In these last few years, mobile robots have been increasingly employed for outdoor applications. Autonomous driving in these applications is a challenging issue in mobile robotics, particularly when the domain is unstructured and harsh. In addition, uneven environments are often characterized by low visibility due to poor illumination conditions and weather phenomena including fog, rain, snow and hail, or presence of dust clouds and smoke. Thus, advanced autonomous mobile systems are primarily required for an off-road robot to sense and understand its environment, while ensuring, at the same time, robustness under compromised conditions. Therefore, this thesis addresses the problem of the design, implementation and realization of an autonomous mobile robot navigating in an uneven environment. The first issue in this work deals with the environment sensing, as it is crucial for better environment modeling strategy. A study of the most important sensors used in mobile robotics is presented. So, millimetre-wave radar (MMW radar) is chosen for our application. After that, a technique for 3D uneven environment modelling that is based on data acquired from MMW radar has been proposed. The returned raw data from the MMW are stored in a database then transferred to the CAD model, and represented as objects using an algorithm. Then, the environment is rebuilt by using Non-Uniform Rational Bi-Spline (NURBS) curves to obtain the polygon mesh representing the surface of the uneven environment. NURBS curves are used for trajectory reconstruction since they have been proven to be the best parametric curves for path planning both for 2D mobile robots and 3D curve approximation. The polygonal mesh decomposition helps us to locate the different obstacles and to build the optimal path to reach the target starting from any initial position, by taking into consideration the terrain traversability. The optimal path is obtained by applying distance calculation method and speed limits. The second issue treats the problem of path tracking, where the robot has to autonomously track the planned trajectory, provided in real-time, on rapidly varying, off-road terrain. The objective is to build a controller which permits to the robot to execute the path following task. This controller generates the actions that will drive the robot straight on the path to reach the final destination. Hence, an algorithm for data extraction is proposed and the way of sending these data to the robot platform is explained. The last issue deals with the software and hardware requirement for the realization of the mobile robot platform. Our proposed study would be useful for real-world robotic applications such as intelligent navigation for motorized wheelchairs, surveillance and security purposes, in Nuclear power plants where humans are prone to harmful radiations, for planetary exploration and every where the robot is expected to encounter rough terrain