The Unmanned Airship Vehicle (UAV) has a massive ability for low altitude and low speed exploration and surveillance applications. In order to develop a blimp based on a small size, light weight, high level functionality and communications, the navigation system and autonomous embedded blimp system are presented in this paper. The low-weight components of a Gumstix computer-on-module running embedded Linux system were described. The interface between onboard Linux operating system and device drivers makes the blimp more applicable and increase the efficiency of exploration to meet the actual needs. The main challenges of designing such a low weight blimp in regard to autonomous operation are the efficient interaction between the software and hardware components and also the efficient of the controller algorithm to improve the behaviors of the blimp. Therefore, the architecture of the fuzzy control is introduced and employed. The experiments results show the system ensures the stability and reliability to accomplish actual missions.