NASA ISGC: Automated Process for Robotic Assembly of Thin-Film Solar Arrays

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Background

The overarching goal is to **execute process and business development initiatives inspired by patented technologies made available through the NASA Technology Transfer to University (T2U) program**. Through informal discussions with NASA, we have discovered that NASA has ~1500 patented technologies that have potential for high societal impact but are not directly being utilized by NASA. The T2U program thus serves as a conduit for transfer of these technologies directly to universities to facilitate product development and commercialization opportunities via licensing of the technology should a product market exist. As a result, a tremendous opportunity exists to leverage the T2U program to engage students in state-of-the-art innovation using already patented technologies, while at the same time integrating both engineering and entrepreneurship students into the product development and business planning processes.

Project Description

The objectives of this project are to a) **develop and demonstrate an automated assembly process for compiling thin-film cells into larger photovoltaic arrays using tandem robotic armatures**, and b) **evaluate the potential for implementation into a real-world application**. Typically, the process for assembling solar arrays on the market today is manually accomplished and includes multiple steps, which is time-consuming and prone to human error. To dramatically increase process efficiency, NASA has developed a novel print-assisted photovoltaic assembly (PAPA) process that is robotically enabled to accomplish four tasks including 1) applying adhesive, 2) placing the cells, 3) printing the electronic connections between the cells, and 4) adding a protective cover.

Last year, a capstone design team utilized two Denso robotic armatures (donated from the Boeing Company) to develop end effectors and the required movements to accomplish the assembly process (Fig. 1). They made great progress but have not fully completed a comprehensive demonstration of solar array assembly. As a result, it is desired for this team to assess the prior team's progress, identify any knowledge and capability gaps, and strive to demonstrate a representative assembly of solar arrays.

Looking ahead, we are interested in exploring the potential for commercialization of the patented PAPA technology. The charge for this team is to brainstorm potential applications, select one, and develop a conceptual design to evaluate its feasibility for widespread commercialization. Given the potential large scale, this portion of the project can be a "paper study" involving 3D modeling, structural analysis, thermal analysis, cost estimations, and possibly some rapid prototyping.

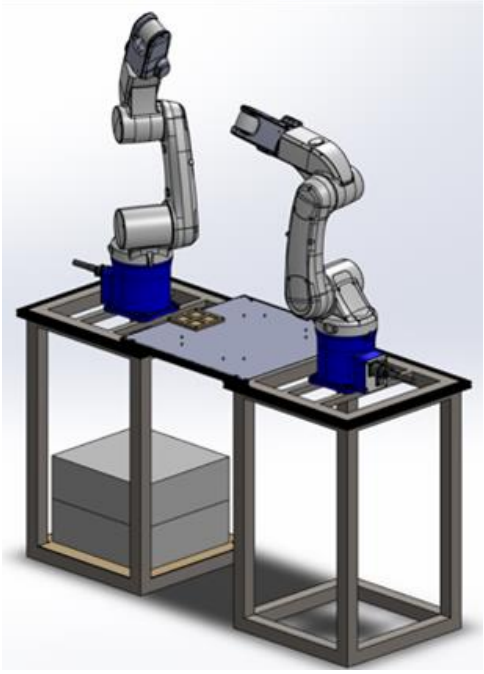

Figure 1. Rendering of two robots configured for automated assembly of photovoltaic arrays.

The available budget for student spending is ~$1,686 but the money must be spent within the first semester.

Engineering Disciplines: ME, EE, CS, and possibly CE.