Team 9

In The Spotlight

Automatic Tracking LED Spotlight System
Team Members

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Outline

❖ Introduction
❖ Deliverables
❖ System Design
❖ Subsystems
  ➢ Lighting
  ➢ Actuation
  ➢ Sensing
  ➢ Tracking
  ➢ User Interface
❖ Conclusion
Current Problems

❖ Current Spotlights are Labor Intensive
  ➢ Individual Spotlight Operators
  ➢ Occupational Hazards Include
    ➢ Heights
    ➢ Burns
    ➢ Hearing Loss
❖ Difficult to Use After Blackout
❖ Difficult to Coordinate

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Our Solution - Deliverables

- Simplified LED Spotlight
- Automated Light Actuation
- Actor Sensing
- Automated Tracking
- Graphical User Interface
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System Design

- Physically Separated Sensing, Control, Tracking, Actuation, and Lighting Units
- PC Based User Interface and Tracking
- Ethernet Communication
  - Long Distances (>100ft)
  - Video and Bi-direction Commands
  - Existing Wiring Infrastructure
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Lighting

❖ Light Source
  ➢ Chip on board LED array

❖ Thermal Management
  ➢ Hybrid cooling
  ➢ Temperature sensor

❖ Dimming
  ➢ PWM

Actuation

❖ Primary Requirements
  ➢ < 30 dB Noise When Moving
  ➢ Required Pan and Tilt Angles

❖ Primary Design Alternatives
  ➢ Direct Pointing
    ➢ Full Range of Pointing Angles
    ➢ Slower and Louder
  ➢ Mirror Pointing
    ➢ Faster and Quieter
    ➢ Limited Pointing Angles

❖ Motor Considerations
  ➢ Brushless DC Pan Motor
  ➢ Brushed DC Tilt Motor

http://www.fullcompass.com/common/products/original/107956.jpg

Sensing

❖ Ideal
  ➢ Dual camera system
    • Near-Infrared camera
    • Visual camera
  ➢ Near-Infrared Beacons
  ➢ High Frame Rate and High Resolution Cameras

❖ Prototype
  ➢ Possibly One Camera: Visual camera with the IR filter removed
  ➢ 25-40 Frames Per Second
  ➢ 480p-720p Resolution
  ➢ Possible Second Visual Camera if a Visible Light Filter is Used

http://www.vividlight.com/29/images/Spectrum%20of%20Light.jpg
Sensing Demonstration

❖ Early Prototype
  ➢ Variable Speed Flashing Prototype
  ➢ 850nm and 950nm 120° LEDs

❖ Future Improvements
  ➢ Improved Camera Control
  ➢ Video Frequency Filtering and Background Subtraction
Control

- **PC User Interface**
  - Clickable View of Stage
  - Tracking Selection
  - Light Parameter Adjustment

- **DMX Integration with Existing Lighting Boards**

- **Custom DMX Control Board (Stretch Goal)**

[Link](http://static.musiciansfriend.com/derivates/6/001/208/512/DV019_Jpg_R331775.jpg)
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Conclusion – Focus Areas

- Tracking System
  - Camera Selection
  - Tracking Algorithm Development

- User Control System
  - User Interface Development
  - Communications

- Simplified LED Spotlight
  - Part Selection

- Light Actuation System
  - Physical Design and Mockups
Questions?