**Charging Station deployment using Non-dominated Sorting Genetic Algorithm-II for WRSNs**

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1. **Background/ Objectives and Goals**

While wireless sensor networks (WSNs) allow user access to information more convenient, there are still some inherent problems. In WSNs, each sensor node senses various kinds of information and then transfers them to relay nodes. All of those actions will consume energy, but the energy of sensors is limited by battery capacity. With the development of wireless charging technology, wireless rechargeable sensor networks (WRSNs) have gained a lot of attention. In WRSNs, wireless charging stations can recharge the batteries of sensor nodes so that they can operate sustainably. Since wireless charging stations are costly and have limited charging distances, how to deploy the minimal number of charging stations to cover all sensor nodes and satisfy the energy requirements of all sensor nodes is an important and challenging issue.

1. **Methods**

Regarding this issue, most of the researches focus on reducing the number of charging stations. They do not take the distance between sensor node and charging station into account. Actually, when the distance between sensor node and charging station decreases, the charging efficiency will be increased. Consequently, the charging stations do not need to replenish the sensor nodes’ power frequently. Therefore, this paper proposes a new deploy strategy by taking the number of charging stations and the distance between sensor node and charging station into account simultaneously. We formulate the proposed strategy into a multi-objective problem and employ a non-dominated sorting genetic algorithm-II (NSGA-II) to solve this problem. With the help of NSGA-II method, the generated solutions can avoid falling into a single objective. In our method, we encode all possible locations of charging stations into a set of genes, which is known as a chromosome. Through the phases of crossover and mutation, different chromosomes are generated for maintaining the diversity of the next generation of solutions. In the selection phase, non-dominated sorting scheme is used to avoid falling into local optimal solutions.

1. **Expected Results/ Conclusion/ Contribution**

To verify the feasibility of proposed strategy, we implement the simulation environment by using Python programming language. The sensor nodes are distributed randomly on an indoor environment of 20 X 15 square meters. We compare the proposed approach to the simulated annealing-based charging algorithm (SABC) and the layoff simulated annealing-based charging algorithm (LSABC) in terms of the number of charging stations and the overall charging power. The simulation results revealed that the overall charging power obtained using the proposed approach is 5% and 8% higher than that obtained using SABC and LSABC approaches. Moreover, the number of charging stations obtained using NSGA-II is 6% and 1% less than that obtained using SABC and LSABC approaches, respectively.

**Keywords**: Wireless Rechargeable Sensor Networks, Wireless Charging Stations Deployment, NSGA-II