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Self-Healing Autonomous Vehicles

Increasing System Resiliency with Automated Program Repair

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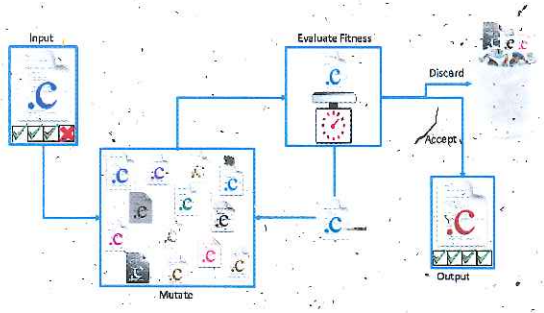
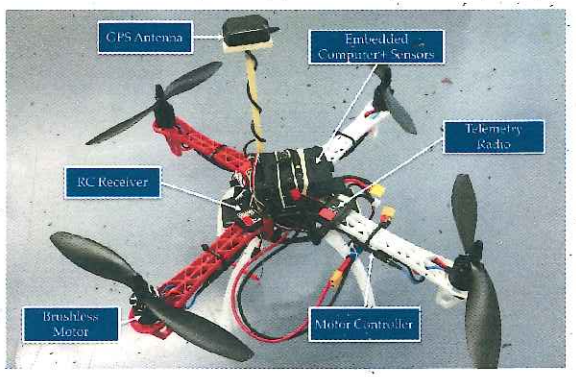


Autonomous vehicles, such as quadcopters and rovers, perform critical tasks for government agencies and emergency services. Missions often take place in locations where communication with human operators is infrequent or delayed, such as distant planets, war zones, and remote crash sites. Consequently, humans may not be able to take manual control to recover the vehicle if the software begins to malfunction. Many of these malfunctions, or software bugs, do not cause total loss of the vehicle, but rather hinder the successful completion of a mission (e.g., a sample is not collected or a camera is not pointed in the correct direction). How can an autonomous vehicle fend for itself when such malfunctions occur?

To help solve this problem, our research group is currently adapting automated program repair techniques to autonomous vehicle applications. Our tool, GenProg, makes use of an evolutionary approach to repairing software bugs in which small changes are incrementally added to the software and tested until a solution is found. After finding a repair with GenProg, the next challenge is deployment to the autonomous vehicle. In many situations, it is impossible to stop or change the software running on these devices. Our group is currently developing a solution for directly inserting repairs into running programs using specialized hardware.



Our contributions aim to increase system resiliency for autonomous vehicles, allowing more missions to complete successfully in the face of software defects.

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