In this dissertation, two coverage path planning (CPP) approaches for a nonholonomic mobile robot are proposed. The first approach is the Local Coverage Path Planning (LCPP) approach which is designed for all sensing ranges. The second approach is the Global Coverage Path Planning (GCPP) approach which is designed for sufficient sensing range that can observe all points of interests in the target region (TR). The LCPP approach constructs CP after finding observer points for all local regions in the TR. The GCPP approach computes observer points after CP construction. Beginning with the sample TR, the LCPP approach requires 8 algorithms to find a smooth CP and sufficient number of observers for complete coverage. The Global Coverage Path Planning approach requires 17 algorithms to find the smooth CP with sufficient number of observers for completed coverage. The worst case running time for both approaches are quadratic which is considered to be very fast as compared to previous works reported in the literature. The main technical contributions of both approaches are to provide a holistic solution that segments any TR, uses triangulation to determine the line of sights and observation points, and then compute the smooth and collision-free CP. Both approaches provide localization, speed control, curvature control, CP length control, and smooth CP control. The first approach has applications in automate vacuum cleaning, search and rescue mission, spray painting, and etc. The second approach is best used in military and space applications as it requires infinite sensing range which only resource rich organizations can afford. At the very least, the second approach provides simulation opportunity and upper bound cost estimate for CPP. Both approaches will lead to a search strategy that provides the shortest CP with the minimum number of observer and with the shortest running time for any sensing range.

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The public is welcome to attend.