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/**
 * @file pid.c
 * @brief A PID implementation
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 *
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 */

#include "../include/pid.h"
#include <math.h>

void PID(PIDSettings *settings) {
    float error;
    float power;

    error = settings->target - (settings->sensor ?
                                settings->sensor->average :
                                settings->root->sensor->average);

    if (sgn(error) != sgn(settings->_error))
        settings->_integral = 0;
    settings->_integral += error / (millis() - settings->_time);
    settings->_time = millis();
    settings->_derivative = error - settings->_error;
    settings->_error = error;

    power = clipNum(
        (settings->kP * error) +
        (settings->kI * ((settings->integrallimit == -1) ? settings->_integral :
                        clipNum(settings->_integral, settings->integrallimit,
                                -settings->integrallimit))) +
        (settings->kD * settings->_derivative),
        settings->max,
        settings->min);
}

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    if (!mutexTake(settings->root->_mutex, 5)) {
        return;
    }

    settings->root->power = round(power);
    mutexGive(settings->root->_mutex);

    if (abs((int)(error + .5)) <= settings->tolerance) {
        if (settings->_reached) {
            if (millis() - settings->_reached >= settings->precision) {
                settings->isTargetReached = true;
            } else {
                settings->isTargetReached = false;
            }
        } else {
            settings->_reached = millis();
            settings->isTargetReached = false;
        }
    } else if (!settings->_reached || settings->isTargetReached) {
        settings->_reached = 0;
        settings->isTargetReached = false;
    }
} /* PID */

```