

Development of a protocol for inclusion of an microcontroller in an multicopter system



Projektseminar Robotik
und Computational Intelligence
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Content

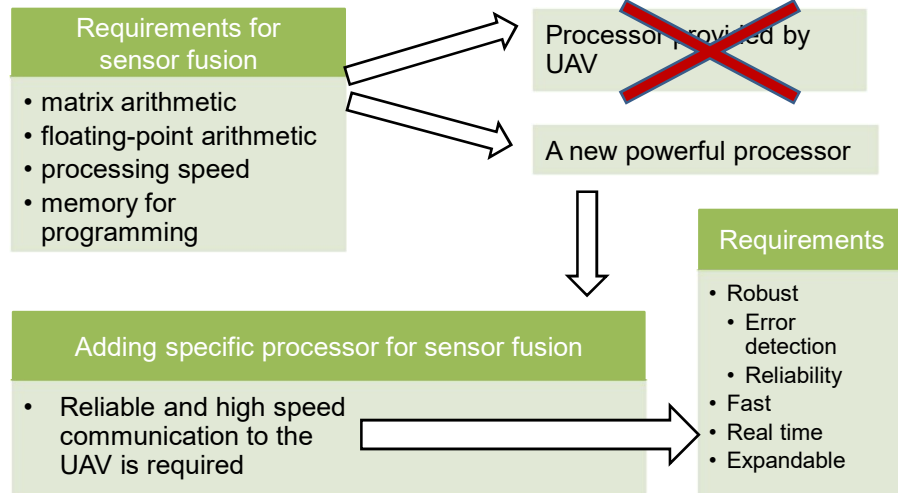


- Motivation
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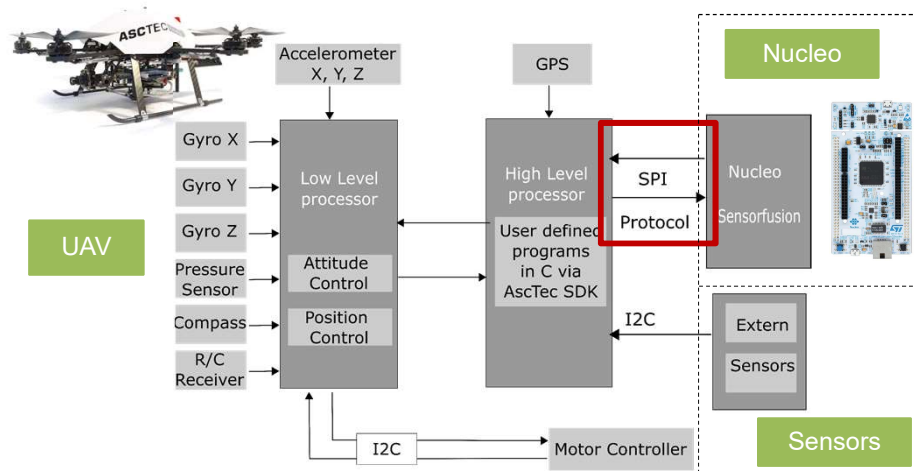
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Motivation



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Basics – System Description



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Basics - Protocols



Communication protocol

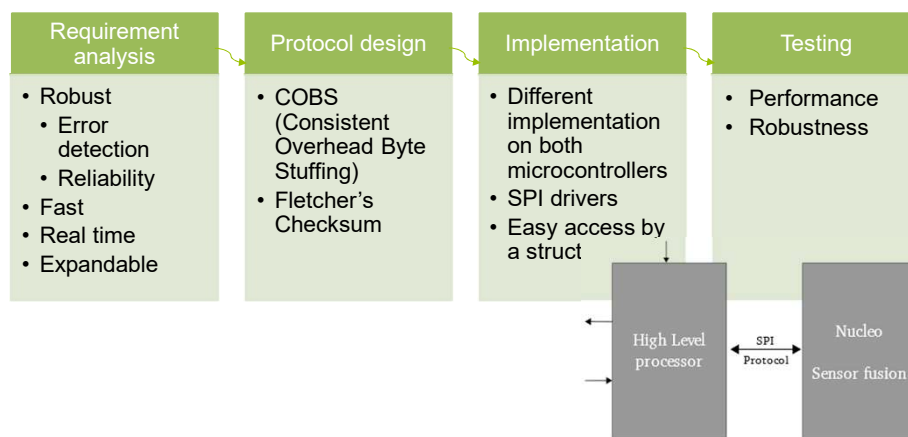
A set of rules allowing communication partners to transmit information. [1]

- Defined timing of communication actions
- Defined format of Packet Data Units (PDUs)
- Partners need to provide several protocol features
 - De- / Encoding of PDUs
 - Error detection
- Layer (provides functions)
 - Serves the layer above, is served by the layer below

Protocol design – Presentation (1)



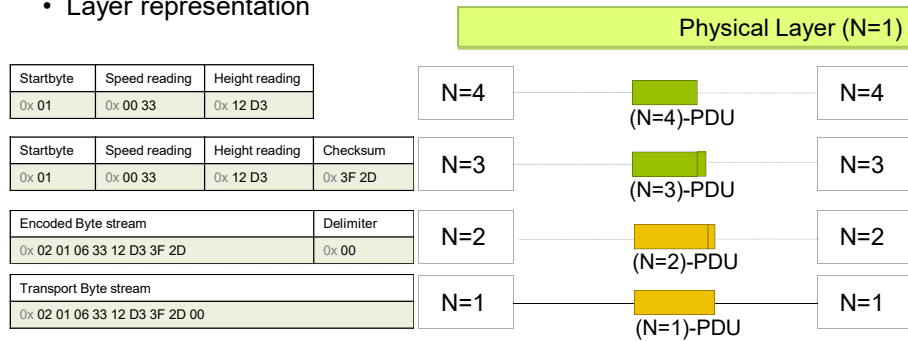
- Waterfall model



Protocol design – Presentation (2)



• Layer representation



- Filling / reading new packets in Application layer (N=4)
- Bit transfer in physical layer (N=1)

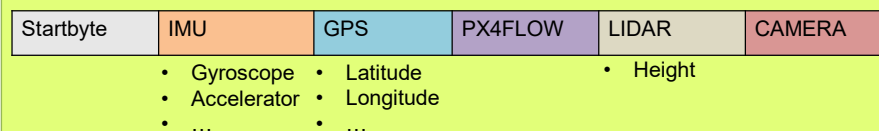
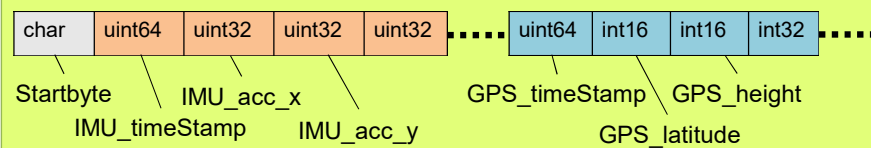
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Protocol design – Presentation (3)



PDU Definition



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Evaluation Standards

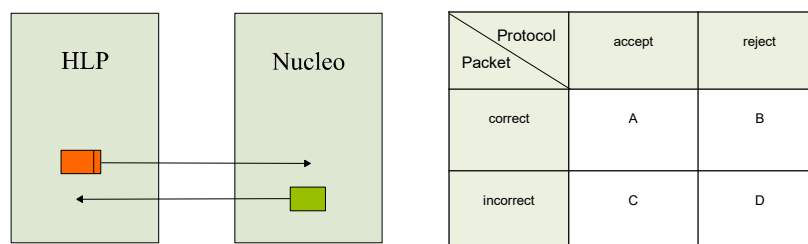


- Conformity
- Interoperability
- Performance
- Robustness

Factors:

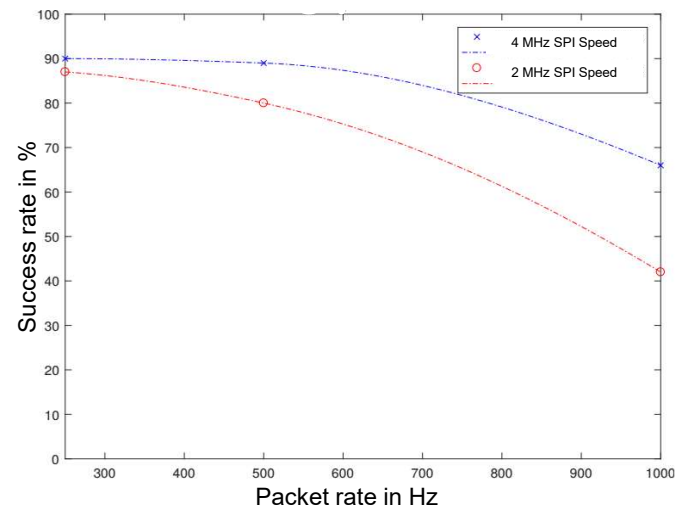
- SPI transfer speed (in bits per second)
- Packet size (in bytes)
- Packet exchange rate (number of transmitted PDUs per second)
- Operating status of UAV (calibration/initialization)

Analyzing Results



- Best situation A: Protocol accepts the packet and in fact the packet is correct.
- Worst situation C: Protocol accepts the packet but the packet is incorrect.

Benchmark Results



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Summary



- A protocol has been developed that meets most expectations
 - 500Hz packet rate
 - Reliable error detection
 - Expandable by small effort
 - Success rate is still improvable
- Real control performance not tested (future work)

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Sources



- [1] H. König, *Protocol Engineering*, 1st ed. Wiesbaden, Deutschland: Teubner, 2003.
- [2] H. Wörn, *Ed*, 2005.
- [3] T.C. Maxino, *Embedded Cor*
- [4] J.F. Kurose, Pearson/Addisc
- [5] S. Cheshire, TRANSACTION
- [6] C. Noviello,
- [7] S.C. Hill und *interface for use in a data processing system*, Google Patents, 1989.
- [8] D. HONEGGER, *An open source and open hardware embedded metric optical flow cmos camera for indoor and outdoor applications*, Robotics and Automation (ICRA), IEEE International Conference on. IEEE, 2013.
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**Thank you for your
Attention!**