ABSTRACT

Limited access to electricity in remote areas presents a major challenge in supporting the operation of Unmanned Aerial Vehicles (UAV), particularly in the battery charging process. This research aims to design a solar-powered battery charging system at a ground station as an alternative to dependence on conventional electricity sources. The charging system is focused on utilizing lithium-ion 18650 batteries in a 4S3P configuration and a 12V VRLA battery for energy storage. The scope of this research is limited to normal weather conditions without extreme disturbances, and it uses a monocrystalline solar panel integrated with a Solar Charge Controller (SCC) equipped with Maximum Power Point Tracking (MPPT) to optimize energy conversion.

The energy from the solar panel is converted through the SCC and delivered to the VRLA battery to supply power for the charging process of the 18650 battery. The system is equipped with current and voltage sensors to monitor the parameters of the VRLA battery. Additionally, a voltmeter is used to observe the charging process of the 18650 battery, and the charger is connected to an inverter via a power supply, with the output voltage regulated using a step-down module to match the charging requirements. Testing was conducted on voltage, current, and power parameters entering the batteries.

The test results show that the system is capable of operating independently, generating a solar panel voltage of approximately 21.2–23.0 V. The battery voltage increased gradually, accompanied by a decrease in charging current and power. The system demonstrated an adaptive response to fluctuations in sunlight intensity and can operate without relying on conventional power grids.

Keywords: *Solar panel, battery charging, Li-ion battery, VRLA battery*