Hubrina - master-slave navigation in agriculture

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Intelligent Autonomous Weeder

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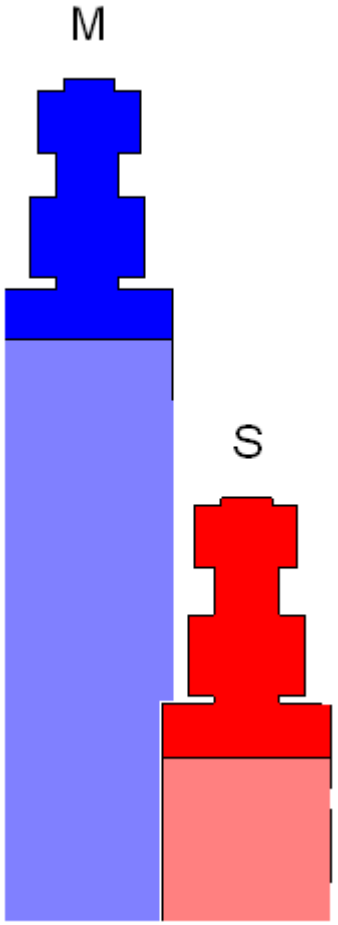
Not used in practice…

- Despite all research effort, fully autonomous robots are not used in farming today
- Main problems:
  - Safety (humans, animals, crop)
  - Robustness
- These problems are still hard to solve!

- Another approach: master-slave systems

Master-slave systems in agriculture



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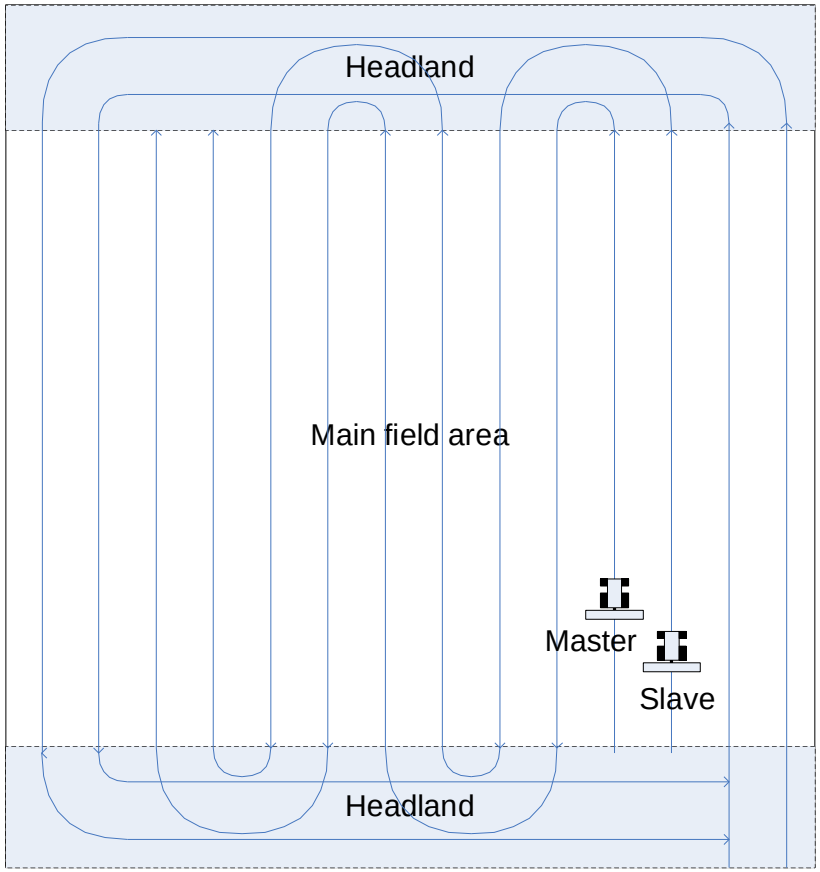
ECHORD experiment HUBRINA

- HUBRINA:
  - Human-roBot cooperation IN Agriculture
- Human operator drives a master tractor which is followed by an autonomous slave tractor



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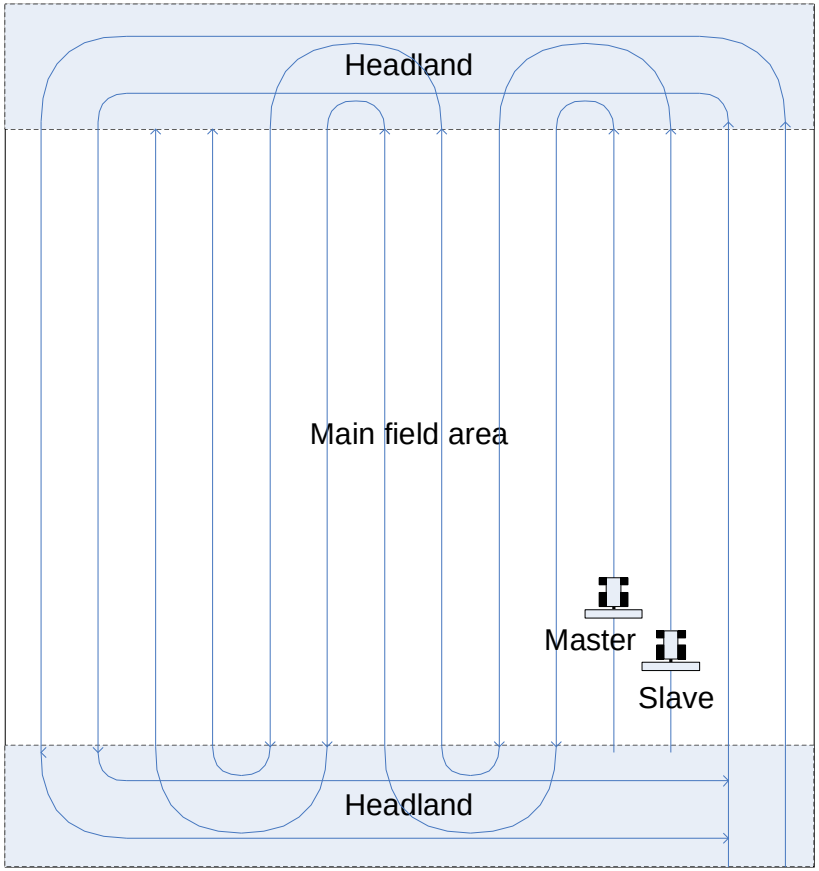
ECHORD experiment HUBRINA

- Project team:
  - Company: Tyker Technology
  - Institute:
    - WUR – DLO (CRO)
    - WUR – University
- Supported by:
  - EU FP7 ECHORD
  - Company: CLAAS



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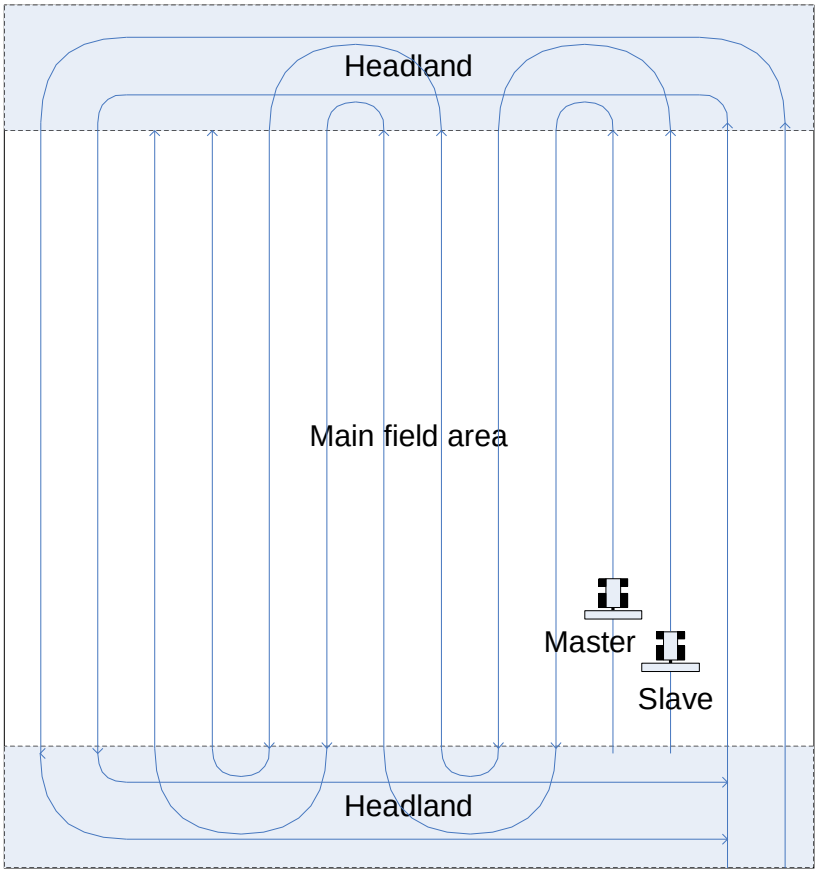
ECHORD experiment HUBRINA

- Project objectives:
  - Development of master-slave control
  - Demonstration of its feasibility by performing a field cultivation in practice using two tractors.



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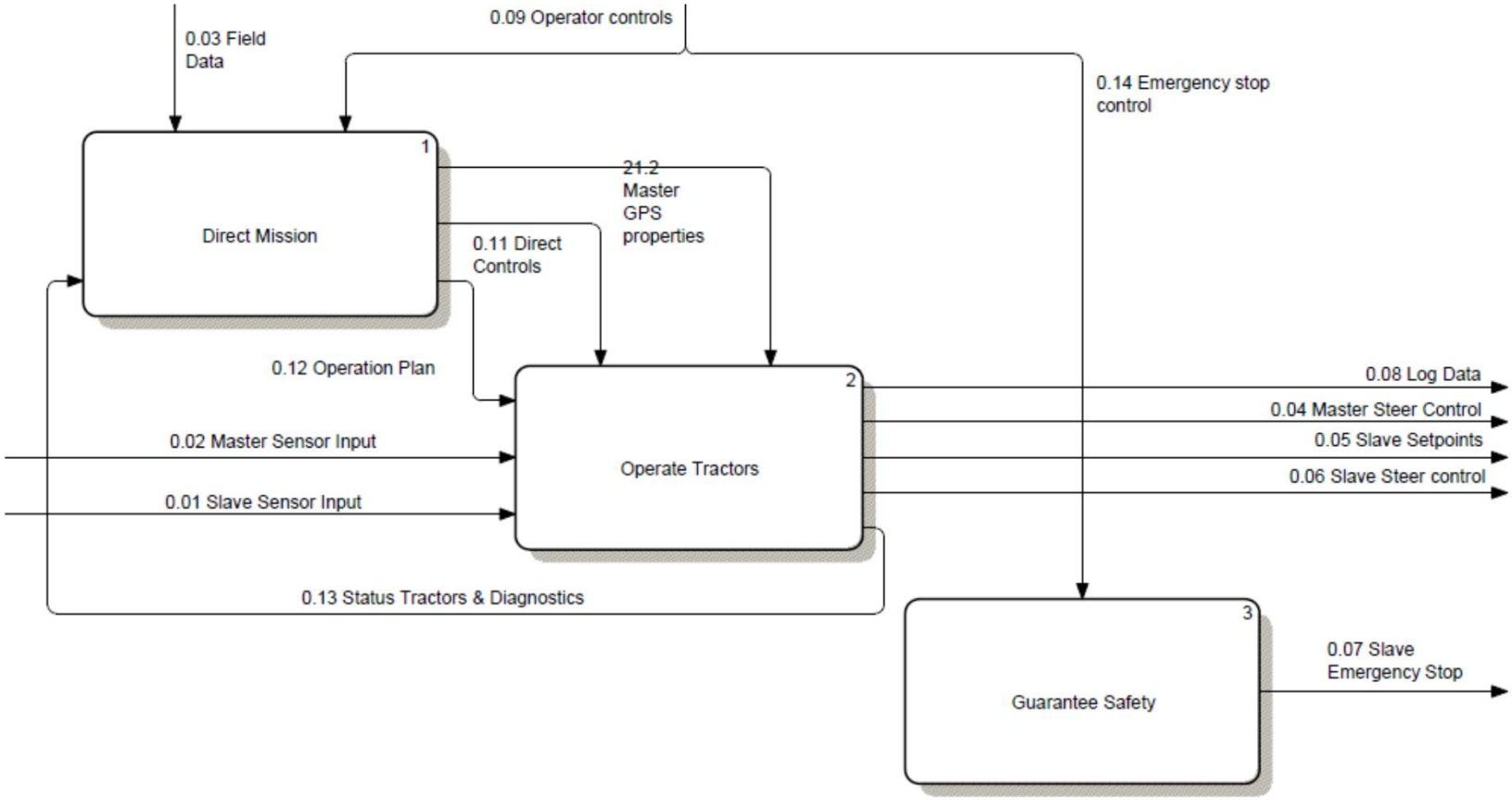
Some results

- Software development
- Coverage route planning
- Path tracking master
- Master-slave operation
- Hard-ware in the loop simulation

Results – 1. Software design using IDEF0



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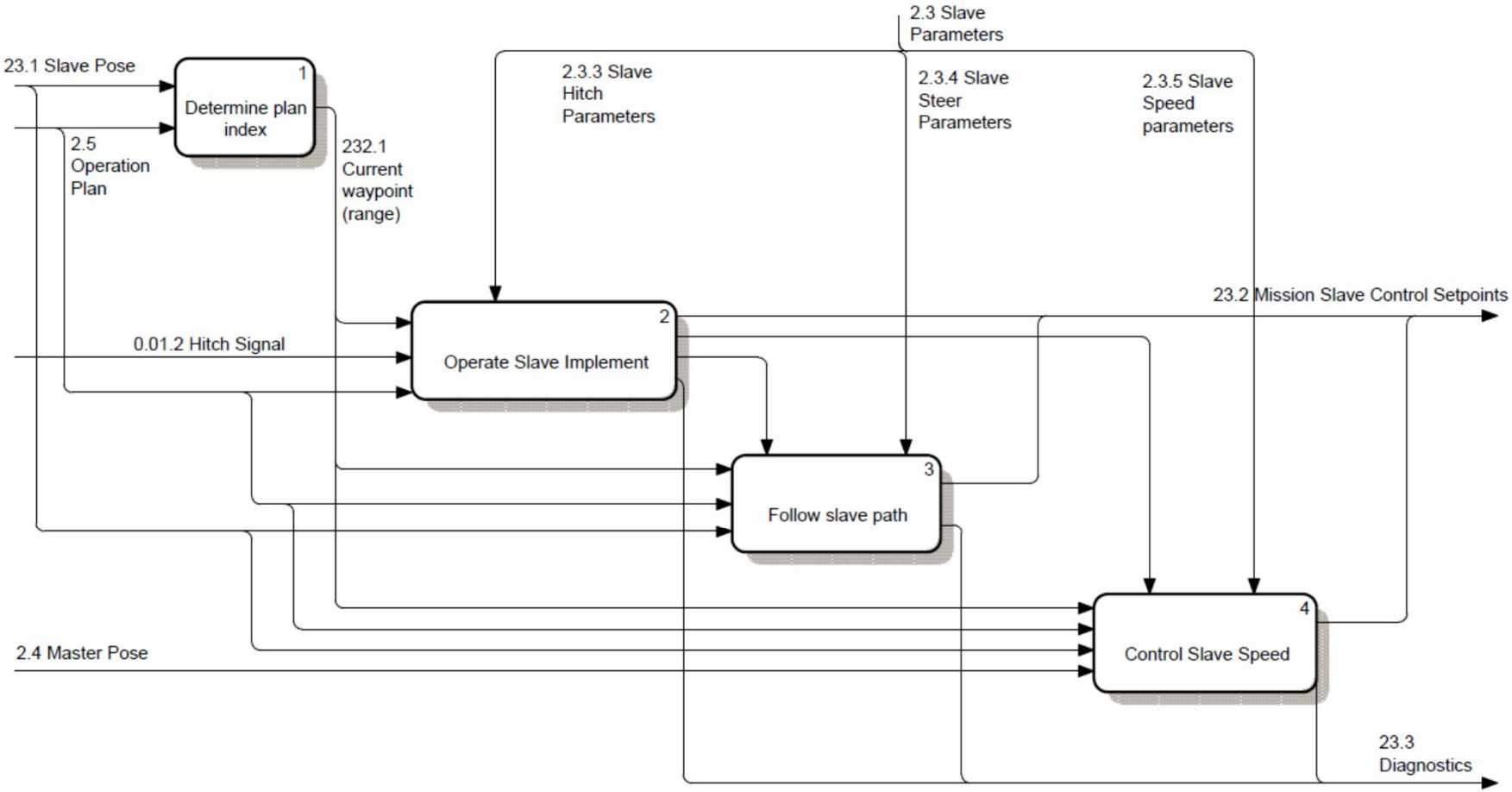
Results – 1. Software design using IDEF0



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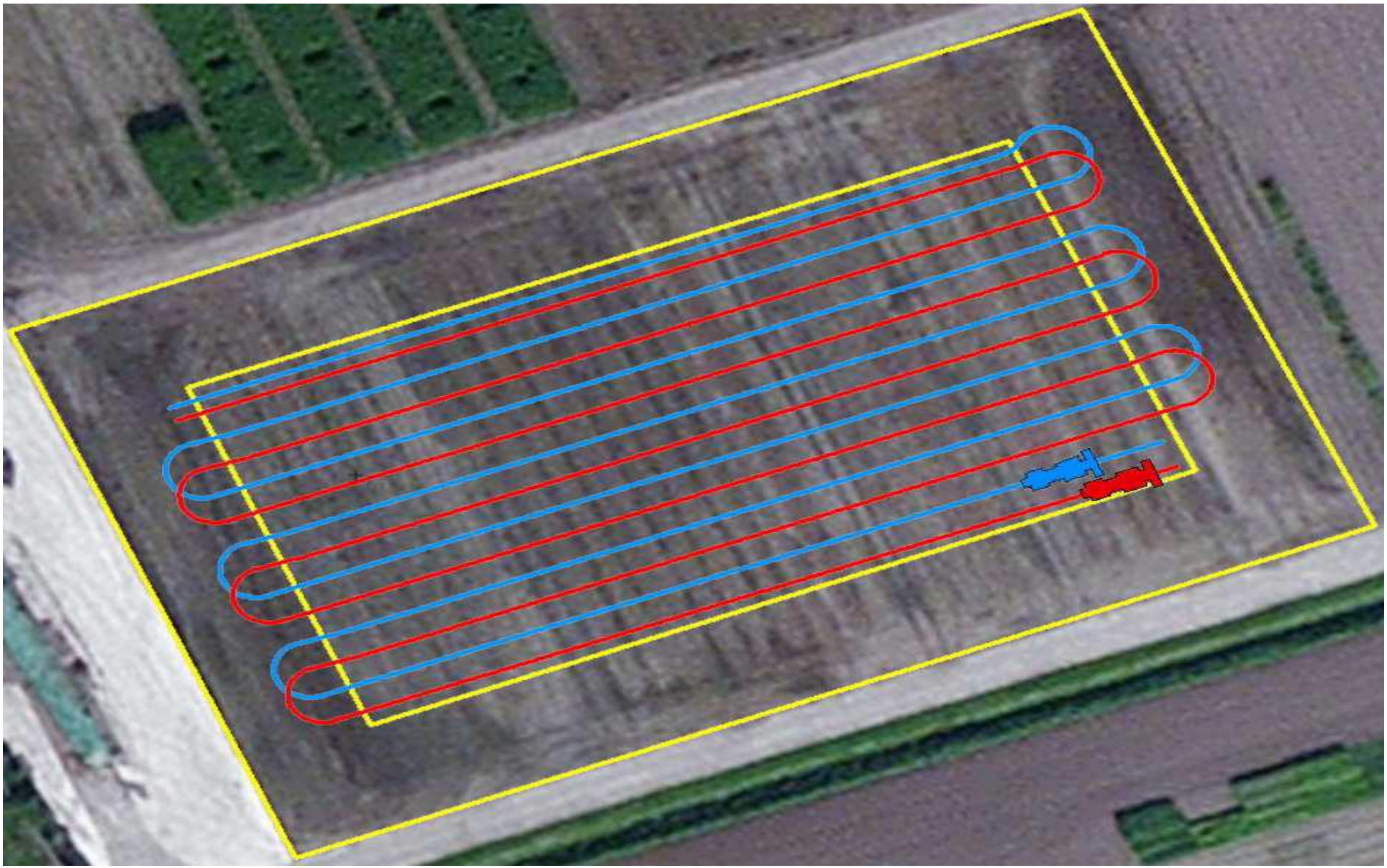
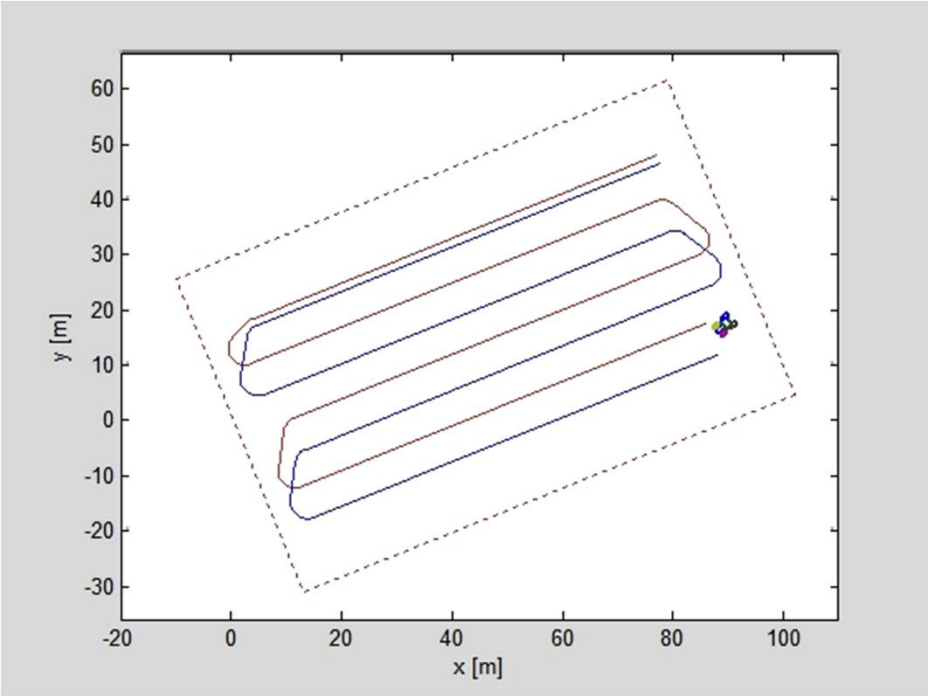
Results – 2. Coverage route planning



Results – 3. Master route tracking



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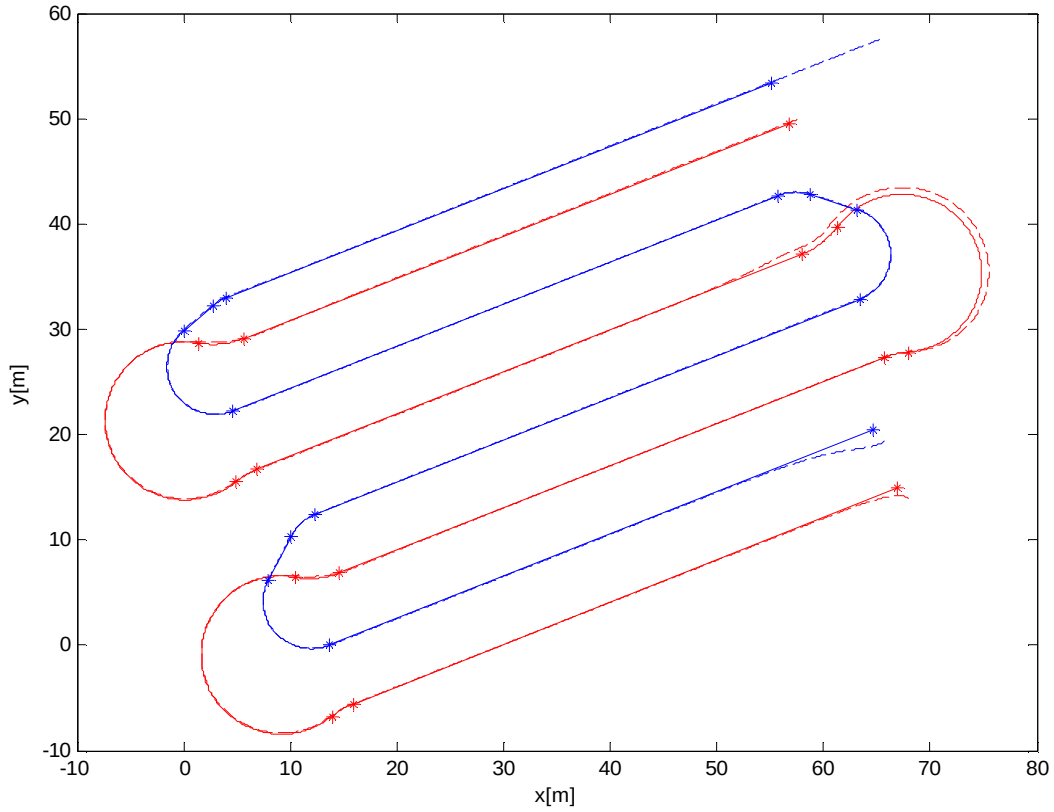
Results – 3. Master-slave operation



Master and slave desired route (—) and driven route (---)

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Results – 4. Hardware in the loop simulation

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Results 4 – Hardware in the loop simulation

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Collaboration with manufacturers

- Key drivers:
  - More and more good quality food is needed, but less and less people are willing to do the job!
  - Efficient use of limited and often non-reusable resources
  - Reduction of emissions
- And also:
  - Tech as problem solver: heavy, dirty, tiring work
  - Tech as facilitator: do new things, new production systems

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Collaboration with manufacturers

- Some challenges:
  - Robotics is a means, not an objective! Rethink production system.
  - Focus industry: 100% replacement of human labour!!!!!?
  - Economy seems main driver at first, but in the end this is not always true -> e.g. milking robot!
  - Industry is not waiting for academic exercises
  - Relatively small and highly fragmented markets (limited budgets, high risks)
  - Standardization (combination of brands in one machine fleet)
  - Education level in industry (manufacturers/farmers)
  - Still strong focus on mechanical engineering, but in agriculture, sensing and software are the key issues!
  - IP rights!
  - .....

Thanks for your attention!

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