TEXAS SPACE GRANT CONSORTIUM
DESIGN CHALLENGE

TOPIC # - TDC - 25 – S22

ADVANCED SPACECRAFT LIGHTING CONTROL SYSTEM

BACKGROUND

Future spacecrafts/haibtats will require new and innovative advanced lighting systems to minimize power, improve reliability such as compensating for degrading lighting sources, and provide lighting necessary for the biological aspect of the human (maintaining crew's circadian rhythms). Moreover, the lighting system should aid in growing plants and vegetation in vehicles and habitats. The spacecraft lighting system not only must put out the right intensity and color for the crew and plants but also monitors any degradation of the light and compensate for this degradation such as light intensity has decreased or the lighting cover or diffuser has aged and become more opaque causing less light output and/or the color such as blue is filtered out. These advanced lighting systems should be part of a network bus to premit control from a central station GUI or tablet.

PROBLEM DESCRIPTION

This project has a **primary** and **secondary** (or stretch goal) design goal:
(1)The primary goal of this project is to have multiple lighting source (circadian rhythm maintained) and sensors (for compensation) in various rooms and have a unified control over these lights using a simple application running on a smart phone or a dedicated local web server. The design monitors the output light of a LED light fixtures for degradation of light intensity (nominal light intensity around 500 lux measured at 8 feet) and color spectrum/intensity changes. Changes in either the lighting intensity or color spectrum are flagged. Both auditory and visual warnings are annunciated through a user interface (UI) and the information is sent to the lighting controller to compensate. In addition, the system must maintain the crew's circadian rhythm (CR). Since multiple lighting sources/sensors will be distributed throughout the spacecraft, a communication network to tie all the lighting sources and sensors together to simplify cabling for communications is desired. (**2) The secondary goal** (or stretch goal) for the system design is to encompass all the requirements of the primary goal **plus** the system must be commanded and control the lighting network on a common bus such as Ethernet standard as well as process voice commands to change various parameters of the lighting systems. The lighting system should be programmable for growing plants and vegetation. The smart application should be able to control the color and wavelength for the plant (leafy vegetable/ flowers/crops) being grown.

CONSTRAINTS

- Use commercial components (This is a proof of concept prototype)
- Main lighting unit uses AC power vs. using a battery
- System can be programmed to change the threshold parameters of intensity and color spectrum.
- Can program for circadian rhythms of at least two crew members.
- Communication network between the sensor/lighting system and the user interface can be wired such as DMX-512 standard or wireless like Bluetooth.
- Highly desired to demonstrate the concept with four lighting fixtures
- For Secondary goal, voice control WER <5 is highly desired.
- Packaging and size considerations for transportation should be considered.

Deliverables: Schematics, block diagram build of materials, Operating manual, software code, known bugs.

Design Project Topic Offered By:
NASA JSC, EV/Human Interface Branch

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DESIGN TEAM PROFILE

NASA MENTOR:	George Salazar
LEVEL:	Upper Division [JR/SR];
MAJOR / DISCIPLINES:	Electrical Eng., Computer Eng.
AREA OF RESEARCH:	Lighting and spacecraft systems
TEAMS:	Mentor will accept one or two teams for this project.
DURATION:	Two Semester Project

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