Abstract

When mobile robots control is considered, the intuitiveness of the human–robot interface, as well as of the control module itself, plays a great role. Within this thesis, various models for controling mobile robot with the aid of a system of accelerometers are presented, all of which are later evaluated for their intuitiveness and convenience of control.

Following a short introduction about equipment used for experiments — which includes the Seekur Jr robot and a mobile phone equipped with a tree-axes accelerometer and a Wi-Fi adapter — three different models for translating accelerometer output to robot motion are proposed.

Two of those models can be classified as "traditional" models - they are based on multivariate interpolation, widely used in digital image processing. The first of those two models utilizes the bilinear interpolation algorithm, one of the simples algorithms used when altering the resolution of an image. The second model makes use of Shepard's interpolation, one of the first algorithms for multivariate interpolation to be able to interpolate on an irregular grid of points.

The remaining algorithm stems from the *genetic programming* paradigm, aiming for independent problem solution by computers, without any human interaction during the solution-finding phase. Proposed are various criteria of resulting approximation functions rating, needed for proper search for solutions. Later, the findings from those searches are discussed.

Later within this thesis, methods for filtering input data from the accelerometer are discussed. Filtering is considered neccessary for eliminating a possibly negative effect of the vibrations of a hand on robot control. Two methods are proposed, both of which are based on the *moving average* method, namely the simple moving average and the exponential moving average.

After the discussion on filtering follows a detailed technical description of the control system. Full specification of the communication protocol between the application running on the robot (the server) and the application gathering input from accelerometers (the client) is given. Several methods to ensure safety while operating the robot are described and implemented.

Later, a description of the test cases is given, as well as a summary of obtained results. In the last part of the thesis, several inferences based on the conducted work and experiments are presented, along with a recapitulation of the whole thesis.

There are two appendices to this thesis, first of which describes the standarized way of storing a floating point single-precision number in memory and the second, which describes the algorithm used to calculate CRC checksums. Both of them are important in the light of the content presented within the thesis.