Title: Active and On-demand Multi Robot Perception (AOMRP)
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City/State: Fayetteville, NC
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Summary:
The project titled Active and On-demand Multi Robot Perception (AOMRP) will build on structures established at Fayetteville State University (FSU) to contribute to the priorities of NASA STMD and Artemis. The project will increase the capacity of FSU to participate in research of interest to NASA. A research priority for NASA is to find valuable science targets on extraterrestrial surfaces by deploying autonomous Multi Robot Systems (MRS). This project proposes multi robot perception, which is an important part of MRS since it will help find science targets in an efficient manner using image sensors, which are highly specialized cameras. This visual exploration and analysis has to be done under conditions of limited communication capability, and extreme conditions where only limited and time delayed MRS control by humans from base station will be possible. MRS exploration is necessitated due to these challenges. The proposed work will develop technical approaches for aggregating and refining data from image sensors so that the MRS is able to save energy by saving onboard computational costs. The project team will solve the following research problems to develop this technology: (1) create a deep neural network model that will be able to stop computation on-demand e.g. when further refinement of target identification with labels may be stopped to save computational efforts (2) the same model will also be able to create scientific labels for objects in camera view and associate confidence levels to these labels (3) using the deep neural network model will be able to produce scientific label inference from pixel data while saving the total energy cost of running onboard computations for the entire MRS. The project will prepare students for advanced research through a combination of the following innovative strategies: physical computing through which students will gain understanding of the connection between hardware and software, process oriented guided inquiry learning which will help students construct advanced knowledge through teamwork, and participation in entrepreneurship activities which will increase the critical thinking abilities and confidence of students. The prepared students will be immersed in research tasks in collaboration with NASA/JPL researchers and collaborators from the software industry.