In this thesis, we propose and evaluate a method for tracking short-term movement and orientation of a device using only its on-board sensors - accelerometer, gyroscope and magnetometer. A straightforward method of motion tracking is described from the theoretical perspective and afterwards transformed into a practical algorithm. To improve its performance, we enhance the method with a stabilization system, which corrects the bias caused by sensor inaccuracies every time the device stands still. The effectiveness of the proposed method and the merits of the enhancement are evaluated in several experiments with two mobile devices. Furthermore, a complete software solution is included, which allows experimentation with smartphone sensors in a user friendly interface.