In recent years, there has been significant growth in the applications of unmanned aerial vehicles (UAVs), which are becoming increasingly important in various aspects of our daily lives. Technological progress, mass production of electronic components, growing demand for the use of UAVs in the military, industry, media, and medicine, an expanding consumer market, the introduction of appropriate regulations, and socio-environmental changes all suggest that this market is likely to develop at an even faster pace. This development will undoubtedly revolutionize further areas of the economy; however, many challenges related to their operation will need to be overcome.

One of the main issues limiting the use of unmanned aerial systems is the limited flight endurance, which is particularly significant in the case of the most popular low-altitude, long-endurance (LALE) class vehicles. The energy available to these vehicles is usually stored in lithium-polymer or lithium-ion batteries due to their numerous advantages (e.g., small size and cost). Unfortunately, these types of batteries have a serious limitation in terms of electrical capacity, which, in the case of long-duration missions, may require the vehicle to return to a base station, recharge the battery, and then continue the mission.

For LALE-class vehicles, it is not possible to use solutions from military aviation, such as aerial refueling (e.g., KC-10 Extender, KC-135 Stratotanker), because, due to the smaller size and mass of UAVs, they are more sensitive to environmental conditions (e.g., gusts), which would significantly complicate precise piloting and could lead to flexible charging cables entanglement, and in the case of using inductive charging technology, it would result in significant energy losses.

An alternative could be the use of energy available from the environment, e.g., solar energy. Photovoltaic systems have lower energy conversion efficiency and are dependent on atmospheric conditions; however, the energy source is inexhaustible, and solar panels can be mounted on the wings, making it possible to effectively use the available surface to generate electricity without significantly deteriorating aerodynamic characteristics.

The scientific goal of the project is to build a generic simulation model describing the flight of a small LALE-class UAV, taking into account the presence of a photovoltaic system. Such models are not available in the literature, as research on solar UAVs focus mainly on the design and subsequent use of the vehicle, e.g., to achieve long flight endurance. This type of scientific goal aligns with the principles of sustainable development, particularly in the context of environmental protection, by promoting technology based on renewable energy sources, reducing emissions associated with testing physical prototypes, and minimizing the use of materials and resources required for their construction.