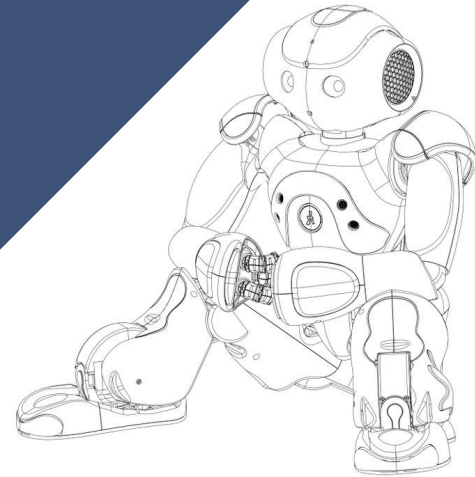# Visual and Aural Telepresence via NAO Robot

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Overview

- Problem Definition
- Project Goals/Detail Specifications
- Open AIs
- Project Status
- Schedule (Milestone Chart)
 - Work Plan/Tasks
  - Milestone Details
- Budget
- Summary

- Applications for telepresence/teleoperation devices

  - Remote in to lectures, classes, conferences

  - Navigate dangerous terrain

  - Work remotely as tour guides, security, consultants, etc.

- Will allow people in far away places or people with disabilities to have face-to-face interactions

Introduction to NAO

- SoftBank Robotics NAO Robot

- Ideal for HRI (human robot interaction)

  ▷ 58 centimeters

  ▷ 25 Degrees of freedom to mimic human motion

  ▷ Microphones (x 4) and speakers (x 2)

  ▷ Cameras (x 2)
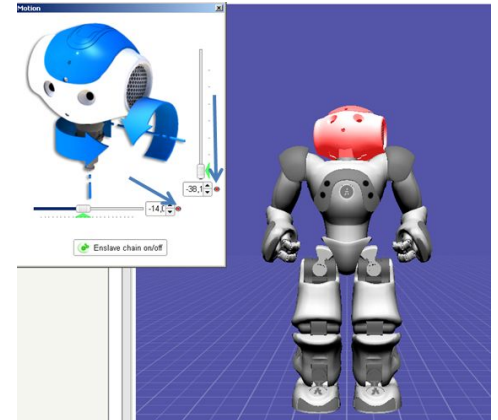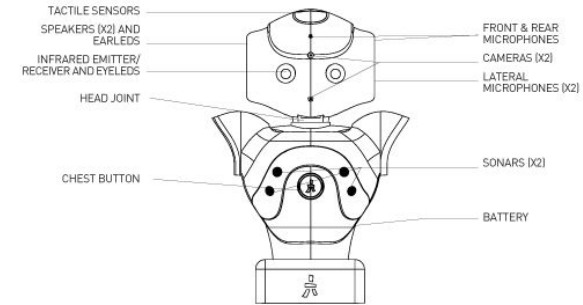
Project Goals

- To aurally engage the user and audience using the NAO robot
- To develop wireless communication between the NAO and a user wearable headset, connecting movement between the two using a gyro sensor
- To develop a mobile application which receives a live video stream from NAO
- To incorporate some or all arduino modules from the previous year's senior project using NAO (*Motion-Based Humanoid Robot Controller* by Olivia Shanley and Yilin Yang)

Team Breakdown

Team Member	Position	Work
Chelsea Cantone	Team Leader	To implement audio streaming and speech processing between the NAO and its operator
Daniel Ponsini	Budget Keeper	To work on controlling NAO movement based on sensor information and work out wireless communication between the NAO and headset
Theresa Pham	Web Developer	To work on video processing and develop the mobile application for video streaming to the operator

Open AIs

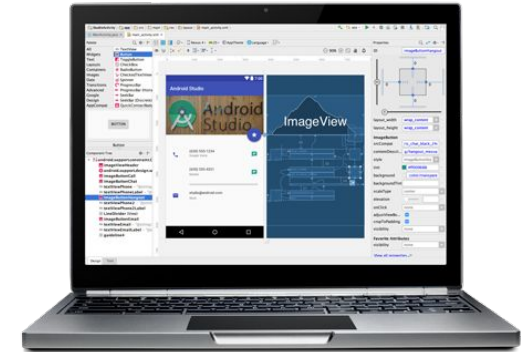| Action Item	Assigned To	Due Date
Understand Android Studio for mobile development	Theresa, Chelsea, Dan	September 18th
Setup project website	Theresa	September 18th
Investigate utilizing a mobile device's internal gyro	Dan	September 20th
Install other python packages on NAO	Dan	September 13th
Research accessing audio and video stream from NAO	Chelsea	September 18th

Project Status

- Began preliminary research into streaming A/V from NAO
  - Identified a completed projects online: *NAO robot control through web and remote camera viewing*
- Decided on a cost-effective VR headset -- Google Cardboard
  - Purchased
- Important project decisions concluded
  - Mobile development for Android
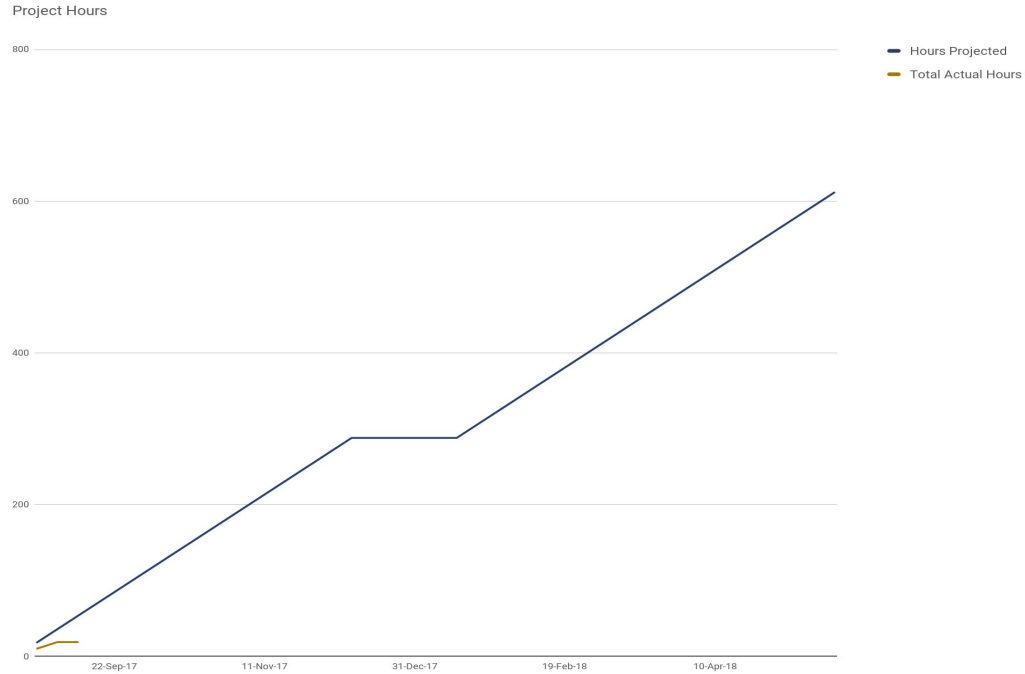 - Investigate gyro in mobile device instead of incorporating extra sensor

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Projected Hours

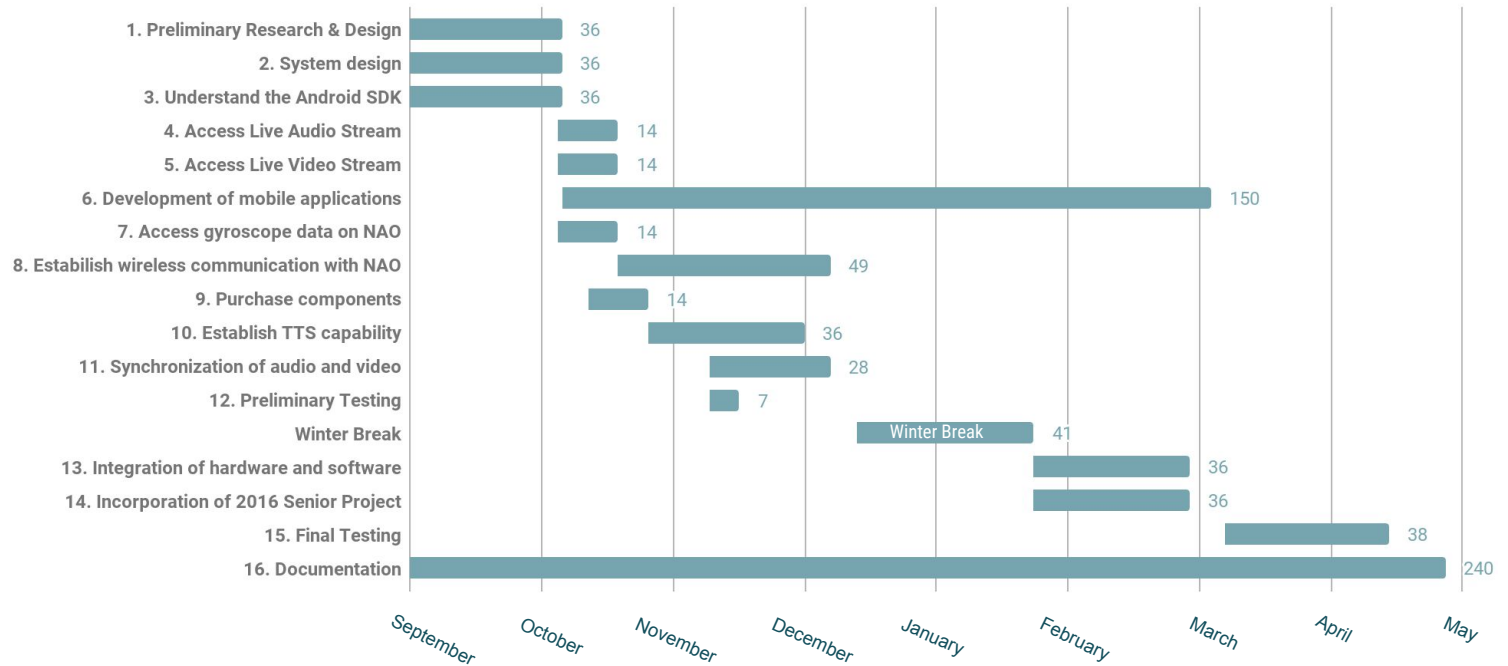Project Hours

Legend:
- Hours Projected
- Total Actual Hours

Schedule

Proposed Schedule for Senior Project

Task	Duration
1. Preliminary Research & Design	36
2. System design	36
3. Understand the Android SDK	36
4. Access Live Audio Stream	14
5. Access Live Video Stream	14
6. Development of mobile applications	150
7. Access gyroscope data on NAO	14
8. Estabilish wireless communication with NAO	49
9. Purchase components	14
10. Establish TTS capability	36
11. Synchronization of audio and video	28
12. Preliminary Testing	7
Winter Break	41
13. Integration of hardware and software	36
14. Incorporation of 2016 Senior Project	36
15. Final Testing	38
16. Documentation	240

September October November December January February March April May

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Project Milestone

Milestone 1: Preliminary Research and Design

Milestone 2: Access and process data from NAO robot

Milestone 3: Develop mobile app to interface with user through Google Cardboard

Milestone 4: Establish communication with NAO

Milestone 5: Test and debugging

Milestone 1: Preliminary Research and Design

Tasks 1 - 3: Present - October 6th

- Research similar projects

- Determine a feasible preliminary design

  ▹ Decide the mobile platform and research app development

  ▹ Determine appropriate hardware and software

- Learn relevant software tools

  ▹ Android Studio

  ▹ Python IDE

Milestone 2: Access and process data from NAO robot

Tasks 4, 5, 11: October 5th - October 19th, November 9th - December 7th

- Access the live video and audio feeds over Wi-Fi

- Synchronize feeds and reduce latency

- Experiment with processing raw data to improve quality

Milestone 3: Develop mobile app to interface with user through Google Cardboard

Task 6: October 6th - March 5th

- Develop intuitive user interface to connect a specific NAO robot to phone

- Show the live video stream through the phone display in a manner that can be watched through Google Cardboard

- Stream the audio feed through the connected headset

- Translate gyroscope sensor data to NAO

Milestone 4: Establish communication with NAO

Tasks 7, 8, 10: October 5th - December 7th

- Connect wirelessly via Bluetooth/Wi-Fi

- Wirelessly send gyroscopic head data to adjust NAO head position

- Send NAO audio and video stream through the mobile app

- Send user speech via strings to NAO

  ▹ Use Text to Speech capabilities on NAO

Milestone 5: Test and debugging

Tasks 12 - 15: November 9th - April 15th

- Ensure all components are interfacing seamlessly

- Get best video and audio quality achievable

- Test text-to-speech with various phrases

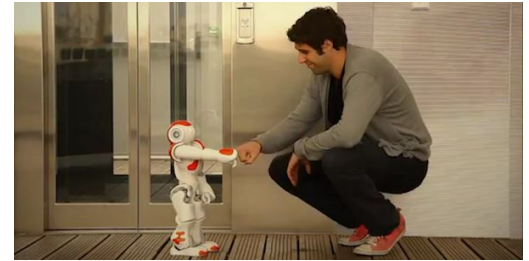- Optimization to reduce latency

- User testing

Budget

Total Budget: $300

Item	Quantity	Cost per Quantity ($)	Total Cost ($)
Gaming Headset	1	$ 149.99	$ 149.99
Google Cardboard	2	$ 19.99	$ 39.98
NAO Robot	1	$9,500.00	N/A
Miscellaneous (extra parts, shipping, etc.)	N/A	N/A	$ 110.03

Summary

- Development of a user-robot system for telepresence applications
- Interface several modules to provide for an engaging visual and aural experience
  - Mobile device, NAO robot, headset (audio), VR headset (video)
- Senior Project I Goals:
  - Finalize overall system design (teleoperated system and mobile device UI)
  - Develop individual modules (audio, video)
    - Refine synchronization in Senior Project II
  - Understand wireless NAO capabilities

Questions?