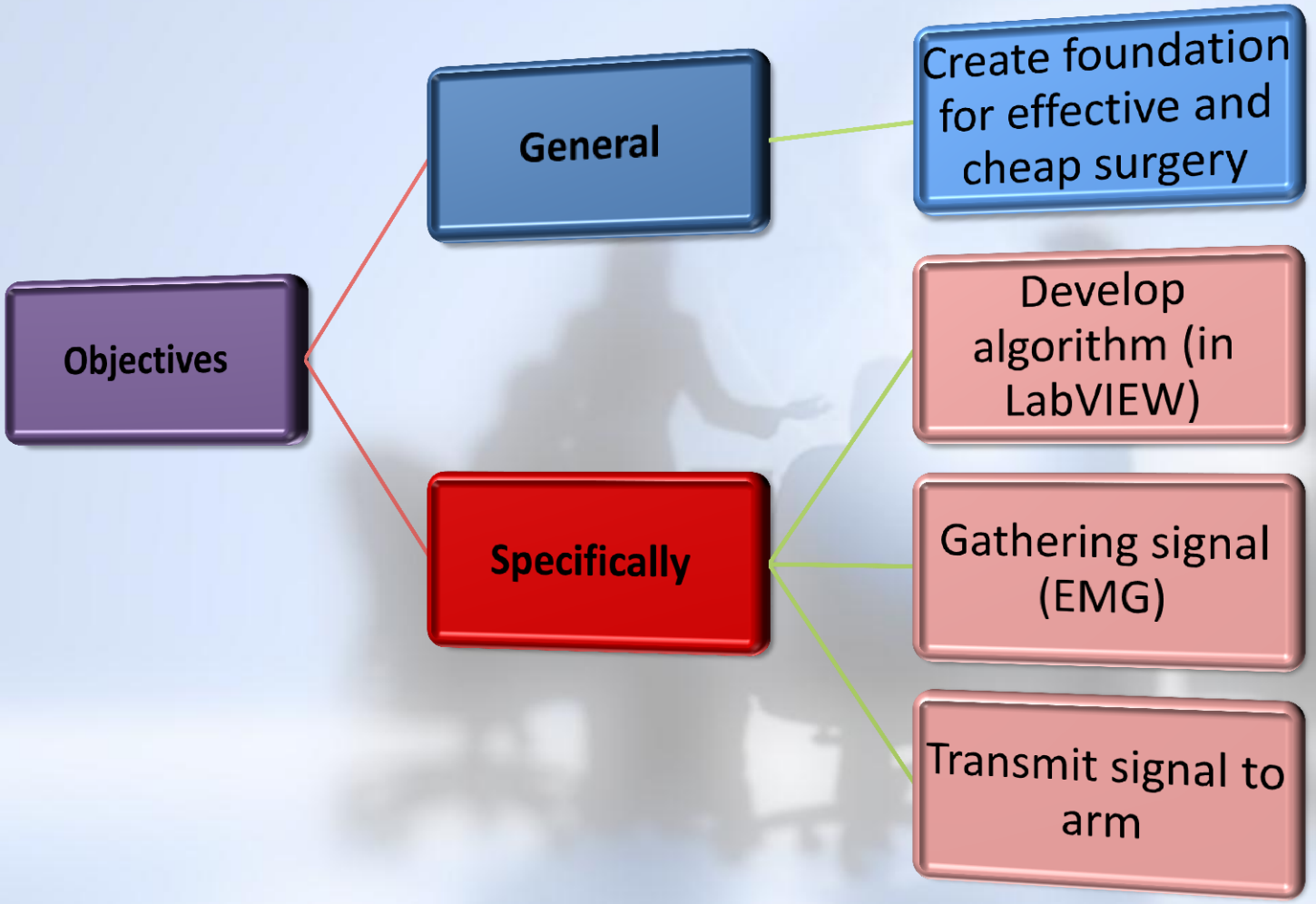
- Global need for specialized surgeons
  - Third world countries
  - Hostile environments
- Obstacles:
  - Time
  - Money
  - Safety

Background

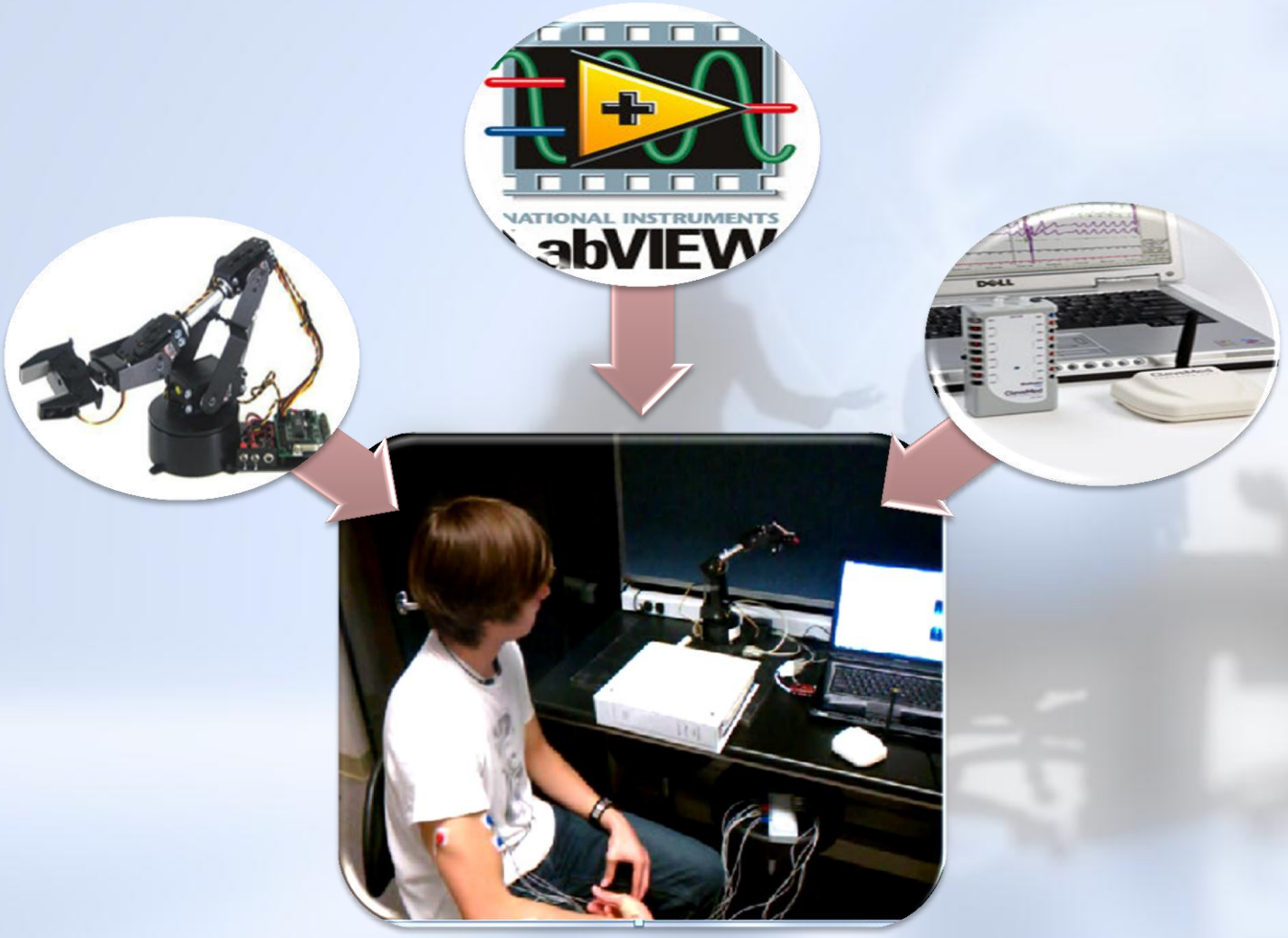
- Current robotic systems:
  - Supervisory control system
  - Telesurgical system
    - Da Vinci surgical system
  - Shared control system



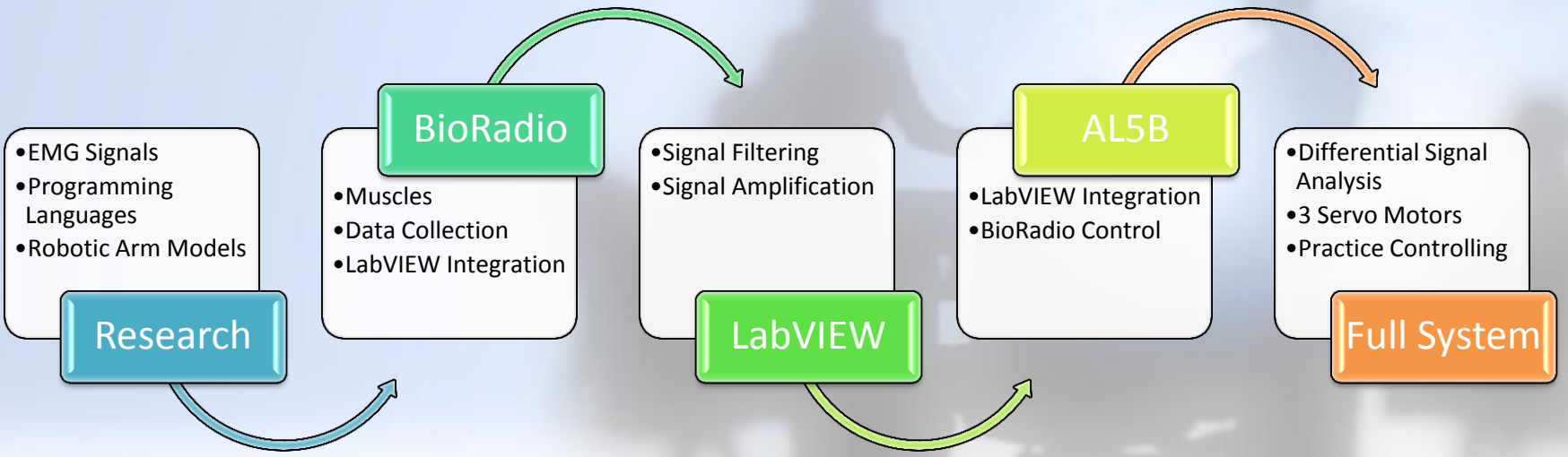



Objectives
General
Create foundation for effective and cheap surgery
Specifically
Develop algorithm (in LabVIEW)
Gathering signal (EMG)
Transmit signal to arm

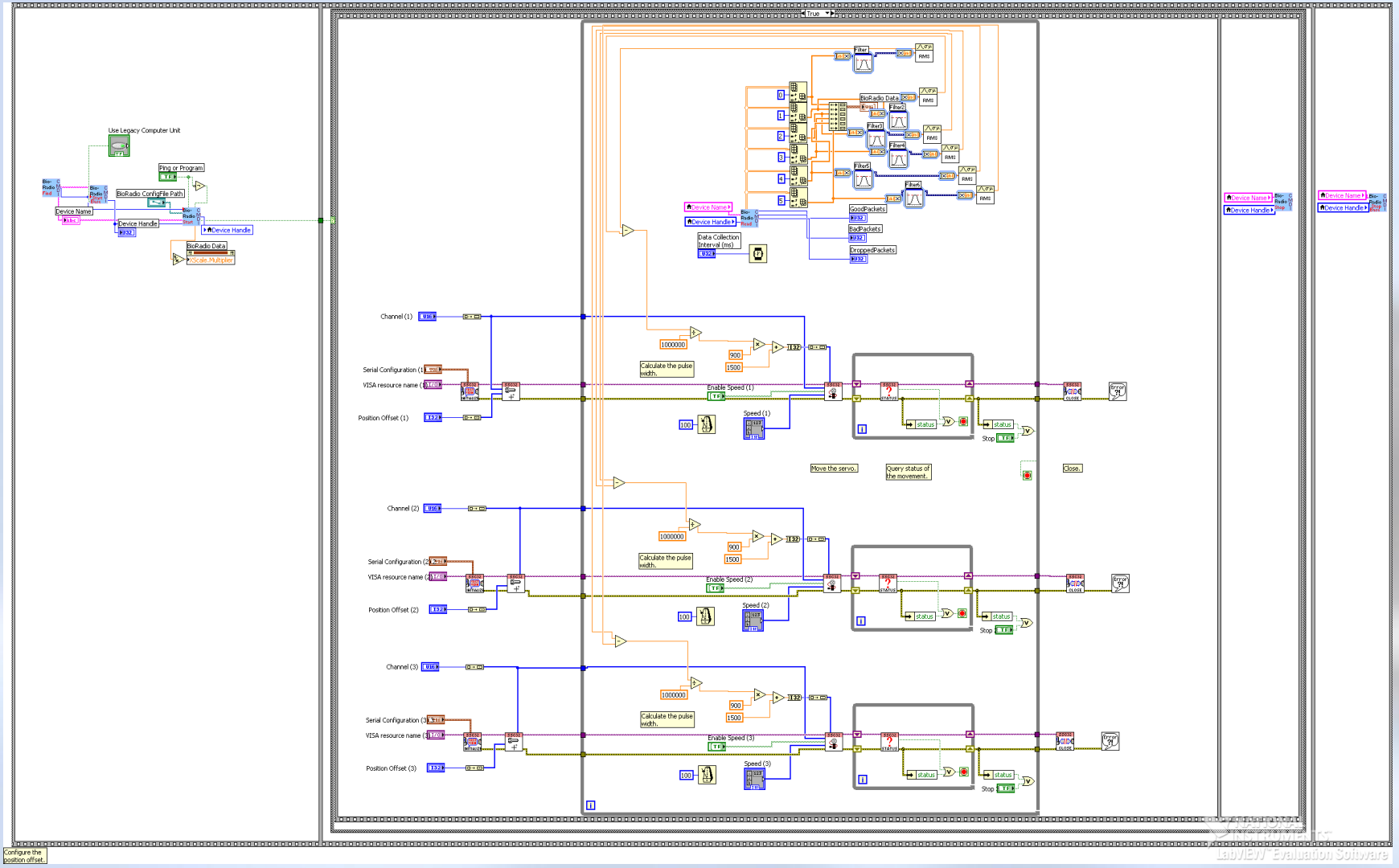
Components



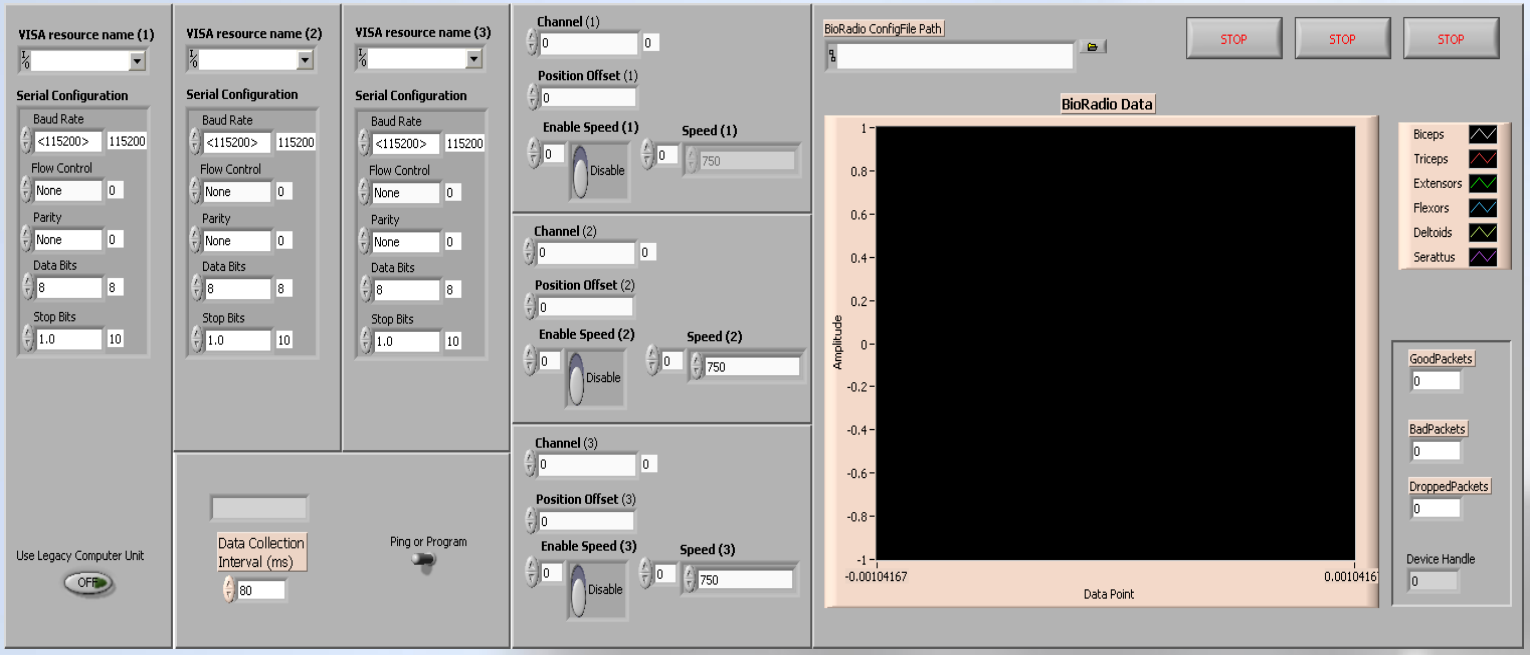
Project Progression



LabVIEW Program

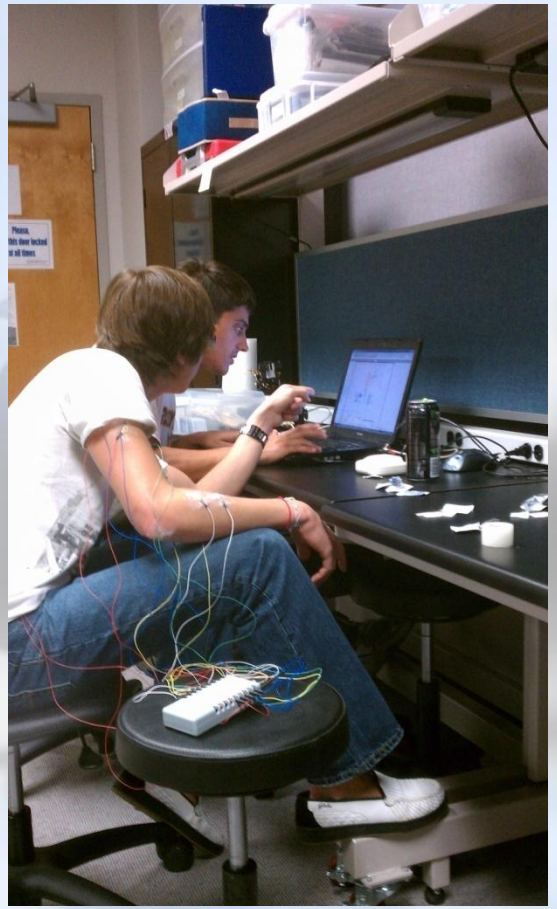


LabVIEW Control Panel



Results

- Develop a VI in LabVIEW to control all components
- Control a single servo motor using a live EMG
  - Incorporate three EMG channels
  - Perform tests to assess accuracy and precision

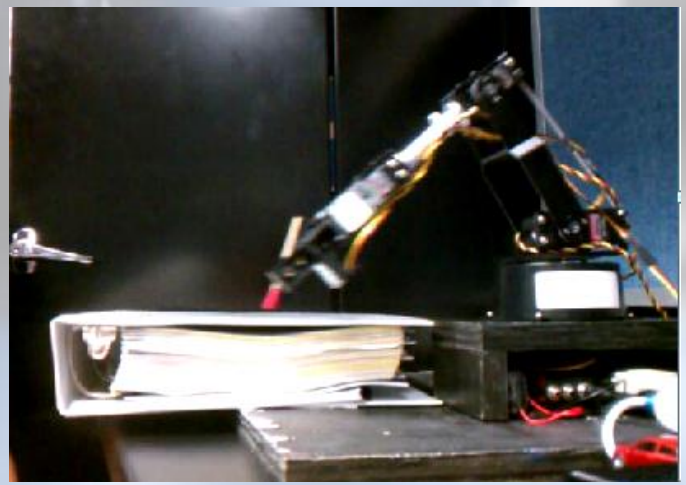


Data

Pointing Accuracy	
Trial	Distance from Target (cm)
1	3.00
2	1.20
3	0.40
4	2.30
5	0.80
6	0.60
7	1.10
8	0.50
9	0.20
10	0.80

Depth Test			
Trial	Target Depth (cm)	Experimental (cm)	Percent Error
1	2.00	4.50	125.00
2	2.00	3.70	85.00
3	2.00	0.70	65.00
4	2.00	2.60	30.00
5	2.00	3.10	55.00
6	2.00	1.60	20.00
7	2.00	2.10	5.00
8	2.00	2.40	20.00
9	2.00	1.80	10.00
10	2.00	1.90	5.00

Test Cut Length			
Trial	Target length (cm)	Experimental (cm)	Percent Error
1	8.00	5.50	31.25
2	8.00	2.40	70.00
3	8.00	6.00	25.00
4	8.00	8.50	6.25
5	8.00	9.30	16.25
6	8.00	6.90	13.75
7	8.00	7.60	5.00
8	8.00	7.20	10.00
9	8.00	5.80	27.50
10	8.00	8.20	2.50



Wrist Control

- Video

Elbow Joint

- Video

Shoulder Control

- Video

Robotic Arm Arc Cut

- Video

Twitchy Cut

- Video

Failed Cut

- Video

Successful Cut

- Video

Straight line

- Video

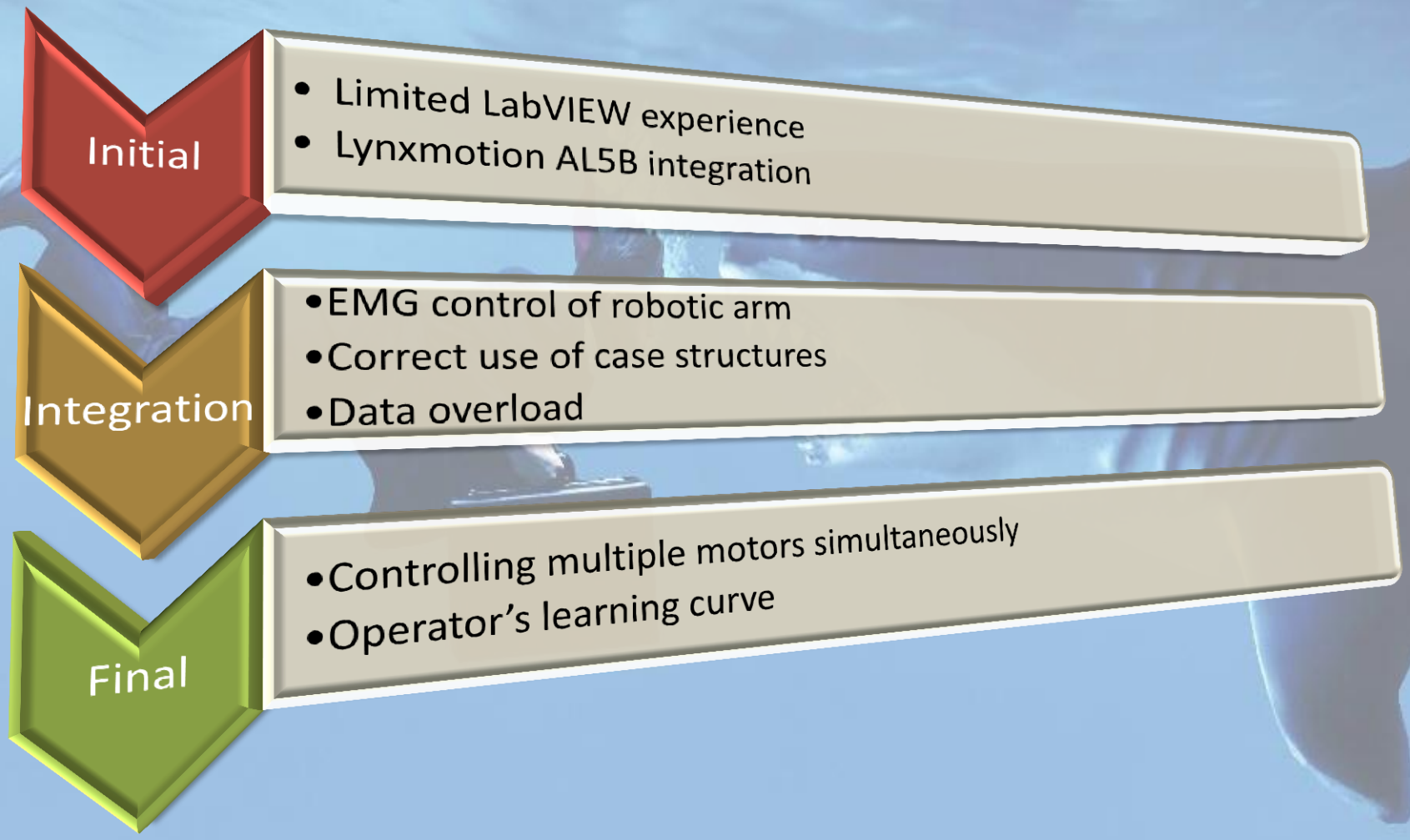
Robotic Arm 2-Planes

- Video

Robotic Arm Back and Forth

- Video

Obstacles


Initial
Limited LabVIEW experience
Lynxmotion AL5B integration
Integration
EMG control of robotic arm
Correct use of case structures
Data overload
Final
Controlling multiple motors simultaneously
Operator's learning curve

Conclusion

- Obtained and processed EMG signal
- Isolated robotic arm to 3 DOF
- Operated 3 motors with 3 corresponding pairs of opposing muscle groups
- Performed cutting motion of specified length and depth using the BioRadio/LabVIEW/AL5B system

Future Work

Signal

- *Better filters*
- *Reduce lag*
- *Needle electrodes*
- *Additional control components*

Robot

- Wrist rotate
- Base rotate
- Base mobility

Other

- Programmable constraints
- Truly wireless signal

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