Novel Implementation of Additive Construction Through Autonomous UAVs

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Despite technological advancements in automation, the construction industry continues to primarily rely on manual labor. This project strives to implement autonomous masonry utilizing drones with the objective to minimize the risks and costs associated with using manual labor in construction. The prototype developed for this project features a drone which runs using a Pixhawk 4 (Chibi, Ardupilot) and a companion computer RaspberryPi 5 (Ubuntu 24.04 server edition). A linear actuator, 'the grabber', is mounted below the drone and is powered via a relay module controlled with a bipolar transistor through PWM from the Pi. Communication between the Pi and the Pixhawk is facilitated using MAVLINK 2.0, while ROS2 is employed for integration with the grabber and modular control of the system. The drone is tested using solid wooden and 3D printed bricks. With native GNSS RTK the drone was able to achieve a supposed in air <2 cm placement accuracy. Since autonomy in construction is still at a nascent stage, this project is a step towards full autonomous construction. Specifically, it introduces a novel application of autonomous UAVs in masonry. This method offers potential benefits over 3D printing construction technology due to its inherent versatility, since printing technology is limited in construction of multiple storey buildings and requires hybrid construction. Future research can leverage camera/LIDAR based localization for even greater precision. Upon application in the industry centralized drone swarms can be utilized. Further different claws 'grabbers' can be use5d for different applications such as applying adhesive and placing beams etc.

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