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/**
 * @file Sensors.h
 * @brief Hardware abstraction for Sensors
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 *
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 */

#ifndef CARL_SENSORS_H_
#define CARL_SENSORS_H_

#include "API.h"

/**
 * The different types of Sensors
 */
typedef enum {
    /** Analog Sensor */
    Analog,

    /** High Resolution Analog */
    AnalogHR,

    /** Digital Sensor */
    Digital,

    /** Quadrature shaft encoder */
    Quad,

    /** Ultrasonic Sensor */
    Sonic,

    /** Gyro Sensor */
    Gyroscope,

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        /** Integrated Motor Encoder */
        IME,

        /** Placeholder for a late init Sensor */
        Placeholder,
    } SensorType;

/**
 * A struct representing a Sensor of a given type
 */
typedef struct Sensor {
    /** Child in the linked list */
    struct Sensor *child;

    /** Current Sensor value */
    int value;

    /** Current Sensor's velocity */
    int velocity;

    /** The average of the Sensor value and it's child's value */
    int averageVal;

    /** The average velocity if the Sensor's velocity and it's children's velocity */
    int averageVel;

    /** Recalculation function of the Sensor's value */
    float (*recalc)(int);

    /** Whether or not the Sensor's value is inverted */
    bool inverted;

    /** Sensor port */
    unsigned char port;

    /** Calibration data, like a gyro multiplier. Can also be used as a bool */
    unsigned short calibrate;

    int zero;
    SensorType _type;
    void *_pros;
    Mutex _mutex;
    unsigned long _lastUpdate;
    int _lastValue;
} Sensor;

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/**
 * Refresh the information on the Sensor
 *
 * @param s the Sensor to refresh
 */
void    sensorRefresh(Sensor *s);

/**
 * Reset a sensor's value
 *
 * @param the Sensor to reset
 */
void    sensorReset(Sensor *s);

/**
 * Create a new Sensor
 *
 * @param type      the type of SensorType, either a Digital, Analog,
 * AnalogHR, Quad, Sonic, or Gyroscope
 * @param port      the port in which the Sensor is in
 * @param inverted  whether or not to invert the value
 * @param calibrate the calibration value in some cases, or anything but 0 to
 * calibrate the Sensor object
 *
 * @return the new Sensor
 */
Sensor newSensor(SensorType    type,
                 unsigned char port,
                 bool           inverted,
                 unsigned short calibrate);

/**
 * Create a new digital Sensor
 *
 * @param port      the port that the digital Sensor is in
 * @param inverted  whether or not to invert the value
 *
 * @return the new digital Sensor object
 */
Sensor newDigital(unsigned char port,
                  bool           inverted);

/**
 * Create a Sonic (aka ultrasonic) Sensor
 *
 * @param orange the port that the orange cable is in

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    * @param yellow the port that the yellow cable is in
    *
    * @return the new ultrasonic Sensor object
    */
Sensor newSonic(unsigned char orange,
               unsigned char yellow);

/**
 * Create and initialize a quadrature encoder (the red ones)
 * @param top      the port that the top wire on the encoder is in
 * @param bottom   the port that the bottom wire on the encoder is in
 * @param inverted whether or not the Sensor's value should be inverted
 *
 * @return the new quadrature encoder Sensor object
 */
Sensor newQuad(unsigned char top,
               unsigned char bottom,
               bool inverted);

/**
 * Create a new analog Sensor
 *
 * @param port      the port that the Sensor is in
 * @param calibrate whether or not to calibrate the sensor
 *
 * @return the new analog Sensor object
 */
Sensor newAnalog(unsigned char port,
                 bool calibrate);

/**
 * Create a new analog HR sensor
 *
 * @param port the port that the Sensor is in
 *
 * @return the new analog Sensor object with High Resolution
 */
Sensor newAnalogHR(unsigned char port);

/**
 * Create a gyroscope Sensor
 *
 * @param port      the analog port that the gyro is plugged into
 * @param inverted  whether or not the gyroscope is inverted
 * @param calibration the calibration of the Sensor
 *

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    * @return the new gyro Sensor object
    */
Sensor newGyro(unsigned char port,
               bool inverted,
               int calibration);

/**
 * Create a IME Sensor
 *
 * @param num the number that the IME is on the daisy chain
 * @param inverted whether or not it's inverted
 *
 * @return the new IME Sensor object
 */
Sensor newIME(unsigned char num,
              bool inverted);

#endif // CARL_SENSORS_H_

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