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Development of an autonomous wide-field camera unit for monitoring optical transients that occur in the atmosphere

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Ground based wide-field cameras are used in many research purposes in the fields of astronomy, atmospheric physics, and aviation, to monitor the sky continuously. These cameras are known as all-sky cameras and are capable of obtaining a hemispherical view of the sky. Existing all-sky camera units are mostly semiautonomous devices and rarely compatible with the requirements of remote monitoring. Therefore, in this research an autonomous camera unit was developed, with the aim of launching it in remote locations, which require minimum human supervision for functioning continuously. The unit is comprised of a fast astronomy camera, fish-eye lens, single board computer and a storage device. A dynamic subsystem of electronic sensors is functioning with the single board computer for obtaining standard time, location, internal temperature, humidity, and orientation of the camera unit. For allowing uninterrupted internet access, the unit includes a wireless network module (Wi-Fi) and a General Packet Radio Service (GPRS) module. All the electronics of the camera unit are housed in an inner enclosure and secondary weather resilient enclosure protects the unit from rain and heat. The unit consumes power of 230V, 10W from mains electricity, and a battery backup of the device can power the unit in case of an interruption. Internet of things (IoT) technology was utilized in developing the software platform of the unit; thus the camera unit can be connected as a cyber-physical application allowing it to upload the acquired data to required peripherals or websites. The camera captures a 185^{o} view of the sky and acquires images of the sky with exposure times of 8 seconds and 5 milliseconds during the night and the day time, respectively. The camera unit was calibrated using astrometric and photometric methods, so that the trajectory and luminosity of any recorded object can be measured. During the initial test run, the camera has captured data of high altitude cloud movements, lightning, meteors, aircraft, and artificial satellites.

Keywords: All-Sky camera, Autonomous, IoT

Acknowledgment: Financial assistance by NRC Research Grant 16-012

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