Hexapod: Design and Programming of a Six-Legged Exploration Robot

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Our project is concerned with the construction and programming of a six-legged exploration robot. The intention of using it for exploration in danger areas such as buildings at risk of collapsing entailed clear requirements. We considered the following application profile: Manoeuvrability in narrow spaces as well as on uneven and unsteady ground; Sufficient uptime; Radio remote controllability even if the local infrastructure is down; Modular structure and equipment adjustable to the purpose; Reliability as well as quick restoration of operation. From this application profile we developed the design of our Hexapod: In order to be able to manoeuvre in narrow spaces, we decided to use legs. A six-legged construction provides high stability and mobility. Because there is always a risk of failure in danger areas, it was important to compensate for the loss of single legs. In order to use the robot for multiple purposes, we needed to come up with a flexible hardware and software design. We designed the parts using CAD. The design of the legs and the chassis gives high freedom of movement. The curved shape of our leg segments turned out to be optimal for stability and freedom of movement. The servos we chose are able to measure deflection and load very precisely. This gives the Hexapod feedback on the current ground conditions and enables the implementation of the dynamic ground adaptation we have developed. We implemented the software with Java, which provided the advantage of a modular, object-oriented programming, and allowed control via a smart phone App also developed by us. We developed all the individual program modules for the control of leg movements, various gait styles, sensor technology etc. We made sure to keep the integration of new modules very simple.