TEXAS SPACE GRANT CONSORTIUM
DESIGN CHALLENGE

TOPIC # - TDC - 86 - S24

INTEGRATED CAMERA & LIGHTING SYSTEM OPTICAL OPTIMIZATION PROJECT

BACKGROUND

In today's world, one can't escape the utilization of camera systems. They are used for recreational, vocational, industrial automation, security, agriculture, safety, and vehicular autonomy. Cameras can be designed to operate for visible and non-visible wavelength reasons. Ultimately, however, cameras require the object they are observing are visible for the wavelength range they were designed for. The visibility of the objects in the field of view of the camera require appropriate illumination, and quality imagery requires a balancing of both the exposure settings on the camera and the illumination field. In many cases, cameras are paired with illumination sources to maximize the effectivity of the camera, and sophisticated cameras use software to dynamically manage camera exposure settings to maintain image quality requirements. When developing an integrated camera and lighting system, it is important to understand the operational task environment, otherwise the system will not work as desired. Today, NASA utilizes integrated lighting and camera systems for a range of critical spacecraft vehicle tasks, some of which use this data for autonomous piloting.

PROBLEM DESCRIPTION

Assume you are responsible for developing an integrated lighting and camera system for a lunar surface rover. Your system needs to operate under total darkness, with other artificial lighting systems in the area, with direct high intensity sunlight, and produce quality imagery even of targets that are in shadow, even though other parts of the camera image are not. Additionally, your system needs to produce quality imagery, even though the surface materials within the image could be dark like asphalt, as diffuse white as canvas, as shiny as polished aluminum, or behave like retroreflectors. The goal of your project is to utilize programmable light sources and a programmable camera system, to determine a range of system geometries and system settings that facilitates quality imagery despite a range of material surface types and patterns despite a range of environmental lighting conditions.

DELIVERABLES: System specs, software or methods, system configuration, test plans, imagery, and explanation of each configuration and why some methods worked, and others did not.

DESIGN TEAM PROFILE

NASA MENTOR:	Toni Clark
LEVEL:	Upper level [JR/SR]
MAJOR / DISCIPLINES:	EE/ME/Optics/Architecture/Automotive/Theatrical/Photogrammetry
TEAMS:	Mentor may accept more than one team
DURATION:	Two-Semester Project