Experimenting with Computer Swarms: a Mobile Platform based on Blimps

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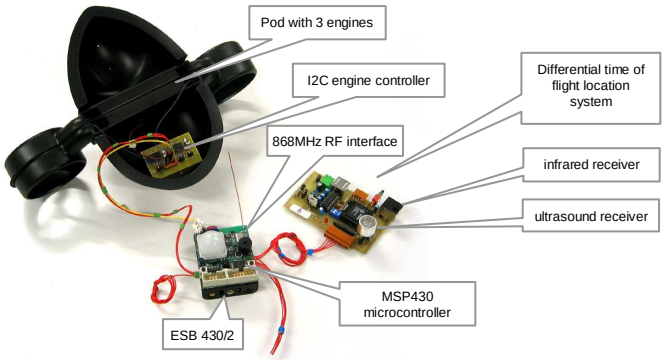
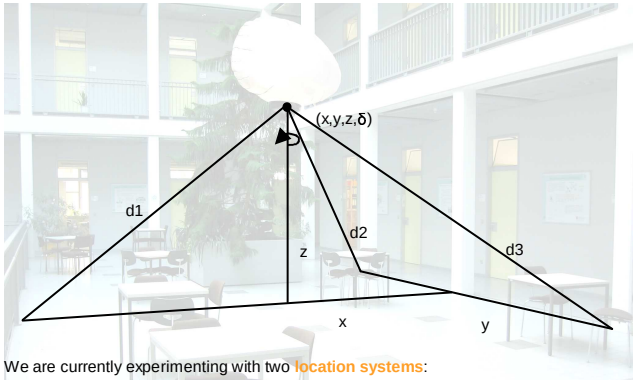


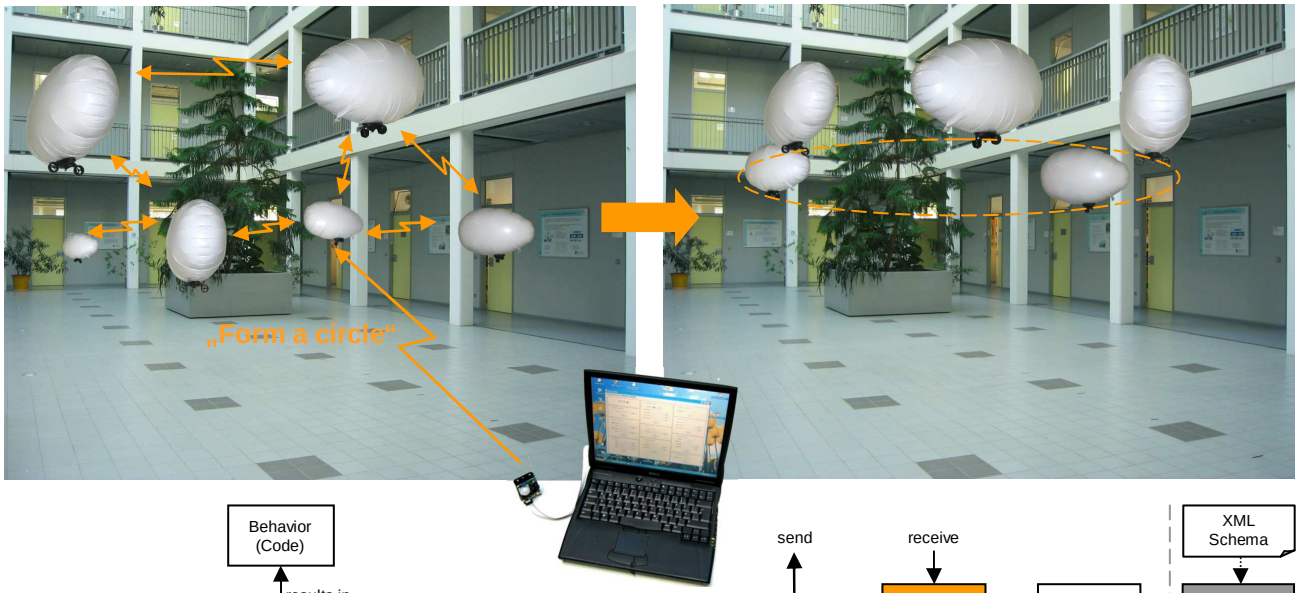
The **hardware platform** consists of three major components:

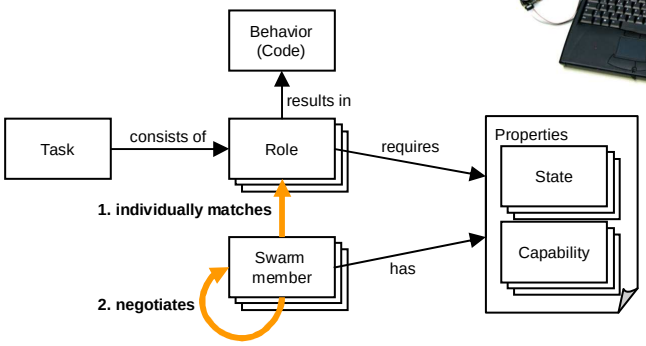
- As the center of the platform, the sensor mote ESB 430/2 runs the application and controls all other components. It is equipped with an 868 MHz radio frequency interface, a Texas Instruments MSP430 microcontroller including 2kB of memory, 60kB of program memory, 64kB of EEPROM and five different sensors.
- The engine pod with the I2C engine controller that translates I2C bus commands into engine states.
- The location system is based on differential time of flight (see on the right).



We are currently experimenting with two **location systems**:

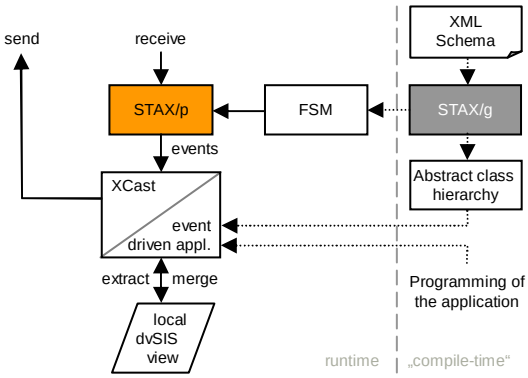
- The first system is based on differential time of flight in combination with a magnetic compass sensor to gain information on the orientation about the vertical axis. Measuring the interval between the arrival of ultra sound and infra red light emitted from beacons, the current position can be calculated by the means of lateration.
- The second, more advanced systems relies on the measurement of magnetic field vectors, yielding not only position but also orientation. Thus no extra sensor is needed.





Coordination model

- all coordinated behavior is formulated as a task that consists of a number of roles
- every role results in a certain behavior (execution of certain code), and requires certain properties of the individual taking the role
- Properties consist of states (e.g. remaining battery capacity) and capabilities (e.g. availability of a certain sensor)
- When roles need to be taken, swarm members first match which roles can be fulfilled best, and then negotiate the distribution of roles



Application development: The application running on the sensor motes consists of

- the STAX/p message parser using
- a finite state machine description of the XML schema describing the structure of the distributed virtual shared information space (dvSIS) that is generated by the STAX/g generator. It also generate an abstract class hierarchy representing the schema.
- The XCast context based forwarding scheme for data dissemination
- The local instance of the distributed virtual shared information space

SWARMS

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