Quadruped Wild-Environment Ranger Based on Inverse Kinematics and Gait-Changes

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The task of wild environment ranging in mountainous forest environment is long conducted by the human forest rangers with limited and rudimentary mountain equipment, which leads to lack of continuous data regarding mountainous forest environments. With the recent quadruped robotics advancement, implication of quadruped rangers in forest environments becomes plausible. The gaol of this project is to explore the possibility of quadruped robot's manoeuvring through mountainous forest environments as a potent tool of forest ranging. Under this thought, a quadruped forest ranger consists of servos, simple sensors, and 3D-printed materials is developed and programmed. The quadruped ranger has an octagonal main body and four identical legs in a configuration that allows the quadruped ranger to easily manoeuvring around forest environments. A variety of gaits are designed to allow the ranger to overcome the complex terrains and obstacles. All gaits are derived through the crawling and trotting movements of four-leg-animals. The servo controlling algorithm is based on a recursive Forward and Backward Inverse Kinematics (FABRIK). Through experiments and testing conducted in laboratorial environments designed to mimic true mountainous forest environments, the efficiency of each gait to the corresponding specific environments is determined. The experiments and testing conclude that this quadruped ranger has the basic ability of manoeuvring through the assumed mountainous forest environments, eventually proving its further possibilities. In the future, with further AI and communication advancements, quadruped rangers could replace the traditional forest ranging tools, making year-long data collecting in forest environment consecutive.

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