# Low Level Controller

The Low Level Controller is based on the ATmega2560 microcontroller. Its sole purpose is to act as the interface between the physical and the digital world.

## Communication (SPI Slave)

The LLC / ATmega2560 acts as a SPI slave to the MLC / Raspberry Pi. See Mid Level Controller, SPI for details.

## Inputs / Sensors

### ADC

The ADC measures the battery voltage and the motor current. These are only used for monitoring, not control.

### IMU

The yaw rate and acceleration vector are read from the IMU via I2C. The yaw rate is summed, to give an estimate of the yaw angle.

### Odometer

The odometer has 3 digital outputs. Each signal change (rising or falling) is handled by an interrupt. The signal change indicates a motor rotation of approx. 60 degrees. The rotation count and motor speed are derived from those signals.

## Outputs / Controls

### Servo

The servo is controlled through a standard 50 Hz PWM signal, where the signal is encoded in the ON-time, from 1000 us to 2000 us.

### Motor

The motor is controlled by a PWM H-bridge at 20 kHz.

### LEDs

The four LEDs are individually controlled through GPIO pins.

## Watchdog

Should the communication with the MLC fail repeatedly, the LLC will enter a safe mode. The motor is commanded to brake. The safe mode is indicated by flashing all LEDs.