Efficient Path Planning and Truthful Incentive Mechanism Design for Mobile Crowdsensing

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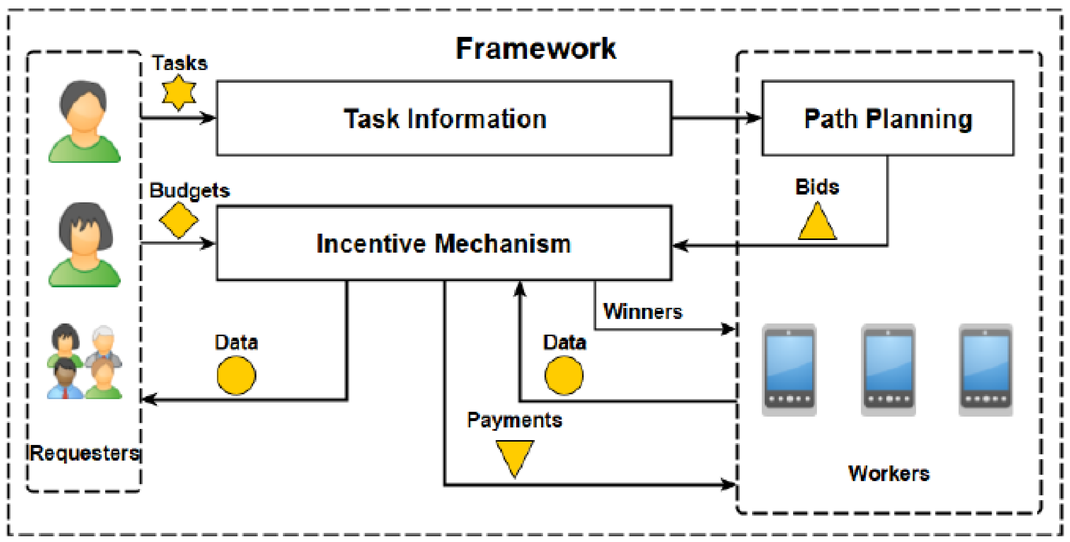
ABSTRACT

Mobile crowdsensing (MCS) is a promising paradigm for large-scale sensing. We make an attempt to build a technical framework for MCS, which is associated with two challenging problems: path planning and incentive mechanism design. In the path planning problem, every worker independently plans a tour to carry out the posted tasks according to its own strategy. A heuristic algorithm is proposed for the path planning problem, which is compared with two baseline algorithms and the optimal solution. In the incentive mechanism design, the platform employs a truthful mechanism to select the winners and determine their payments. The proposed mechanism is proved to be computationally efficient, individually rational, and truthful. In order to evaluate the performance of our proposed mechanism, the well-known Vickrey-Clarke-Groves (VCG) mechanism is considered as a baseline.

FRAMEWORK



PATH PLANNING

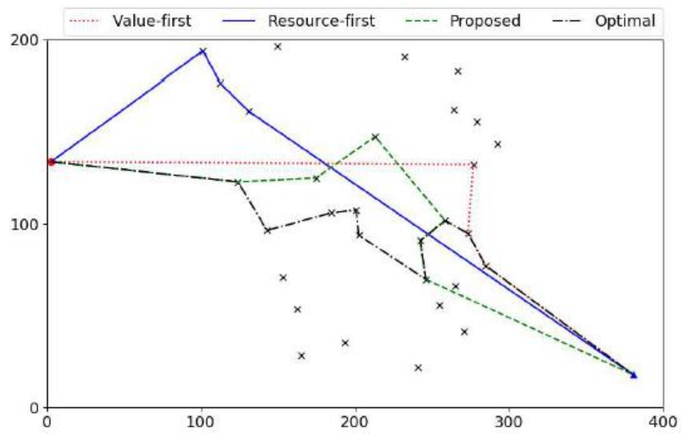


Fig. 1. Paths of Work #10

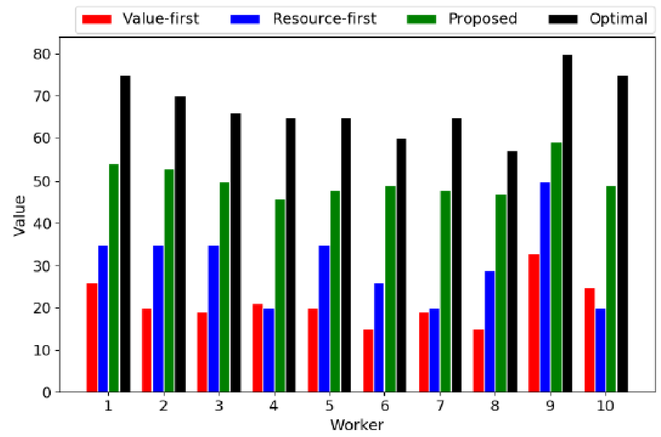
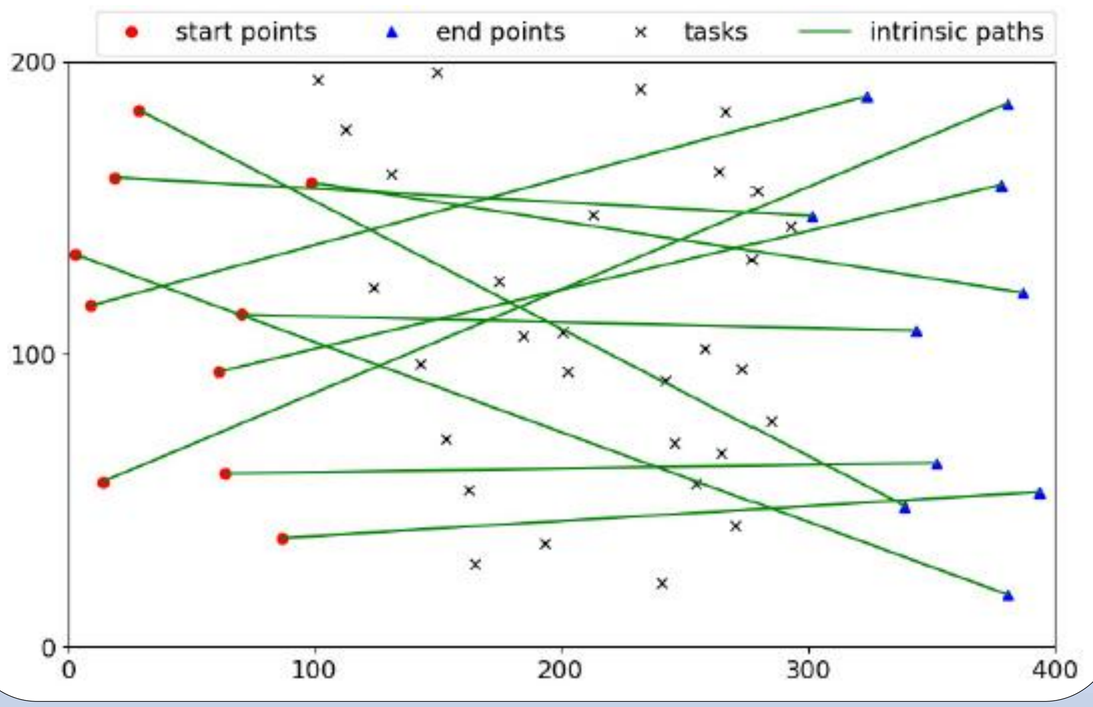


Fig. 2. Values of paths

SCENARIO



INCENTIVE MECHANISM

Mechanism	Winner Selection
Proposed mechanism	{0, 1, 1, 1, 1, 1, 1, 1, 1, 0}
VCG mechanism	{0, 1, 1, 1, 1, 1, 1, 1, 1, 0}
Optimal solution	{0, 1, 0, 1, 1, 1, 1, 1, 1, 1}

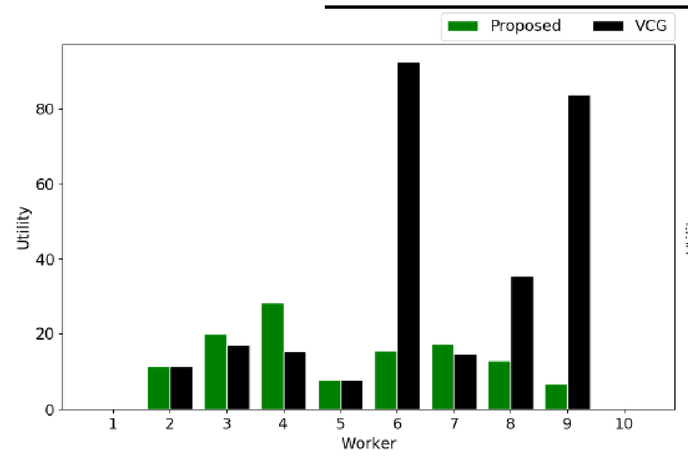


Fig. 3. Utilities of workers

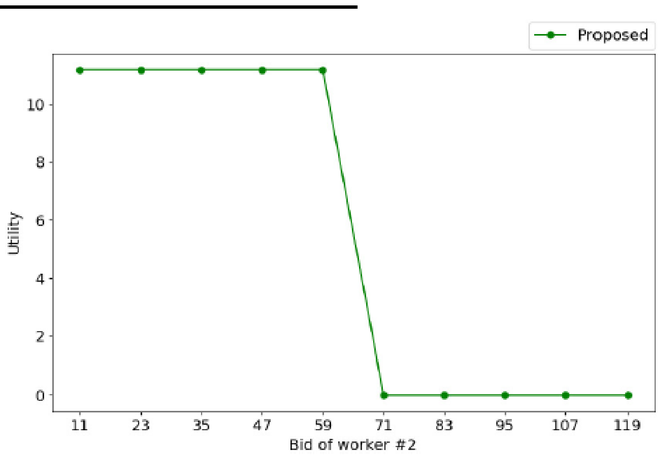


Fig. 4. Truthfulness of proposed mechanism

CONCLUSION

We have built a technical framework for MCS with novel solutions to two key problems, namely, path planning and incentive mechanism design. The simulation results validate the high efficiency and good properties of the proposed solutions, and show the performance improvement over several benchmarks in terms of task value and workers' utilities.

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