IIoT-REPLAN
## Industrial IIoT-driven remote path planning

GOALS

- Provide a realistic setup for autonomous, low cost path planning of mobile agents

- Investigate the computation offloading opportunities in control and estimation problems

- **Propose a practicable offloading strategy and develop a scheduler that distributes computation locally/at the edge/at the cloud**

CHALLENGES

- Safety-critical and mission-critical application

- Nonlinear dynamics of the mobile agent, the communication network and the resources

- **Heterogeneous software/hardware, dynamic resource availability. Uncertainty in the dynamics, measurements, actuation, network traffic and edge/cloud resources**
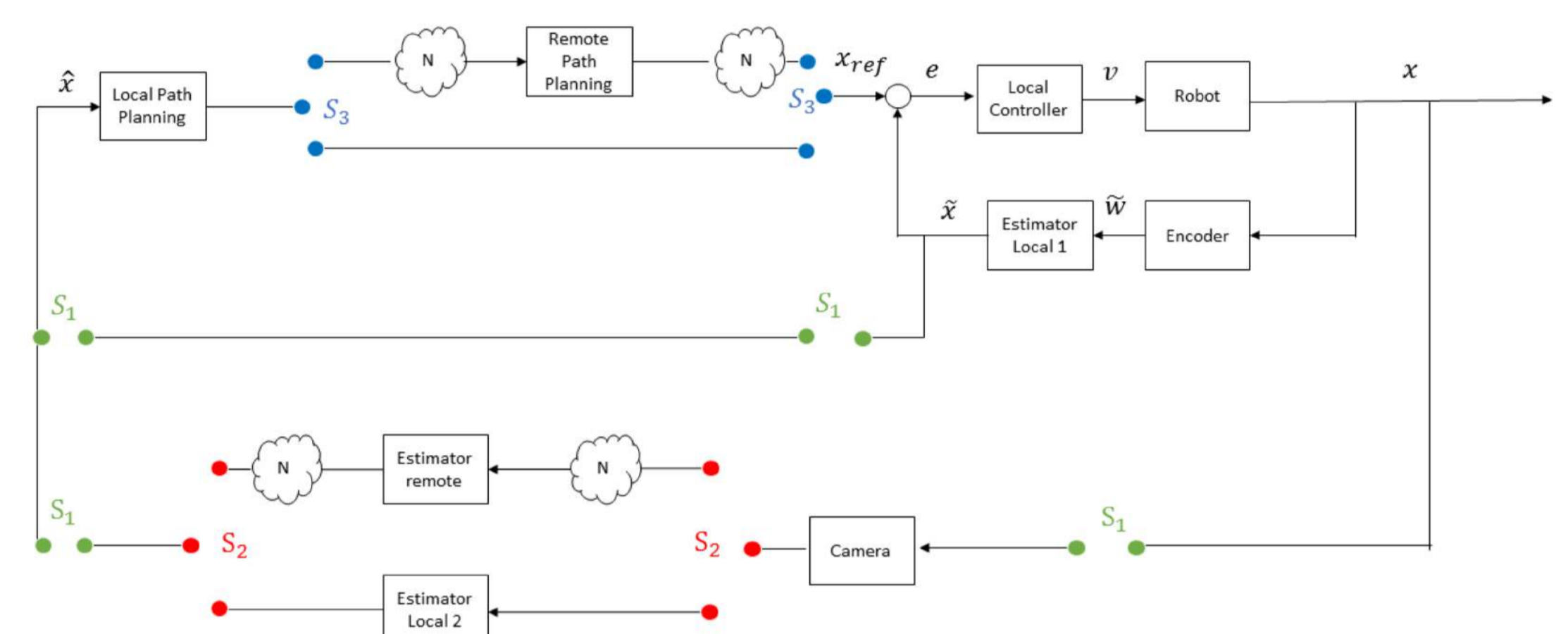
DEMO SETUP
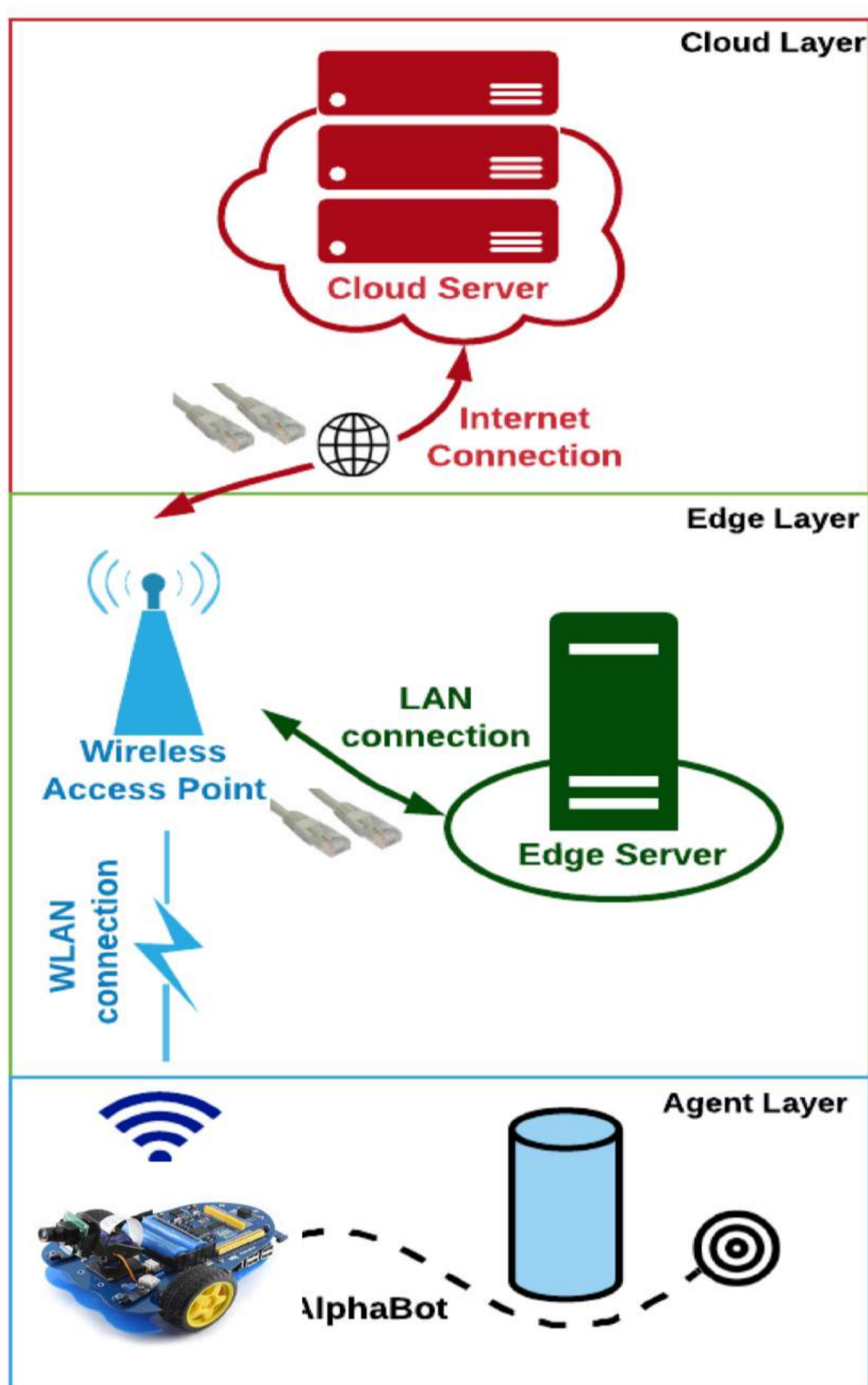
Mobile robot: Alphabot, equipped with Raspberry Pi 3B+, Camera Pi, Wireless.

Edge server: NETMODE testbed Intel Atom CPU (0.25-1.5 cores allocated), 8GB Ram, 1Gbit Ethernet port

Access point: 100Mbs 2 Single Band (2.4GHz)

Cloud: IMEC testbed server virtual wall 2 1x 6core Intel E5645 (2.4GHz) ram 12GB RAM

APPROACH AND METHODOLOGY

Switch 1: decision of estimator from encoders or from image processing based algorithm

Switch 2: image processing based estimation offloading strategy

Switch 3: advanced path planning (trajectory generation) mechanism and offloading strategy

EXPERIMENTAL RESULTS

Set up:

Time vs alg. steps

Switch 1

Switch 2

Switch 3

Uncertainty vs time

Resources estimator
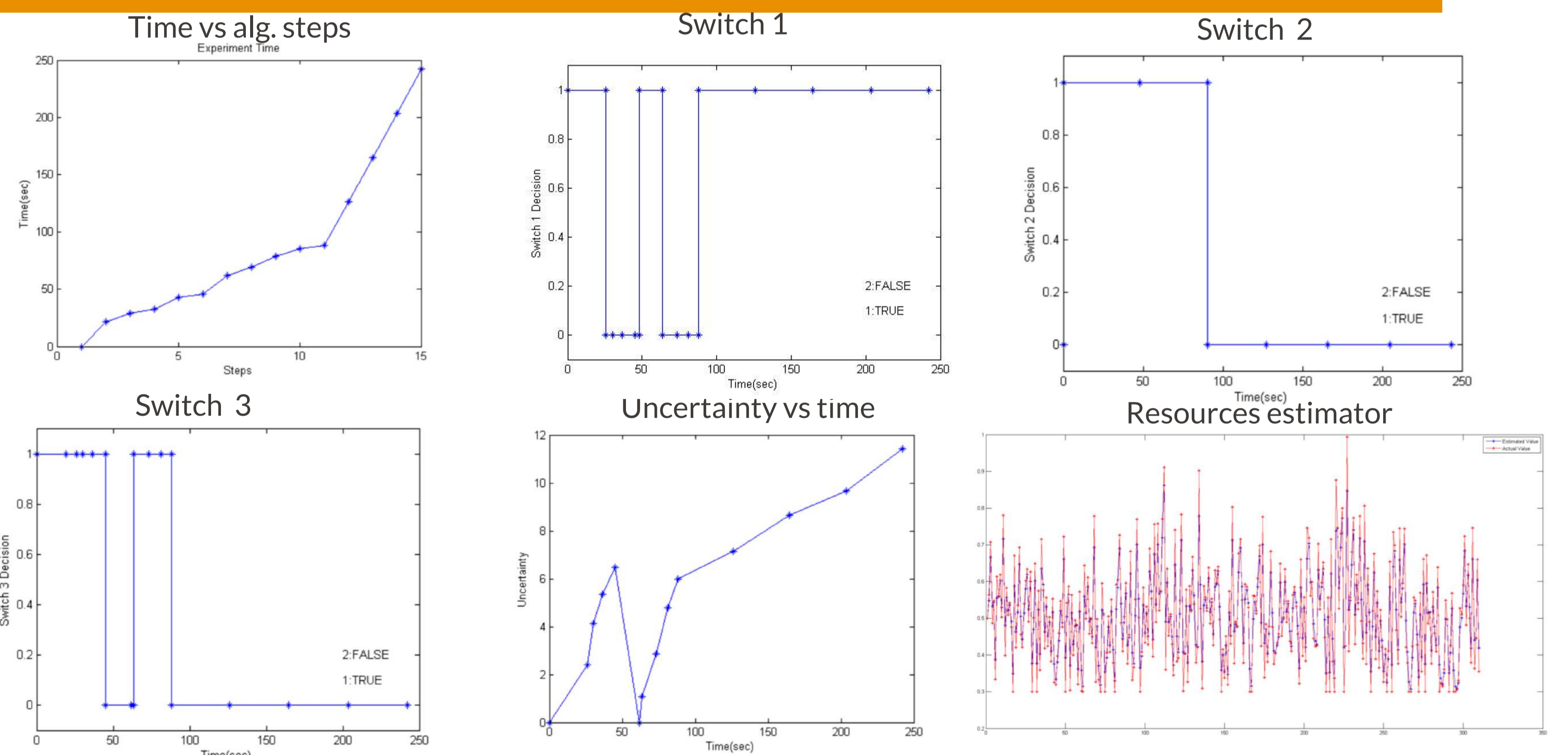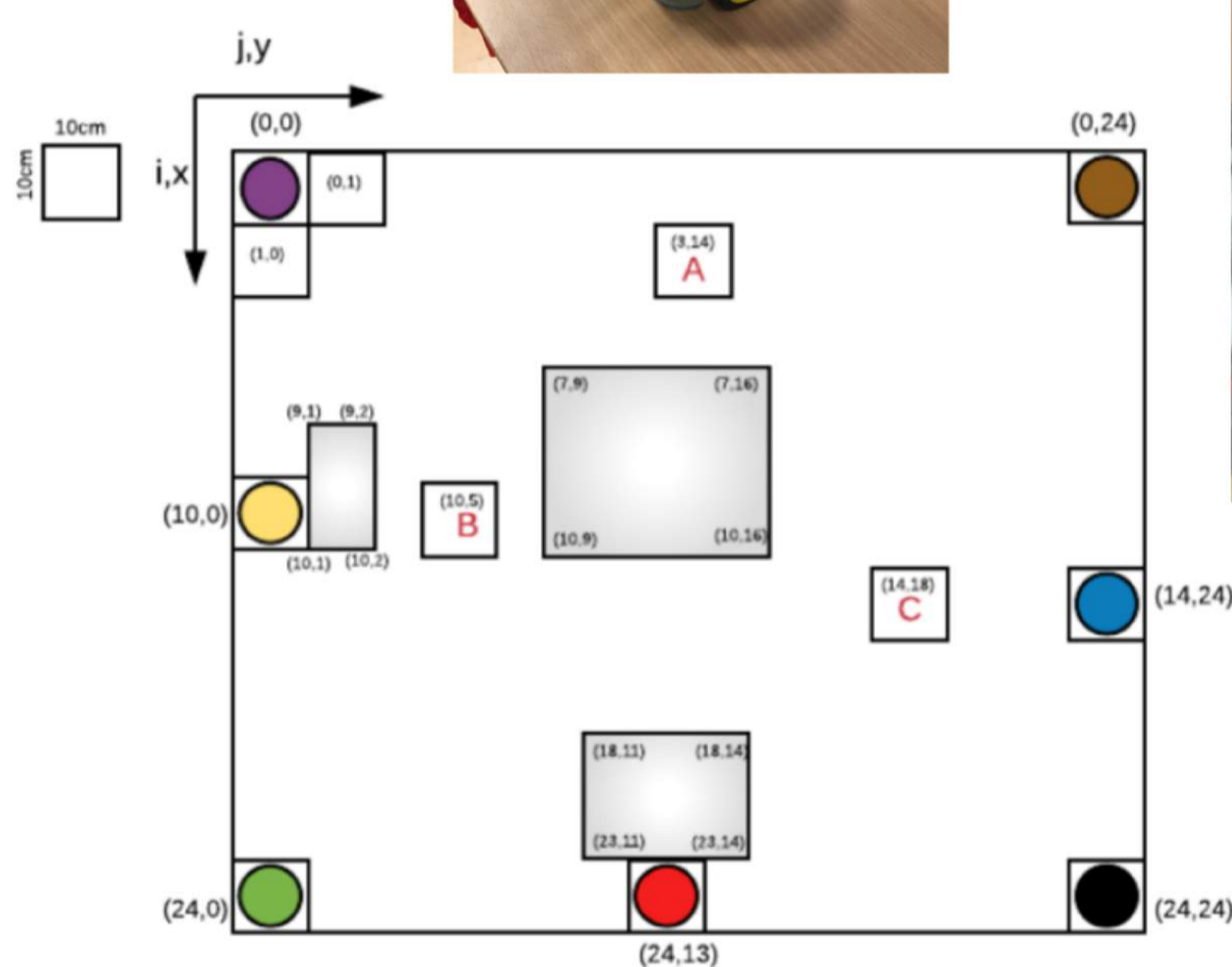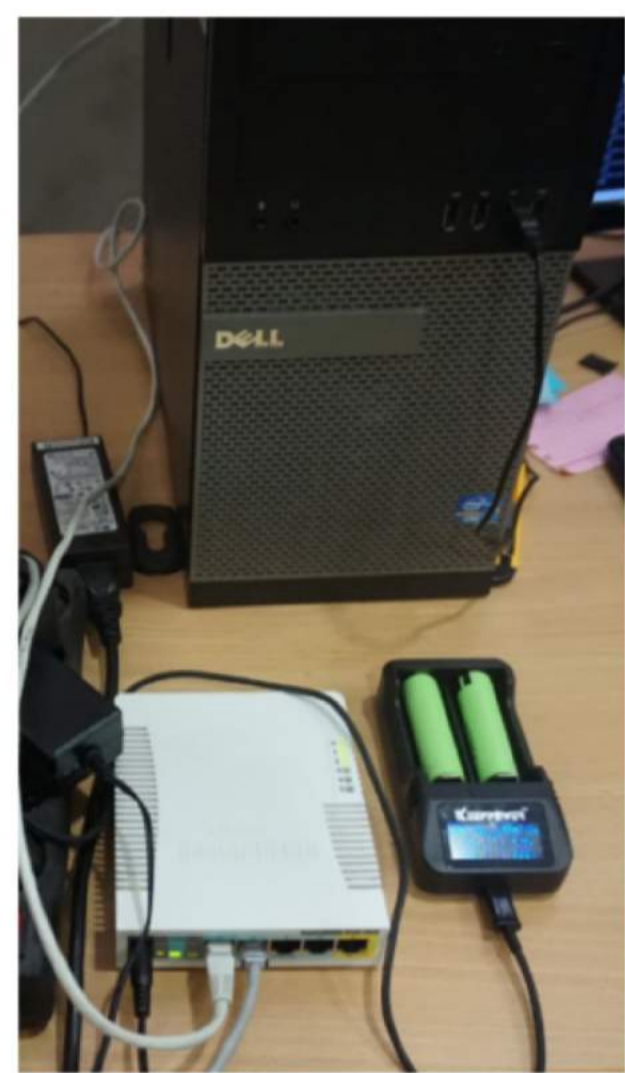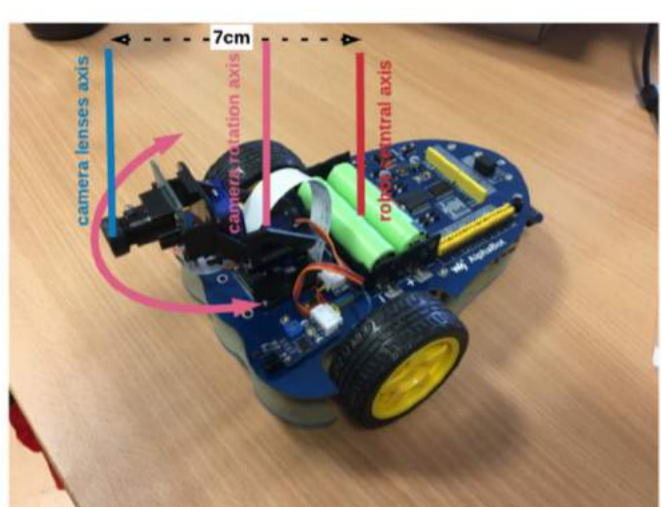
CONCLUSIONS

- A system-theoretic approach can be used to establish smart switching strategies for path offloading and estimation algorithms

- A combination of local and remote computation is better than fixing the computing to be in the cloud/edge.

- Estimation and control design and implementation should take into account the available infrastructure/resources **(co-design)**

FUTURE WORK

- Theoretical guarantees for stabilization/stablity

- Extension of proposed offloading strategy to other applications

- Extension to Multi-agent systems and multiple edge / cloud servers

- Evaluation of different estimation/control algorithms in a co-design setting