

UAV_ALOA

- **U**nmanned **A**erial **V**ehicle with **A**utomated **L**anding and **O**bstacle **A**voidance
- Project goals
 - Landing sequence
 - Obstacle avoidance

UAV_ALOA

The UAV

- UAV from mikrokopter.de
 - Open source software (almost)
 - GPS Navigation
 - Position hold
 - Altitude hold

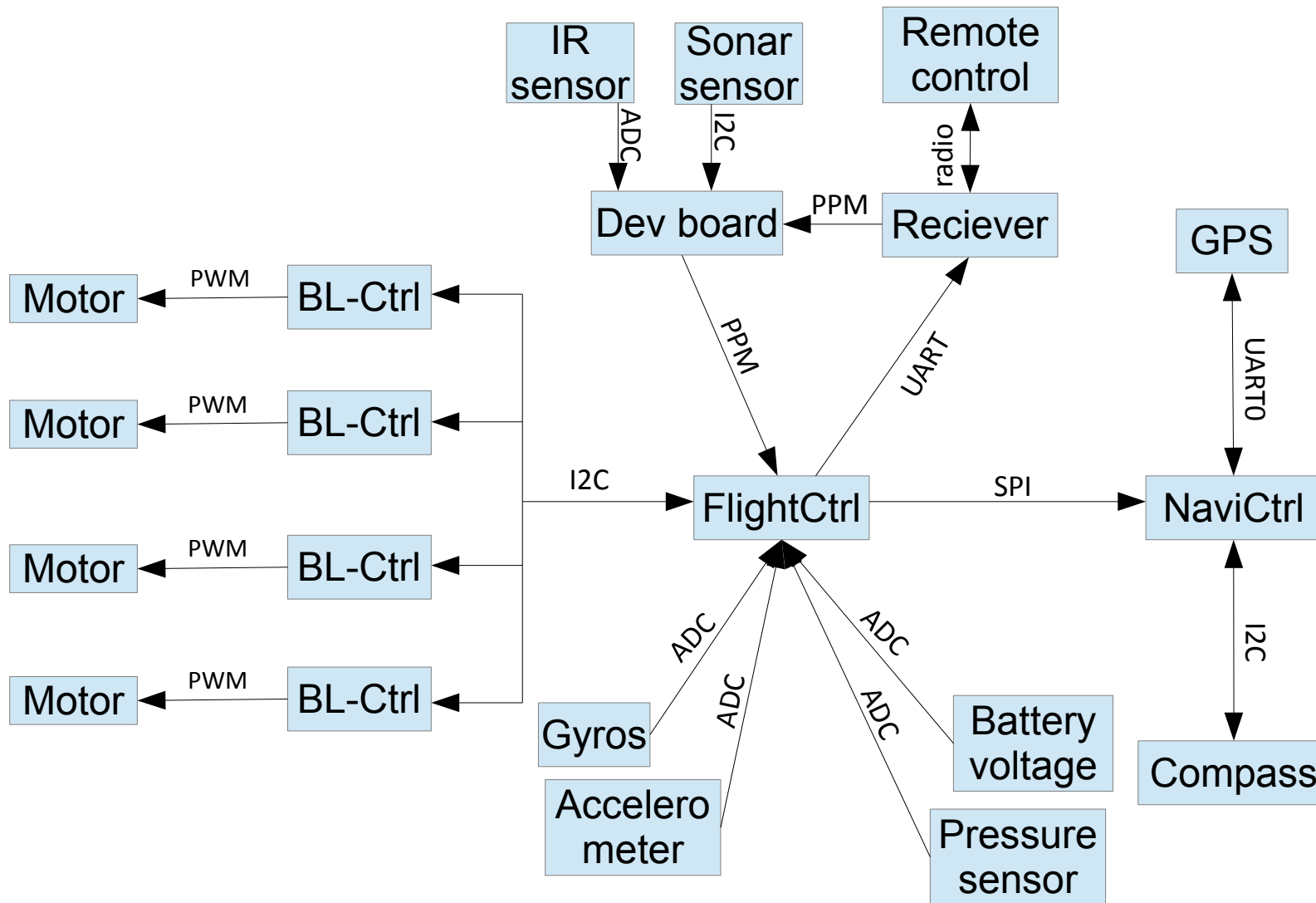
UAV_ALOA

Built in software

- Flight controller
 - Control algorithms for trajectory control
- Navi controller
 - Waypoint flight
 - Position hold
 - Altitude hold
- BL control
 - Converts commands from FC to PWM

UAV_ALOA

UAV overview



UAV_ALOA

The controller

- Devboard with STM32F103ZE microcontroller
 - Smaller and lighter than the proposed eval board
 - Also cheaper => more crash friendly
 - Three 12bit A/D
 - Two 12bit D/A
 - 112 I/O pins
 - Two I2C, five USART, three SPI, CAN, USB, SDIO

UAV_ALOA

Ground sensor

- Sharp GP2Y0A02YK0F IR Sensor
 - Range 20 – 150 cm
 - Output voltage 0.4 – 2.1V (Non linear)
 - Connected to ADC

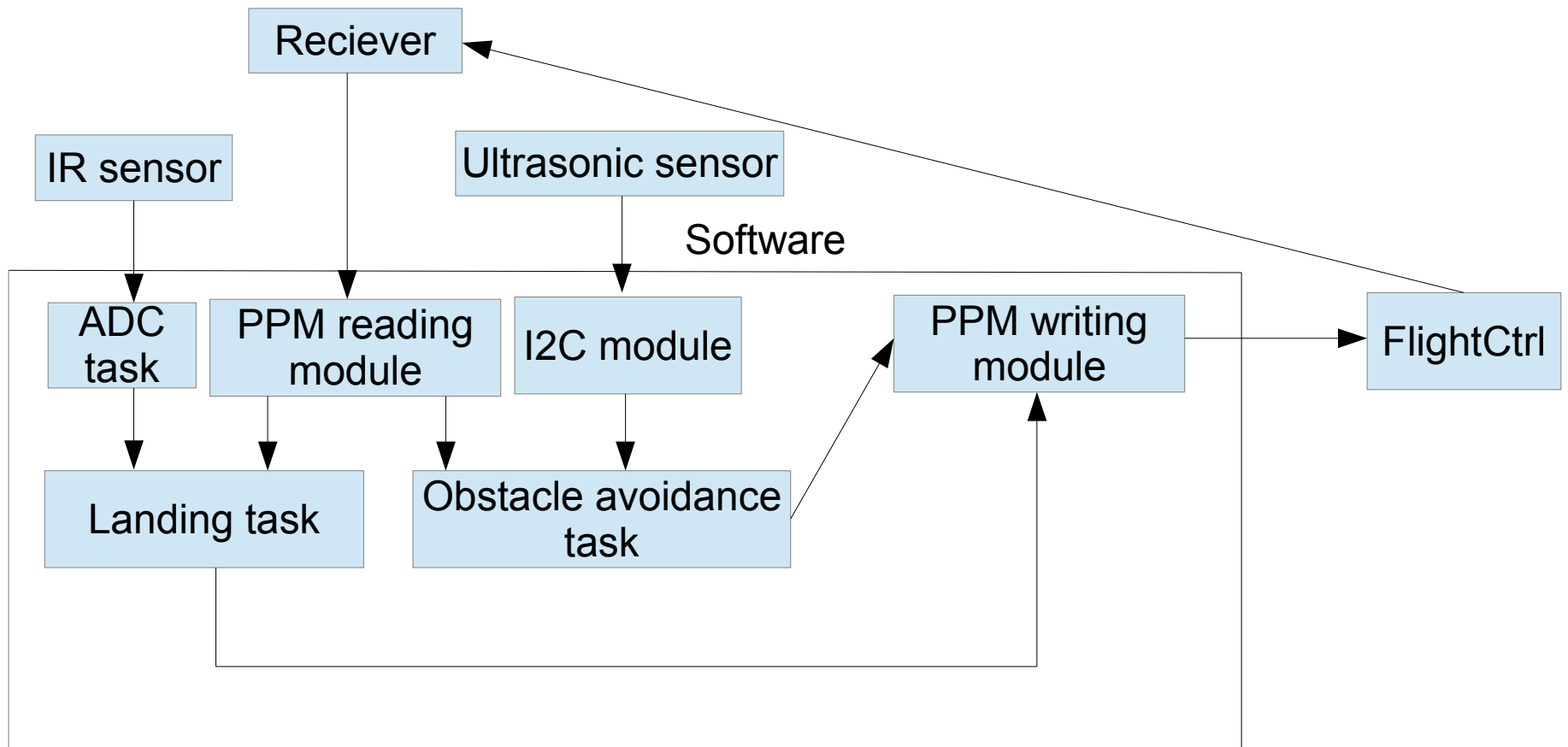
UAV_ALOA

Obstacle sensor

- Devantech SRF02 Ultrasonic range finder
 - Range 15 – 600 cm
 - Connected on I2C
 - Outputs cm in a 16bit integer

UAV_ALOA

Software overview



UAV_ALOA PPM driver

- When no changes forwards PPM from RC
- Interrupt based timer
- Capture mode for reading the PPM input
- Compare mode for outputting PPMs

UAV_ALOA

Landing sequence

- Algorithm
 - PD controller offsetting the throttle depending on the distance
- Implementation
 - One task for sensor reading
 - One task for landing
 - Both have a period of 50ms

UAV_ALOA

Obstacle avoidance

- Algorithm
 - Go straight until obstacle detected
 - Roll left until no obstacle detected
 - Go straight
- Implementation
 - Periodic task with period 70/10ms

UAV_ALOA Result

- Landing sequence works smoothly
- Object avoidance needs some tuning
- UAV get a magnet error that prevents demo and final tuning

UAV_ALOA

Difficulties

- Mount and provide power
- Recover I2C after errors
- Find good parameters
- Not possible to alter NaviCtrl software
- UAV not so stable
- PPM not well documented
- Low availability of oscilloscope
- Only one obstacle avoidance sensor

UAV_ALOA

Further work

- Safety task
- Add sensors to the sides
- Better mounting of obstacle sensor