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**Politecnico di Torino**Master Degree in Mechatronic Engineering

***Mechanized Irrigation Center Pivot Arm Corner***

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Candidate:

Majd Farhat

***Abstract:***

**This thesis addresses the inherent limitation of traditional center pivot irrigation systems in effectively irrigating square or rectangular field corners due to their circular watering pattern. By proposing an enhanced swing arm system integrated with Real-Time Kinematic (RTK) GPS guidance and a U-channel synchronization mechanism, the study aims to maximize land coverage, improve water efficiency, and ensure precise irrigation in irregularly shaped fields. The swing arm extends beyond the main pivot’s circular path, utilizing RTK GPS for centimeter-level positioning accuracy to dynamically adjust its movement along field boundaries. A U-channel mechanical coupling simplifies synchronization between the swing arm and the main pivot, reducing reliance on complex computational systems while ensuring robust operation in agricultural environments. The design incorporates a rack-and-pinion steering mechanism, electromechanical actuators, and variable-rate sprinklers to optimize water distribution. Simulations demonstrate the system’s ability to achieve 87.21% Christiansen’s Uniformity Coefficient, exceeding the 70% threshold for satisfactory irrigation, and validate its capacity to cover 1000×1000-meter fields with a 207.1-meter swing arm. Results highlight a 15–30% reduction in water waste through adaptive nozzle spacing, pressure regulation, and GPS-guided path planning. The integration of RTK and U-channel mechanisms offers a cost-effective, reliable solution for extending center pivot functionality to field corners, enhancing crop yields and resource efficiency. This research CONTRIBUTES sustainable agricultural practices by bridging the gap between circular irrigation systems and rectangular field geometries, providing actionable insights for farmers and policymakers to mitigate water scarcity challenges.**