```
/**
 * @file auto.c
 * @brief The primary source for the autonomous operation period
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 *
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 */

#include "../include/auto.h"

bool isAuto = true;

void autonLeft12();
void autonLeft22();
void autonRight12();
void autonRight22();
void autonSkills();
void autonTest();
void autonStack();

void autonNone() {}

void testMotors();

void autonRehuh();

int   selectedAuton         = 6;
Auton autons[MAX_AUTON + 1] =
{ {
                // index 0
                .name       = "left 12",
                .sensorName = "lift",
                .sensor     = &lift.sensor,
                .execute    = &autonLeft12,
        },{
```

```
        // index 1
        .name       = "left 22",
        .sensorName = "gyr2",
        .sensor     = &gyro.child,
        .execute    = &autonLeft22,
},{
        // index 2
        .name       = "right 12",
        .sensorName = "intake",
        .sensor     = &intake.sensor,
        .execute    = &autonRight12,
},{
        // index 3
        .name       = "right 22",
        .sensorName = "mgo",
        .sensor     = &mogo.sensor,
        .execute    = &autonRight22,
},{
        // index 4
        .name       = "skills",
        .sensorName = "snc",
        .sensor     = &sonic,
        .execute    = &autonSkills,
},{
        // index 5
        .name       = "none",
        .sensorName = "lift",
        .sensor     = &lift.sensor,
        .execute    = &autonNone,
},{
        // index 6
        .name       = "test",
        .sensorName = "lef",
        .sensor     = &drive[0].sensor,
        .execute    = &autonTest,
},{
        // index 7
        .name       = "test motors",
        .sensorName = "rit",
        .sensor     = &drive[1].sensor,
        .execute    = &testMotors,
},{
        // index 8
        .name       = "drive and autostack",
        .sensorName = "4bar",
        .sensor     = &manip.sensor,
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                .execute    = &autonStack,
        }, };

void liftToPosition(float pos, unsigned long until) {
        liftSettings.target = pos;
        until             += millis();

        do {
                PID(&liftSettings);
                motorUpdate(&lift);
                sensorRefresh(lift.sensor);
                delay(10);
        } while (!liftSettings.isTargetReached && millis() < until);
} /* liftToPosition */

void driveToPosition(int l, int r, unsigned long until) {
        driveSettings[0].target = l;
        driveSettings[1].target = r;
        until                  += millis();

        do {
                PID(&driveSettings[0]);
                PID(&driveSettings[1]);

                motorUpdate(&lift);
                sensorRefresh(lift.sensor);
                sensorRefresh(&gyro);

                for (int i = 0; i < 2; i++) {
                        motorUpdate(&drive[i]);
                        sensorRefresh(drive[i].sensor);
                }

                delay(10);
        } while ((!driveSettings[0].isTargetReached ||
                  !driveSettings[1].isTargetReached) &&
                   millis() < until);

        drive[0].power = 0;
        drive[1].power = 0;
        update();
} /* driveToPosition */

void driveToPositionAngle(int l, int r, int a, unsigned long until) {
        int gError;
        driveSettings[0].target = l;
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        driveSettings[1].target = r;
        until                  += millis();

        do {
                gError = (a - gyro.averageVal) * 1.5;
                PID(&driveSettings[0]);
                PID(&driveSettings[1]);
                drive[0].power += gError;
                drive[1].power -= gError;

                motorUpdate(&lift);
                sensorRefresh(lift.sensor);
                sensorRefresh(&gyro);

                for (int i = 0; i < 2; i++) {
                        motorUpdate(&drive[i]);
                        sensorRefresh(drive[i].sensor);
                }

                delay(10);
        } while ((!driveSettings[0].isTargetReached ||
                  !driveSettings[1].isTargetReached) &&
                                                millis() < until);

        drive[0].power = 0;
        drive[1].power = 0;
        update();
} /* driveToPosition */

void mogoP(int p) {
        mutexGive(mogo._mutex);
        mutexGive(mogo.child->_mutex);
        mutexGive(mogo.sensor->_mutex);
        int pow;

        do {
                pow = sgn(p - mogo.sensor->averageVal);
                sensorRefresh(mogo.sensor);
                mogo.power = (pow ? pow : 1) * 127;
                motorUpdate(&mogo);
                delay(10);
        } while ((isAutonomous() || !isAuto) && abs(p - mogo.sensor->averageVal) > 78);

        mogo.power = 0;
        motorUpdate(&mogo);
} /* mogoP */
```

```
Task mogoPT(void *p) {
        mogoP((int)p);
} /* mogoPT */

float gyroPIDC[3] = {
        5.279,
        0.0,
        1.953,
};

void gyroPID(int target, int precision) {
        int error      = 0;
        int integral   = 0;
        int derivative = 0;

        do {
                derivative = (target - gyro.averageVal) - error;
                error      = target - gyro.averageVal;
                integral  += error / 10;

                drive[0].power = -((error * gyroPIDC[0]) +
                                   (integral * gyroPIDC[1]) +
                                   (derivative * gyroPIDC[2]));
                drive[1].power = ((error * gyroPIDC[0]) +
                                  (integral * gyroPIDC[1]) +
                                  (derivative * gyroPIDC[2]));

                if (lcdReadButtons(uart1)) {
                        gyroPIDC[0] += 0.005;
                        delay(100);
                }
                info();
                #ifdef DEBUG_MODE
                        printf("%f\n", gyroPIDC[0]);
                #endif
                lcdPrint(uart1, 1, "%f", ((float)(powerLevelMain())) / 1000.0);
                lcdPrint(uart1, 2, "%f", gyroPIDC[0]);
                update();
                delay(10);
        } while (true || abs(error) > precision ||
                 integral > 10);

        drive[0].power = 0;
        drive[1].power = 0;
} /* gyroPID */
```

```
void turnTo(int angle, unsigned long until) {
        until += millis();

        gyroSettings[0].target = angle;
        gyroSettings[1].target = angle;

        do {
                PID(&gyroSettings[0]);
                PID(&gyroSettings[1]);

                update();
                delay(10);
        } while ((!gyroSettings[0].isTargetReached ||
                  !gyroSettings[1].isTargetReached) &&
                                                millis() < until);

        driveSet(0, 0);
} /* turnTo */

void getMogo() {
        intake.power         = -25;
        liftSettings.target = ARM_QUARTER + 20;
        lift.power = -70;
        motorUpdate(&lift);
        delay(300);
        driveSet(25, 25);

        TaskHandle liftHandle = GO(liftPID, NULL);
        TaskHandle mogoHandle = GO(mogoPT, MOGO_DOWN + 10);
        delay(600);

        driveToPosition(2075, 2075, 2300);
        driveSet(15, 15);

        while (taskGetState(mogoHandle))
                delay(10);

        mogoHandle = GO(mogoPT, MOGO_UP);

        driveSet(127, 127);
        delay(260);

        driveSet(18, 18);

        while (mogo.sensor->averageVal > MOGO_MID) {
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                sensorRefresh(mogo.sensor);
                delay(10);
        }

        if (taskGetState(liftHandle))
                taskDelete(liftHandle);
        driveSet(0, 0);
        mogo.power = 6;
        motorUpdate(&mogo);
} /* getMogo */

Task backUp(void *time) {
        unsigned long t = (unsigned long)time;

        while (millis() - t < 14250) {
                delay(10);
        }

        t = millis();

        while (isAutonomous() && millis() - t < 500) {
                driveSet(-127, -127);
                update();
                delay(10);
        }
} /* backUp */

void placeCone() {
        // Arm down
        liftToPosition(ARM_DOWN + 35, 400);

        // Drop cone
        intake.power = 127; // Open intake
        motorUpdate(&intake);
        delay(475);       // Give intake time to open
        intake.power = 0;   // Stop intake
        liftToPosition(ARM_QUARTER, 400);
        lift.power = 10; // Keep lift up
        motorUpdate(&lift);
        #ifdef DEBUG_MODE
                print("Cone placed!\n"); // Notify computer of cone state
        #endif
        delay(150);
} /* placeCone */

Task placeConeT(void *none) {
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        placeCone();
} /* placeCone */

TaskHandle dropMogo20(TaskHandle mogoHandle) {
        int p[2] = { drive[0].sensor->value, drive[1].sensor->value };

        // Start the mogo intake down
        if (!mogoHandle && taskGetState(mogoHandle))
                mogoHandle = GO(mogoPT, MOGO_MID + 125);
        driveToPosition(p[0] + 250, p[1] + 250, 600);
        driveSet(30, 30);

        // Wait until the mogo intake is up
        while (taskGetState(mogoHandle)) {
                delay(10);
        }

        // Wait a bit for the mobile goal to settle
        mogo.power = 127;
        motorUpdate(&mogo);
        driveSet(-64, -64);
        delay(315);
        mogo.power = 30;

        driveToPosition(p[0] - 400, p[1] - 400, 3000);
        return GO(mogoPT, MOGO_UP);
} /* dropMogo */

void autonomous() {
        unsigned long startTime = millis();
        isAuto = true;
        reset();
        sensorReset(drive[0].sensor);
        sensorReset(drive[1].sensor);
        sensorReset(lift.sensor);
        sensorReset(mogo.sensor);
        sensorReset(&gyro);

        selectedAuton = clipNum(selectedAuton, MAX_AUTON, 0);
        if (autons[selectedAuton].execute != NULL)
                autons[selectedAuton].execute();

        liftSettings.target = lift.sensor->averageVal; // Set target to current pos

        #ifdef DEBUG_MODE
                printf("\n\n\rFinished autonomous in %ldms\n\n", millis() - startTime);
```

```
        #endif
        while (isAutonomous()) {
                PID(&liftSettings);                     // Hold the lift position
                update();
                delay(10);
        }
} /* autonomous */

void testMotors() {
        while (isAutonomous()) {
                for (int i = 1; i <= 10; i++) {
                        motorSet(i, 127);
                        delay(250);
                        motorStopAll();
                }
        }
} /* testMotors */

Task driveToPositionAngleT(void *triple) {
        Triple *t = (Triple *)triple;

        driveSettings[0].target = t->a;
        driveSettings[1].target = t->b;

        do {
                PID(&driveSettings[0]);
                PID(&driveSettings[1]);
                drive[0].power += (t->c - gyro.averageVal) * 2.3;
                drive[1].power -= (t->c - gyro.averageVal) * 2.3;

                motorUpdate(&lift);
                sensorRefresh(lift.sensor);
                sensorRefresh(&gyro);

                for (int i = 0; i < 2; i++) {
                        motorUpdate(&drive[i]);
                        sensorRefresh(drive[i].sensor);
                }

                delay(10);
        } while ((!driveSettings[0].isTargetReached ||
                  !driveSettings[1].isTargetReached));

        drive[0].power = 0;
        drive[1].power = 0;
        delete(triple);
```

```
        taskDelete(NULL);
} /* driveToPositionAngleT */

Task liftToPositionT(void *pos) {
        int p = (int)pos;

        liftToPosition(p, p * 1.34);
        taskDelete(NULL);
} /* liftToPositionT */

Task intakeToPositionT(void *pos) {
        manipSettings.target = (int)pos;

        do {
                PID(&manipSettings);
                motorUpdate(&intake);
                sensorRefresh(intake.sensor);
                delay(10);
        } while (!manipSettings.isTargetReached);

        taskDelete(NULL);
} /* intakeToPositionT */

Task die(void *none) {
        taskDelete(NULL);
}

void moveTo(int leftV, int rightV, int liftV, int mogoV, int intakeV, int gyroV) {
        TaskHandle driveHandle, liftHandle, mogoHandle, intakeHandle;
        update();

        if ((abs(leftV - drive[0].sensor->value) > driveSettings[0].tolerance) ||
            (abs(rightV - drive[1].sensor->value) > driveSettings[1].tolerance) ||
                        (abs(gyroV - gyro.averageVal) > gyroSettings[0].tolerance)) {
                Triple *t = new(Triple);
                t->a        = leftV;
                t->b        = rightV;
                t->c        = gyroV;
                driveHandle = GO(driveToPositionAngleT, t);
        }

        if (abs(liftV - lift.sensor->value) > liftSettings.tolerance)
                liftHandle = GO(liftToPositionT, liftV);

        if (abs(mogoV - mogo.sensor->averageVal) > 90)
                mogoHandle = GO(mogoPT, mogoV);
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```
        if (abs(intakeV - intake.sensor->value) > manipSettings.tolerance)
                intakeHandle = GO(intakeToPositionT, intakeV);

        if (driveHandle)
                while (taskGetState(driveHandle))
                        delay(10);

        if (liftHandle)
                while (taskGetState(liftHandle))
                        delay(10);

        if (mogoHandle)
                while (taskGetState(mogoHandle))
                        delay(10);

        if (intakeHandle)
                while (taskGetState(intakeHandle))
                        delay(10);
} /* moveTo */

void liftPID(void *none) {
        while (isEnabled()) {
                PID(&liftSettings);
                delay(10);
        }
}
```