Работа победителя заключительного этапа

командной инженерной олимпиады школьников

Олимпиада Национальной технологической инициативы

Профиль «АВТОНОМНЫЕ ТРАНСПОРТНЫЕ СИСТЕМЫ»

Литвинов Лев Алексеевич

Класс: 11

Город: Горняк

Школа: МБОУ "Гимназия №3"

Регион: Алтайский край

Уникальный номер участника: 322

Команда на заключительном этапе: Вжух и в продакшн

Результаты заключительного этапа:

№	Индивидуальный этап													Командный этап		ИТОГ
	Физика				Информатика							За задачи	Коэффициент 40%	баллы	Коэффициент 60%	
322	2	6	20	0	6	0	0	0	0	0	0	34	9,066,666	88,5	21,24	30,307

Индивидуальная часть

Персональный лист участника с номером 322:

Олимпиада НТИ

ФИО Лютиков Лев Алексеевич

Город Горняк

Школа № МБОУ „Гимназия №3"

Физика

Командная инженерная олимпиада «Олимпиада НТИ»

Направление А+С

Предмет физика

Номер участника 322

1	2	3	4	Σ
2	6	20	0	28

1) $v_1 = 1{,}77$ км/с.

$L = 20$

$a = \frac{v^2}{R} \Rightarrow v_{спут.} = \sqrt{aR}$

$R = G\frac{M}{R^2} \Rightarrow v_{спут} = \sqrt{\frac{GM}{R}}$

$L = 20 \Rightarrow$

$v_{спут} t = 20 - v_1 t$

$t = \frac{20}{v_{спут} + v}$

$S = v_{спут} \cdot t = \frac{v_{спут} 20}{v_{спут} + v} =$

$v_{спут} = \sqrt{\frac{6{,}67 \cdot 10^{-11} \cdot 5{,}97 \cdot 10^{24}}{42157}} = \sqrt{9{,}44 \cdot 10^{-4} \cdot 10^{13}} =$

$= \sqrt{9{,}44 \cdot 10^{9}} \approx 0{,}3 \cdot 10^5 \approx 3000$ м/с $= 3$ км/с

$S = \frac{3 \cdot 20}{3 + 1{,}77} = \frac{60}{4{,}77} \approx 12{,}57$ км.

Ответ: 12,57 км.

2 балла

Командная инженерная олимпиада «Олимпиада НТИ»

Направление АТС

Предмет физика

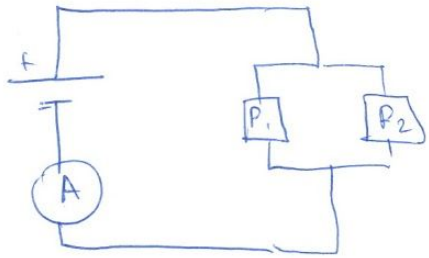
Номер участника 322

$\Rightarrow R = 10$ (Ом)

$\omega_1 = 0{,}18$

$\omega_2 = 1{,}149$

$R_п - ?$



$I_{расч} = \frac{\mathcal{E}}{R + r}$ $\quad I_1 = 0{,}18 I_{расч} = \frac{\mathcal{E}}{R_1 + r}$, где $R_1 = R + R_п$

с другой стороны $I_{12} = 1{,}149 I_{расч} = \frac{\mathcal{E}}{\frac{R_1 R}{R + R_1} + r}$

Тогда: $\frac{\mathcal{E}}{R_1 + r} = 0{,}18 \frac{\mathcal{E}}{10 + r}$; $0{,}18R_1 + 0{,}18r = 10 + r$;

$0{,}82r = 0{,}18R_1 - 10$; $r = 0{,}2195R_1 - 12{,}195$

$\frac{1{,}149\mathcal{E}}{10 + r} = \frac{\mathcal{E}}{\frac{10R_1}{10 + R_1} + r}$; $\frac{11{,}49R_1}{10 + R_1} + 1{,}149r = 10 + r$

$\frac{11{,}49R_1}{10 + R_1} = 10 - 0{,}149r \Rightarrow 11{,}49R_1 = (10 - 0{,}149r)(10 + R_1)$

$\Rightarrow 11{,}49R_1 = (10 - 0{,}033R_1 + 1{,}82)(10 + R_1)$

$11{,}49R_1 = (11{,}82 - 0{,}033R_1)(10 + R_1)$

$11{,}49R_1 = 118{,}2 + 11{,}82R_1 - 0{,}33R_1 - 0{,}033R_1^2$

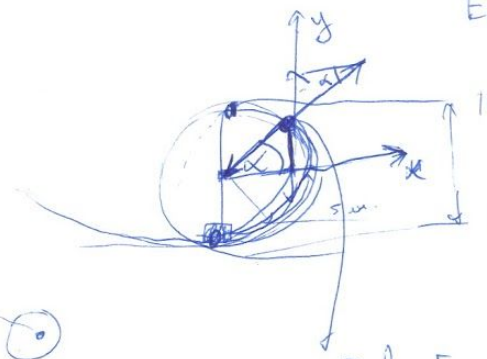
$0{,}033R_1^2 = 118{,}2$ $\quad R_1^2 \approx 3581{,}18 \Rightarrow R_1 \approx 59{,}85$ (Ом) $\Rightarrow$

$\Rightarrow R_п \approx 49{,}85$ (Ом)

Ответ: 49,85 (Ом)

20

$E_k = \frac{mv^2}{2}$



$F_{gab} = \frac{mv^2}{R}$

$F_{gab} = \frac{mv^2}{R}\cos\alpha$

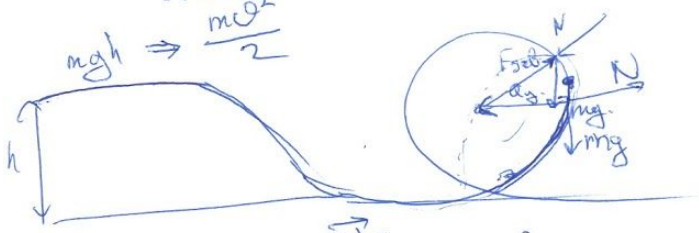
$F_T = mg$

$\frac{10\pi}{\frac{2\pi r}{2}} = 3$ bile

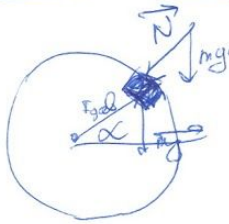
$F_{gab} < F_T$

$E_{mec} = \frac{mv^2}{2}$

$mgh \Rightarrow \frac{mv^2}{2}$



$\frac{mv^2}{R}\cos\alpha < mg +$



$a = 0$

$\frac{mv^2}{R}\cos\alpha < mg - mg\cos\alpha$

$g = G\frac{mM}{R}$

$\frac{v^2}{R}\cos\alpha < g(1-\cos\alpha)$

$F_{gab} < mg + mg\cos\alpha$

$F_{gab} < mg(1+\cos\alpha)$

$\frac{mv^2}{2} - mg$

$F = G\frac{mM}{R^2}$

$a = \frac{v^2}{R}$

$v = \sqrt{aR}$

$\omega = \frac{2\pi v}{T}$

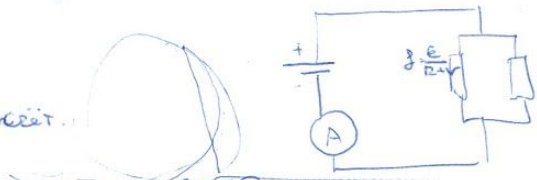
$R_{Sg} = 35786 + 6371$

$0\ 3\ 7\ 1$

$42157\,\text{km}$

$\frac{1}{R} + \frac{1}{R} = \frac{2}{R}$

$\frac{R}{2}$

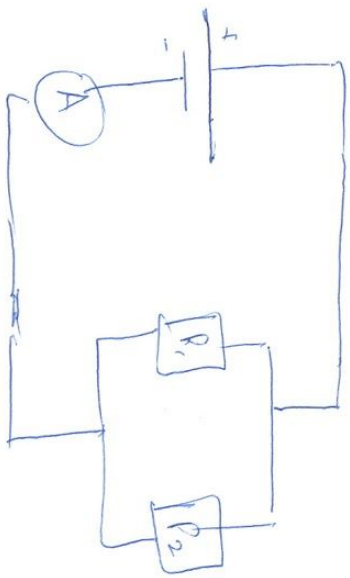


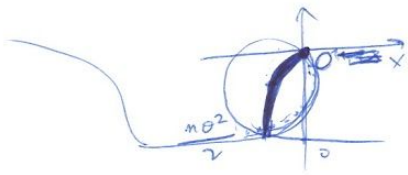
$\mathcal{E} = \frac{\mathcal{E}}{R+r}$

$\mathcal{E} = \frac{\mathcal{E}}{\frac{R}{2}+r}$

$\mathcal{E}_1 = \frac{\mathcal{E}}{R+r} = 0{,}18\,\mathcal{E}_{paralel}$

$\mathcal{E}_2 = \frac{\mathcal{E}}{R+r} = \mathcal{E}_{paralel} \Rightarrow R = \frac{R}{2}$???





$S = \frac{gt^2}{2} = 5t^2$

$11{,}78 = 5t^2$

$\frac{mv^2}{2} = mg \cdot 11{,}78 + \frac{mv_2^2}{2}$

$\frac{11{,}78}{4{,}9} = t^2$

$t \approx 1{,}55$

$\frac{v^2}{2} = g11{,}78 + \frac{v_2^2}{2}$

$v_y = 0$

$v_x = ?$

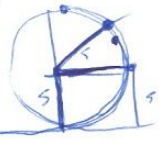
$v^2 = 2gh + v_2^2$

$v_2^2 = v^2 - 2gh$ $2R - h$

$v_x = v_2 = \sqrt{v^2 - 2gh}$

$v^2 = 20g$

$v^2 - 20g = 0$ $v = \sqrt{20g} = 2\pi r$

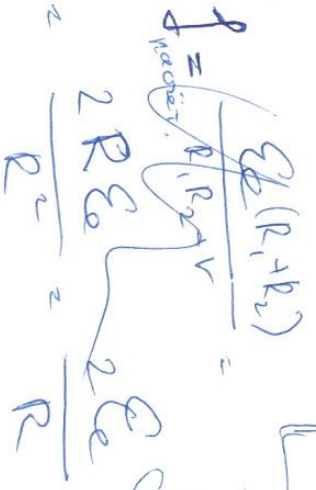


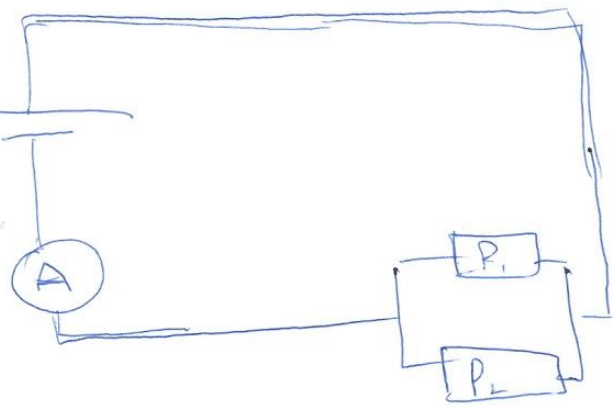
$\Rightarrow v_x = \sqrt{20g - 2gh} =$

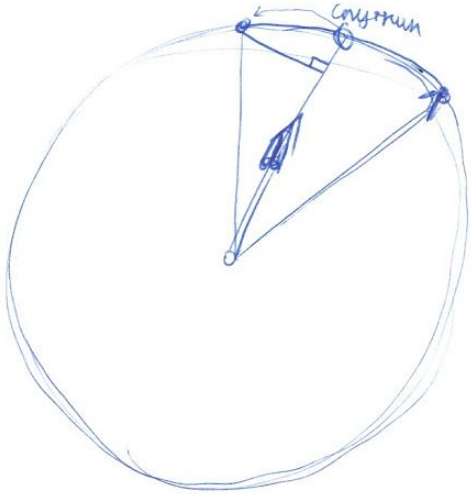
$\frac{2\pi r}{2{,}66} = 11{,}78$ $\frac{2\pi r}{k} = 11{,}78$

$\approx 0{,}75\pi r$

$0{,}18$ }







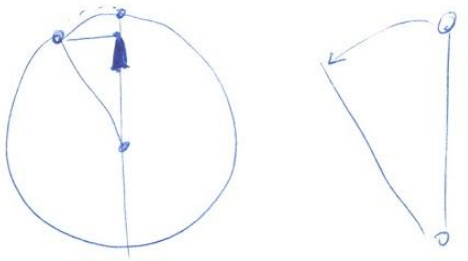
$a = \frac{v^2}{R}$ $v = \sqrt{aR}$

$t = 11,3$ с. (ракета догоняет).

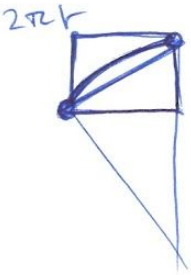
$w = \frac{2\pi v}{T} = \frac{2\pi\sqrt{aR}}{T}$

$g = G\frac{M}{}$

$g = G\frac{M}{R^2}$



$v_1 = \sqrt{\frac{G \cdot M}{R}}$



vt

$wt = 20 - vt$

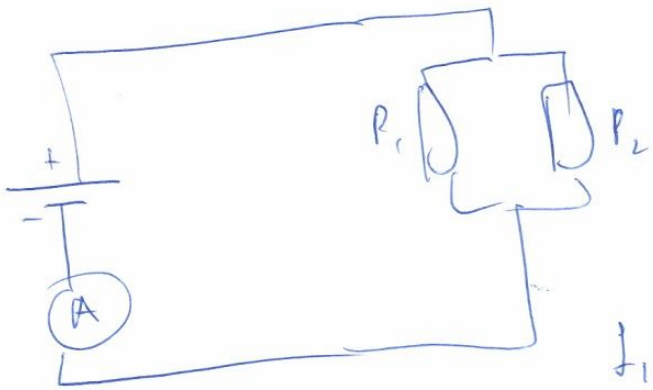
$wt + vt = 20$

$t_1 = \frac{20}{w + v}$

$S = wt_1 = \frac{20w}{w+v}$

$T = \frac{2\pi R}{v}$

$S = \frac{20\sqrt{G\frac{M}{R}}\,v}{\sqrt{G\frac{M}{R}} + v} = 20 \cdot$



$$I_{P_1} = \frac{\mathcal{E}}{R + r} \quad \text{(на один прибор)}$$

$$I_{P_2} = \frac{\mathcal{E}}{\frac{R}{2} + r} \quad \text{(на два прибора)}$$

$$I_1 = \frac{\mathcal{E}}{R_1 + r} = 0{,}18\, I_{P_1}$$

$$I_2 = I_{P_1}$$

$$I_{общ} = \frac{\mathcal{E}}{R_{общ} + r}$$

$$\frac{\mathcal{E}}{R_1 + r} = 0{,}18\,\frac{\mathcal{E}}{10 + r}$$

$$0{,}18R_1 + 0{,}18r = 10 + r$$

$$0{,}18R_1 = 10 + 0{,}82r$$

$$0{,}18R_1 - 10 = 0{,}82r$$

$$1{,}14\, I_{P_1} \frac{\mathcal{E}}{10 + r} = \frac{\mathcal{E}}{R_{общ} + r}$$

$$\frac{1}{10} + \frac{1}{R_1}$$

$$\frac{10 + R_1}{10R_1} \qquad \frac{10R_1}{10 + R_1}$$

Информатика

Задача 1.1

Код программы на языке Python:

```
1    # як весело то
2    def seek(mass, element):
3         h = len(mass) - 1
4         while mass[h] != element:
5         h -= 1
6         return h
7
8    n, k, m = map(int, input().split())
9    hook, ind1, m = 10**20, k, m - 1
10    cnt1, cnt2 = 0, 0
11    mass = list(map(int, input().split()))
12
13    while k < m:
14        mini = min(mass[:k + 1])
15        cnt1 += mini
16        mass[mass.index(mini)] = hook
17        k += 1
18
19    while n - ind1 > m:
20        mini = min(mass[n - k:])
21        cnt2 += mini
22        mass[seek(mass, mini)] = hook
23        ind1 += 1
24
25    print(min(cnt1, cnt2) + mass[m])
```

Программа верно решает задачу (6 баллов).

Задача 1.2

Код программы на языке Python:

```
1    def seek(mass, element):
2         h = len(mass) - 1
3         while mass[h] != element:
4         h -= 1
5         return h
6
7    n, k, m = map(int, input().split())
8    hook, ind1, m = 10**20, k, m - 1
9    cnt1, cnt2 = 0, 0
10    mass = list(map(int, input().split()))
```

```
11
12    while k < m:
13        mini = min(mass[:k + 1])
14        cnt1 += mini
15        mass[mass.index(mini)] = hook
16        k += 1
17
18    while n - ind1 > m:
19        mini = min(mass[n - k:])
20        cnt2 += mini
21        mass[seek(mass, mini)] = hook
22        ind1 += 1
23
24    print(min(cnt1, cnt2) + mass[m])
```

Ошибка при выполнении текста №14 (неверный ответ) (0 баллов).

Задача 1.3

Код программы на языке Python:

```
1    def seek(mass, element):
2        h = len(mass) - 1
3        while mass[h] != element:
4        h -= 1
5        return h
6
7    n, k, m = map(int, input().split())
8    hook, ind1, m = 10**20, k, m - 1
9    cnt1, cnt2 = 0, 0
10    mass = list(map(int, input().split()))
11
12    while k < m:
13        mini = min(mass[:k + 1])
14        cnt1 += mini
15        mass[mass.index(mini)] = hook
16        k += 1
17
18    while n - ind1 > m:
19        mini = min(mass[n - k:])
20        cnt2 += mini
21        mass[seek(mass, mini)] = hook
22        ind1 += 1
23
24    print(min(cnt1, cnt2) + mass[m])
```

Ошибка при выполнении теста №14 (неверный ответ) (0 баллов).

Командная часть

Результаты были получены в рамках выступления команды: Вжух и в продакшн

Личный состав команды:

- Белавенцев Валерий
- Васильев Валерий
- Литвинов Лев
- Лямаев Михаил
- Серянин Александр

Фото команды с собранными устройствами:

Рис.1 - Команда с четырьмя устройствами в сборке

Рис.2 - Отладка на стенде “Маринет” с устройством, на заднем плане - судьи

Баллы командного этапа:

Название команды	МАРИНЕТ	АВТОНЕТ	АЭРОНЕТ	СПЕЙСНЕТ	КОМПЛЕКС	ИТОГО
Вжух и в продакшн	13	17,5	28	30		88,5

Маринет

Название команды	Участники		№ подзадач	База	Номер попытки										лучшая
					1	2	3	4	5	6	7	8	9	10	
Вжух и в продакшн	Белавенцев	Валерий	1	9	9										9
	Васильев	Валерий	2.	5	4										4
	Литвинов	Лев	3.	5											0
	Лямаев	Михаил	4.	17											0
	Серянин	Александр	5.	5											0
			6.	9											0
	РЕЗУЛЬТАТ														13

Автонет

Название команды	Участники		№ подзадач	База	Номер попытки										лучшая
					1	2	3	4	5	6	7	8	9	10	
Вжух и в продакшн	Белавенцев	Валерий	1	10	0	9,5									9,5
	Васильев	Валерий	2.	2	2										2
	Литвинов	Лев	3.	4	4										4
	Лямаев	Михаил	4.	4											0
	Серянин	Александр	5.	2	2										2
			6.	8											0
			7.	20											0
	РЕЗУЛЬТАТ														17,5

Аэронет

Название команды	Участники		№ подзадач	База	Номер попытки										лучшая
					1	2	3	4	5	6	7	8	9	10	
Вжух и в продакшн	Белавенцев	Валерий	1	10	8										8
	Васильев	Валерий	2.	8	8										8
	Литвинов	Лев	3.	12	12										12
	Лямаев	Михаил	4.	15											0
	Серянин	Александр	5.	10											0
			6.	5											0
	РЕЗУЛЬТАТ														28

Спейснет

Название команды	Участники		№ подзадач	База	Номер попытки										лучшая
					1	2	3	4	5	6	7	8	9	10	
Вжух и в продакшн	Белавенцев	Валерий	1	10	10										10
	Васильев	Валерий	2.	5	5										5
	Литвинов	Лев	3.	15	15										15
	Лямаев	Михаил													0
	Серянин	Александр													0
															0
	РЕЗУЛЬТАТ														30

Комплексный проезд

Не приступали.

Решения командного этапа:

Маринет

Код программы на языке C++, обеспечивающий решение задач подтрека:

.LodkaProg.vsarduino.h

```
#ifndef _VSARDUINO_H_

#define _VSARDUINO_H_

#define __AVR_ATmega32u4__

#define __AVR_ATmega32U4__
```

```
#define F_CPU 16000000L
#define ARDUINO 10608
#define ARDUINO_AVR_MICRO
#define ARDUINO_ARCH_AVR
#define USB_VID 0x2341
#define USB_PID 0x8037
#define __cplusplus 201103L
#define __AVR__
#define __inline__
#define __asm__(x)
#define __extension__
#define __inline__
#define __volatile__
#define GCC_VERSION 40801
#define volatile(va_arg)
#define _CONST
#define __builtin_va_start
#define __builtin_va_end
#define __attribute__(x)
#define NOINLINE __attribute__((noinline))
#define prog_void
#define PGM_VOID_P int
#ifndef __builtin_constant_p
     #define __builtin_constant_p __attribute__((__const__))
#endif
#ifndef __builtin_strlen
     #define __builtin_strlen  __attribute__((__const__))
```

```
#endif

#define NEW_H

typedef void *__builtin_va_list;

extern "C" void __cxa_pure_virtual() {;}




#include <arduino.h>

#include <pins_arduino.h>

#undef F

#define F(string_literal) ((const PROGMEM char
*)(string_literal))

#undef PSTR

#define PSTR(string_literal) ((const PROGMEM char
*)(string_literal))

#include "LodkaProg.ino"

#endif
```

LodkaProg.ino

```
#include <NewPing.h>

#include <Servo.h>


#define MAX_DISTANCE 200

#define OFFSET_IN_STEP 500


#define START 5

#define LED_PIN 13

#define  L_wheel 9
```

```
#define  R_wheel 10
#define GEO_CHANEL "AT+C085"
#define SAT_CHANEL "AT+C025"
#define volt_pin A0
#define HC12_SetupPin 4
#define IR_PIN A4
#define P 20
//********* ***********
#define FFtrig 6
#define FFecho 6
NewPing sonarFF(FFtrig, FFecho, MAX_DISTANCE);

//********* ******* * ******* ******* ***********
#define FRtrig  12
#define FRecho  12
#define RRtrig  8
#define RRecho  8
NewPing sonarFR(FRtrig, FRecho, MAX_DISTANCE);
NewPing sonarRR(RRtrig, RRecho, MAX_DISTANCE);

//********* ******* * ******* ******* ***********
#define FLtrig  11
#define FLecho  11
#define RLtrig  7
#define RLecho  7
NewPing sonarFL(FLtrig, FLecho, MAX_DISTANCE);
NewPing sonarRL(RLtrig, RLecho, MAX_DISTANCE);
```

```
float distFF;
float distFL;
float distFR;
float distRL;
float distRR;
float LightIR;
int Voltage;
float vLeft;
float vRight;
int offset = 0;

Servo servoLeft, servoRight;
struct GEO {
     int x;
     int y;
     int grad;
};
char strbuf[40];
GEO geo_data;
GEO points[10];
float TwoPointAngle(GEO point1, GEO point2);
// the setup function runs once when you press reset or power
the board
void setup() {
     setPoints();
     servo_attach();
     Serial.begin(9600);
     Serial1.begin(9600);
```

```
      Serial1.flush();
      pinMode(13, OUTPUT);
      pinMode(START, INPUT);//########## #######
      pinMode(HC12_SetupPin,OUTPUT);
      delay(500);
      set_transmiter_chanel(GEO_CHANEL);
      Voltage = analogRead(volt_pin);
      Serial.print("Voltage:");
      Serial.println(Voltage*10.00 / 1023.00);

      while (!digitalRead(START)){
      if (analogRead(volt_pin) < 720) {
            digitalWrite(LED_PIN,HIGH);
            delay(250);
            digitalWrite(LED_PIN, LOW);
            delay(250);
      }
      else {
            digitalWrite(LED_PIN, LOW);
      }

      read_geo_data();

      sprintf(strbuf, "X:=%d Y:=%d grad:=%d
offset:=%d",geo_data.x,geo_data.y,geo_data.grad, offset);
      Serial.println(strbuf);

      }
```

```
     digitalWrite(LED_PIN, HIGH);
     set_transmiter_chanel(GEO_CHANEL);
     //Serial.println((atan(5/4)*180)/3.14);

}


// the loop function runs over and over again until power down
or reset
void loop() {
     read_geo_data();
     setServo(20, 20);
     while (!(geo_data.y + P >= points[0].y && points[0].y >=
geo_data.y - P)) {
     read_geo_data();
     }
     setServo(-70, -70);
     delay(900);
     setServo(0, 0);
     if (geo_data.grad - 180 < 0) {
     Right();
     }
     else {

     Left();
     }

     setServo(0, 0);
```

```
     setServo(20, 20);
     while (!(geo_data.x + P >= points[1].x && points[1].x >=
geo_data.x - P)) {
     read_geo_data();
     }
     setServo(-80, -80);
     delay(900);
     setServo(0, 0);

//   SensorScan();
     while (1)
     {

     }

}
void Right()
{
     setServo(-20, 20);
     while (!(geo_data.grad + 30 >= points[1].grad &&
points[1].grad >= geo_data.grad - 30)) {
     read_geo_data();
     }
     setServo(80, -80);
     delay(500);
}
void Left()
```

```
{
     setServo(20, -20);
     while (!(geo_data.grad + 30 >= points[1].grad &&
points[1].grad >= geo_data.grad - 30)) {
     read_geo_data();
     }
     setServo(-80, 80);
     delay(500);
}
void SensorScan()
{

     delay(2);
     distFF = sonarFF.ping_cm();
     Serial.print("FF:");
     Serial.println(distFF);

     delay(2);
     distFR = sonarFR.ping_cm();
     Serial.print("FR:");
     Serial.println(distFR);

     delay(2);
     distFL = sonarFL.ping_cm();
     Serial.print("FL:");
     Serial.println(distFL);
```

```
delay(2);
     distRL = sonarRL.ping_cm();
     Serial.print("RL:");
     Serial.println(distRL);
     delay(2);
     distRR = sonarRR.ping_cm();
     Serial.print("RR:");
     Serial.println(distRR);


     LightIR = analogRead(IR_PIN);
     Serial.print("IR:");
     Serial.println(LightIR);

     Voltage = analogRead(volt_pin);
     Serial.print("Voltage:");
     Serial.print(Voltage);
     Serial.print(" ()");
     Serial.println(Voltage*10.00 / 1023.00);

     Serial.println("---");

}
void setServo(float vLeft, float vRight)
{
     if (vLeft > 80) { vLeft = 80; }
```

```
     if (vRight > 80) { vRight = 80; }
     servoLeft.write(90 - vLeft);
     servoRight.write(90 + vRight);

}
void servo_attach() {

     servoLeft.attach(L_wheel);
     servoRight.attach(R_wheel);
     servo_stop();
}

void servo_stop() {

     servoLeft.write(90);
     servoRight.write(90);
}

void read_geo_data() {
     String str;
     //str = "rer";
     while (1)
     {
     if (Serial1.available() > 0) {
          str = Serial1.readStringUntil('\n');
          //str = "00;1019;0609;192";
          if (str.substring(0, 1)=="22") {
```

```
                offset = str.substring(3, 7).toInt();
            }
            else {
                geo_data.x = str.substring(3, 7).toInt();
                geo_data.y = str.substring(8,
12).toInt()+(offset*OFFSET_IN_STEP);
                geo_data.grad = str.substring(13, 16).toInt();
            }
            Serial.println(str);
      }
      }
}

void set_transmiter_chanel(char* set_chanel) {

      digitalWrite(HC12_SetupPin, LOW);
      delay(50);
      Send_command(set_chanel);
      digitalWrite(HC12_SetupPin, HIGH);

}

void Send_command(char* ATcommand) {
      String str;
      Serial1.println(ATcommand);
      Serial.println(ATcommand);
      delay(200);
      if (Serial1.available() > 0)
```

```
    {
    str = Serial1.readStringUntil('\n');// LF
    Serial.println(str);
    }
    delay(100);
}
float TwoPointAngle(GEO point1,GEO point2) {

    return atanf((point2.y-point1.y)/(point2.x-point1.x));
}
void setPoints() {
    points[0].x = 380;
    points[0].y = 180;
    points[0].grad = 270;

    points[1].x = 1000;
    points[1].y = 100;
    points[1].grad = 0;
}
```

Автонет

Код программы на языке C++, обеспечивающий решение задач подтрека:

.MASHINA.vsarduino

```
#ifndef _VSARDUINO_H_
#define _VSARDUINO_H_
#define __AVR_ATmega32u4__
#define __AVR_ATmega32U4__
```

```
#define F_CPU 16000000L
#define ARDUINO 10608
#define ARDUINO_AVR_LEONARDO
#define ARDUINO_ARCH_AVR
#define USB_VID 0x2341
#define USB_PID 0x8036
#define __cplusplus 201103L
#define __AVR__
#define __inline__
#define __asm__(x)
#define __extension__
#define __inline__
#define __volatile__
#define GCC_VERSION 40801
#define volatile(va_arg)
#define _CONST
#define __builtin_va_start
#define __builtin_va_end
#define __attribute__(x)
#define NOINLINE __attribute__((noinline))
#define prog_void
#define PGM_VOID_P int
#ifndef __builtin_constant_p
     #define __builtin_constant_p __attribute__((__const__))
#endif
#ifndef __builtin_strlen
     #define __builtin_strlen  __attribute__((__const__))
```

```
#endif

#define NEW_H

typedef void *__builtin_va_list;

extern "C" void __cxa_pure_virtual() {;}




#include <arduino.h>

#include <pins_arduino.h>

#undef F

#define F(string_literal) ((const PROGMEM char
*)(string_literal))

#undef PSTR

#define PSTR(string_literal) ((const PROGMEM char
*)(string_literal))

#include "MASHINA.ino"

#endif
```

MASHINA.ino

```
// the setup function runs once when you press reset or power
the board


#include <IRremoteInt.h>

#include <IRremote.h>

#include <Servo.h>


#define SIGNAL_FORWARD  0xc00

#define SIGNAL_STOP  0xf00

#define SIGNAL_LEFT  0xa00
```

```
#define SIGNAL_RIGHT  0x900

#define MAX_DISTANCE 200

#define OFFSET_IN_STEP 500

#define MOTOR_PIN 5

#define SERVO_PIN 6

#define LINE_PIN A2

#define SONIC_PIN 3

#define IR_PIN A4

#define SAUND_PIN 7

#define LED_PIN A1

#define HC12_SetupPin 2

#define GEO_CHANEL "AT+C056"

#define SAT_CHANEL "AT+C025"

#define START A0

int offset = 0;

int dist = 0;

IRrecv irrecv(IR_PIN);//пин ик

Servo servo, motor;

//NewPing sonar(SONIC_PIN, SONIC_PIN, MAX_DISTANCE); // NewPing
setup of pins and maximum distance.

//Ultrasonic ultrasonic(SONIC_PIN, 5); // (Trig PIN,Echo PIN)

struct GEO {

     int x;

     int y;

     int grad;

};

char strbuf[40];

GEO geo_data;
```

```
decode_results results;
uint32_t ms, ms1 = 0;
bool led_stat = false;
void setup() {
     Serial.begin(9600);
     Serial1.begin(9600);
     irrecv.enableIRIn();
     servo.attach(SERVO_PIN);
     motor.attach(MOTOR_PIN);
     pinMode(START, INPUT_PULLUP);
     digitalWrite(START,HIGH);
     pinMode(HC12_SetupPin, OUTPUT);
     digitalWrite(HC12_SetupPin,HIGH);
     pinMode(LED_PIN, OUTPUT);
     digitalWrite(LED_PIN, HIGH);
     pinMode(SAUND_PIN, OUTPUT);
     digitalWrite(SAUND_PIN, LOW);
     //digitalWrite(SAUND_PIN, HIGH);
     delay(500);
     set_transmiter_chanel(GEO_CHANEL);
     servo.write(90);
     motor.write(90);
     while (!digitalRead(START)) {
     read_geo_data();
     Serial.println(analogRead(LINE_PIN));

     }
```

```
     cheks();
     while (1);
}
// the loop function runs over and over again until power down
or reset
void loop() {
     read_geo_data();

     if (geo_data.grad > 270) {
     servo.write(80);
     }
     if (geo_data.grad < 270) {
     servo.write(100);
     }



     motorF(110);
     delay(200);
     motorF(100);
}
void IR_read() {
     if (irrecv.decode(&results)) {
     Serial.println(results.value, HEX);
     switch (results.value) {
     case SIGNAL_FORWARD:
          Serial.println("Forward!");
          break;
```

```
      case SIGNAL_LEFT:
            Serial.println("Left!");
            break;

      case SIGNAL_RIGHT:
            Serial.println("Right!");
            break;

      case SIGNAL_STOP:
            Serial.println("Stop!");
            break;

      default:
            Serial.print("Unknown signal: ");
            Serial.print(results.value, HEX);
            Serial.println("!");
      }
      irrecv.resume(); // Receive the next value
      }
}
void motorS() {
      //Serial.print(motor.read());
      if (motor.read() > 90) {
      motor.write(40);
      }
      if (motor.read() < 90)
```

```
      {
      //   motor.write(140);
      }
      delay(150);
      motor.write(90);
      delay(150);
}
void motorF(int speed) {
      motor.write(speed);

}
void motorB(int speed) {
      if (motor.read() > 90) {
      motorS();
      }
      motor.write(speed);
}

void read_geo_data() {
      String str;
      //str = "rer";
      while (1)
      {
      if (Serial1.available() > 0) {
            str = Serial1.readStringUntil('\n');
            //str = "00;1019;0609;192";
            if (str.substring(0, 1) == "22") {
```

```
                offset = str.substring(3, 7).toInt();
            }
            else {
                geo_data.x = str.substring(3, 7).toInt();
                geo_data.y = str.substring(8, 12).toInt() +
(offset*OFFSET_IN_STEP);
                geo_data.grad = str.substring(13, 16).toInt();
            }
            Serial.println(str);
            return;
        }
        }
}

void set_transmiter_chanel(char* set_chanel) {

    digitalWrite(HC12_SetupPin, LOW);
    delay(50);
    Send_command(set_chanel);
    digitalWrite(HC12_SetupPin, HIGH);

}

void Send_command(char* ATcommand) {
    String str;
    Serial1.println(ATcommand);
    Serial.println(ATcommand);
    delay(200);
```

```
     if (Serial1.available() > 0)
     {
     str = Serial1.readStringUntil('\n');// LF
     Serial.println(str);
     }
     delay(100);
}
int Distanse() {
  pinMode(SONIC_PIN, OUTPUT); //Ультразвук

  unsigned int impulseTime = 0;
  digitalWrite(SONIC_PIN, HIGH);
  /* Подаем импульс на вход trig дальномера */
  delayMicroseconds(10); // равный 10 микросекундам
  digitalWrite(SONIC_PIN, LOW); // Отключаем
     pinMode(SONIC_PIN, INPUT); //Ультразвук
  impulseTime = pulseIn(SONIC_PIN, HIGH); // Замеряем длину
импульса
//Serial.print(impulseTime);
  return  impulseTime / 58; // Пересчитываем в сантиметры

}
void cheks() {

     motorF(105);
     delay(1000);
     motorF(100);
     //Serial.println("F");
```

```
      while (analogRead(LINE_PIN) > 500);
      //Serial.println("S");
      //motorS();

      motorF(105);
      delay(500);
      motorF(100);
      while (analogRead(LINE_PIN) > 500)
      {
      ms = millis();
      // Событие срабатывающее каждые 500 мс
      if ((ms - ms1) > 200 || ms < ms1) {
            ms1 = ms;
            // Инвертируем светодиод
            digitalWrite(LED_PIN, led_stat);
            led_stat = !led_stat;
      }
      }
      digitalWrite(LED_PIN, HIGH);
      motorS();
      digitalWrite(SAUND_PIN, HIGH);
      delay(500);
      digitalWrite(SAUND_PIN, LOW);

}
```

Аэронет

Код программы на языке C++, обеспечивающий решение задач

подтрека:

Copter01.ino

```
#include <Servo.h>
#include <Ultrasonic.h>

Servo Roll;
Servo Pitch;
Servo Throt;
Servo Yaw;

Ultrasonic sForward(11, 12);

void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);
  Roll.attach(3, 1000, 2000);
  Pitch.attach(5, 1000, 2000);
  Throt.attach(6, 900, 2000);
  Yaw.attach(9, 1000, 2000);
  delay(6000);

  while(!digitalRead(2))
  {
    Serial.println(sForward.Ranging(CM));
    delay(100);
  }
  Throt.writeMicroseconds(900);
```

```
  Roll.writeMicroseconds(1500);
  Pitch.writeMicroseconds(1500);
  Yaw.writeMicroseconds(2000);
  delay(4000);
  Yaw.writeMicroseconds(1900);
  delay(100);
  Yaw.writeMicroseconds(1800);
  delay(100);
  Yaw.writeMicroseconds(1700);
  delay(100);
  Yaw.writeMicroseconds(1600);
  delay(100);
  Yaw.writeMicroseconds(1500);
  delay(100);

}

void loop()
{
  Throt.writeMicroseconds(1000);
  delay(1000);
  Throt.writeMicroseconds(1100);
  delay(1000);
  Throt.writeMicroseconds(1200);
  delay(1000);
  Throt.writeMicroseconds(1300);
  delay(1000);
```

```
  Throt.writeMicroseconds(1400);
  delay(1000);
  Throt.writeMicroseconds(1500);
  delay(2000);
  //Roll.writeMicroseconds(1500);
  //Pitch.writeMicroseconds(1500);
  //Yaw.writeMicroseconds(1500);

}
```

Copter02.ino

```
#include <Servo.h>
#include <NewPing.h>

Servo Roll;
Servo Pitch;
Servo Throt;
Servo Yaw;

NewPing sForward(4, 4, 100);
NewPing sBack(7, 7, 100);
NewPing sLeft(8, 8, 100);
NewPing sRight(10, 10, 100);
NewPing sDown(11, 11, 100);

void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);
```

```
  Roll.attach(3, 1000, 2000);
  Pitch.attach(5, 1000, 2000);
  Throt.attach(6, 900, 2000);
  Yaw.attach(9, 1000, 2000);
  delay(5000);

  while(!digitalRead(2))
  {
    delay(10);
  }

  Throt.writeMicroseconds(900);
  Roll.writeMicroseconds(1500);
  Pitch.writeMicroseconds(1500);
  Yaw.writeMicroseconds(2000);
  delay(4000);
  Yaw.writeMicroseconds(1900);
  delay(100);
  Yaw.writeMicroseconds(1800);
  delay(100);
  Yaw.writeMicroseconds(1700);
  delay(100);
  Yaw.writeMicroseconds(1600);
  delay(100);
  Yaw.writeMicroseconds(1500);
  delay(100);
}
```

```
void loop()
{
  Serial.println(sonar.ping_cm());
  delay(100);



}
```

Copter03.ino

```
#include <Servo.h>
#include <NewPing.h>

Servo Roll;
Servo Pitch;
Servo Throt;
Servo Yaw;

NewPing sForward(4, 4, 100);
NewPing sBack(7, 7, 100);
NewPing sLeft(8, 8, 100);
NewPing sRight(10, 10, 100);
NewPing sDown(11, 11, 100);

int rollVal = 1500;
int pitchVal = 1500;
int throtVal = 1000;
int yawVal = 2000;
```

```
void control(int roll, int pitch, int throt, int yaw)
{
  Roll.writeMicroseconds(roll);
  Pitch.writeMicroseconds(pitch);
  Throt.writeMicroseconds(throt);
  Yaw.writeMicroseconds(yaw);
}

void arming()
{
  rollVal = 1500;
  pitchVal = 1500;
  throtVal = 1000;
  yawVal = 2000;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(5000);
  yawVal = 1900;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1800;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1700;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1600;
  control(rollVal, pitchVal, throtVal, yawVal);
```

```
  delay(100);
  yawVal = 1500;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
}

void takeOff()
{
  rollVal = 1500;
  pitchVal = 1500;
  throtVal = 1000;
  yawVal = 1500;
  while(throtVal <= 1300)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);

  while(throtVal <= 1500)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);
```

```
  while(throtVal <= 1600)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);

  while(throtVal <= 1750)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);
}

void landing()
{
  rollVal = 1500;
  pitchVal = 1500;
  throtVal = 1500;
  yawVal = 1500;
  while(throtVal >= 1300)
  {
    throtVal -= 50;
```

```
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(500);
  }
  delay(1000);
}

void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);

  Roll.attach(3, 1000, 2000);
  Pitch.attach(5, 1000, 2000);
  Throt.attach(6, 1000, 2000);
  Yaw.attach(9, 1000, 2000);
  delay(3000);

  while(!digitalRead(2))
  {
    delay(10);
  }

  arming();
  takeOff();
  delay(1000);
  landing();
```

```
}

void loop()
{
  if (!digitalRead(2))
  {
    throtVal = 1000;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(10);
  }
  if (sDown.ping_cm() <= 5)
  {
    throtVal = 1000;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(10);
  }
  Serial.println(sDown.ping_cm());
  delay(100);



}
```

Copter04.ino

```
#include <Servo.h>
#include <NewPing.h>

Servo Roll;
Servo Pitch;
Servo Throt;
```

```
Servo Yaw;

NewPing sForward(4, 4, 100);
NewPing sBack(7, 7, 100);
NewPing sLeft(8, 8, 100);
NewPing sRight(10, 10, 100);
NewPing sDown(11, 11, 100);

int rollVal = 1500;
int pitchVal = 1500;
int throtVal = 1000;
int yawVal = 2000;

#define rollMid 1460
#define pitchMid 1460
#define throtMid 1950
#define yawMid 1500

#define throtMax 1950

#define toWall 50
#define toFlour 70

void control(int roll, int pitch, int throt, int yaw)
{
  Roll.writeMicroseconds(roll);
  Pitch.writeMicroseconds(pitch);
```

```
  Throt.writeMicroseconds(throt);
  Yaw.writeMicroseconds(yaw);
}

void arming()
{
  Serial.println("Arming");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = 1000;
  yawVal = 2000;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(5000);
  yawVal = 1900;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1800;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1700;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1600;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1500;
  control(rollVal, pitchVal, throtVal, yawVal);
```

```
  delay(100);
}

void takeOff()
{
  Serial.println("Take Off start");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = 1000;
  yawVal = yawMid;
  while(throtVal <= 1300)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);

  while(throtVal <= 1500)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);

  while(throtVal <= 1600)
```

```
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);

  while(throtVal <= 2000)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(700);

  while(throtVal > throtMid)
  {
    throtVal -= 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1500);
  Serial.println("Take Off end");

}

void landing()
```

```
{
  Serial.println("Landing");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = throtMid;
  yawVal = yawMid;
  while(sDown.ping_cm() >= 5)
  {
    while(throtVal > 1250)
    {
      throtVal -= 50;
      control(rollVal, pitchVal, throtVal, yawVal);
      delay(500);
    }
    delay(100);
  }

  throtVal = 1200;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  throtVal = 1100;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  throtVal = 1000;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  Serial.println("End");
```

```
  while (1)
  {
    delay(100);

  }
}

void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);

  Roll.attach(3, 1000, 2000);
  Pitch.attach(5, 1000, 2000);
  Throt.attach(6, 1000, 2000);
  Yaw.attach(9, 1000, 2000);
  delay(3000);

  while(!digitalRead(2))
  {
    delay(10);
  }

  arming();
  takeOff();
}
```

```
int t = 0;
# define delta 75
void loop()
{
  if (!digitalRead(2))
  {
    throtVal = 1000;
  }
  if (t >= 30000)
  {
    landing();
  }

  //ВЫСОТА
  if (sDown.ping_cm() <= toFlour - 10)
  {
    throtVal += delta;
    throtVal = constrain(throtVal, 1200, throtMax);
  }
  if (sDown.ping_cm() >= toFlour + 10 or sDown.ping_cm() == 0)
  {
    throtVal -= delta;
    throtVal = constrain(throtVal, 1200, throtMax);
  }

  //ЛЕВО ПРАВО
  if (sLeft.ping_cm() <= toWall and sLeft.ping_cm() != 0)
```

```
{
  rollVal += delta;
  rollVal = constrain(rollVal, 1000, 2000);
}
if (sRight.ping_cm() <= toWall and sRight.ping_cm() != 0)
{
  rollVal -= delta;
  rollVal = constrain(rollVal, 1000, 2000);
}

//ПЕРЕД ЗАД
if (sForward.ping_cm() <= toWall and sForward.ping_cm() != 0)
{
  pitchVal += delta;
  pitchVal = constrain(pitchVal, 1000, 2000);
}
if (sBack.ping_cm() <= toWall and sBack.ping_cm() != 0)
{
  pitchVal -= delta;
  pitchVal = constrain(pitchVal, 1000, 2000);
}

control(rollVal, pitchVal, throtVal, yawVal);
delay(30);
t += 30;
Serial.println(t);
Serial.println(throtVal);
```

```
}
```

Copter05.ino

```
#include <Servo.h>

#include <NewPing.h>


Servo Roll;

Servo Pitch;

Servo Throt;

Servo Yaw;


NewPing sForward(4, 4, 100);

NewPing sBack(7, 7, 100);

NewPing sLeft(8, 8, 100);

NewPing sRight(10, 10, 100);

NewPing sDown(11, 11, 100);


int rollVal = 1500;

int pitchVal = 1500;

int throtVal = 1000;

int yawVal = 2000;


#define rollMid 1460

#define pitchMid 1450

#define throtMid 1950

#define yawMid 1500
```

```
#define throtMax 2000

#define toWall 50
#define toFlour 120

void control(int roll, int pitch, int throt, int yaw)
{
  Roll.writeMicroseconds(roll);
  Pitch.writeMicroseconds(pitch);
  Throt.writeMicroseconds(throt);
  Yaw.writeMicroseconds(yaw);
}

void arming()
{
  Serial.println("Arming");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = 1000;
  yawVal = 2000;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(5000);
  yawVal = 1900;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1800;
  control(rollVal, pitchVal, throtVal, yawVal);
```

```
  delay(100);
  yawVal = 1700;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1600;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
  yawVal = 1500;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
}

void takeOff()
{
  Serial.println("Take Off start");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = 1000;
  yawVal = yawMid;
  while(throtVal <= 1300)
  {
    throtVal += 50;
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);
```

```
while(throtVal <= 1500)
{
  throtVal += 50;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
}
delay(1000);

while(throtVal <= 1600)
{
  throtVal += 50;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
}
delay(1000);

while(throtVal <= 2000)
{
  throtVal += 50;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(100);
}
delay(700);

while(throtVal > throtMid)
{
  throtVal -= 50;
```

```
    control(rollVal, pitchVal, throtVal, yawVal);
    delay(100);
  }
  delay(1000);
  Serial.println("Take Off end");

}

void forward()
{
  throtVal = 1950;
}

void landing()
{
  Serial.println("Landing");
  rollVal = rollMid;
  pitchVal = pitchMid;
  throtVal = throtMid;
  yawVal = yawMid;
  while(sDown.ping_cm() >= 5)
  {
    while(throtVal > 1250)
    {
      throtVal -= 50;
      control(rollVal, pitchVal, throtVal, yawVal);
      delay(500);
```

```
    }
    delay(100);
  }

  throtVal = 1200;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  throtVal = 1100;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  throtVal = 1000;
  control(rollVal, pitchVal, throtVal, yawVal);
  delay(500);
  Serial.println("End");
  while (1)
  {
    delay(100);

  }
}

void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);

  Roll.attach(3, 1000, 2000);
```

```
  Pitch.attach(5, 1000, 2000);
  Throt.attach(6, 1000, 2000);
  Yaw.attach(9, 1000, 2000);
  delay(3000);

  while(!digitalRead(2))
  {
    delay(10);
  }

  arming();
  takeOff();
}

int t = 0;
# define delta 75
void loop()
{
  if (!digitalRead(2))
  {
    throtVal = 1000;
  }
  if (t >= 5000)
  {
    landing();
  }
```

```
 //ВЫСОТА
 if (sDown.ping_cm() <= toFlour - 10)
 {
   throtVal += delta;
   throtVal = constrain(throtVal, 1200, throtMax);
 }
 if (sDown.ping_cm() >= toFlour + 10 or sDown.ping_cm() == 0)
 {
   throtVal -= delta;
   throtVal = constrain(throtVal, 1200, throtMax);
 }

 /*//ЛЕВО ПРАВО
 if (sLeft.ping_cm() <= toWall and sLeft.ping_cm() != 0)
 {
   rollVal += delta;
   rollVal = constrain(rollVal, 1000, 2000);
 }
 if (sRight.ping_cm() <= toWall and sRight.ping_cm() != 0)
 {
   rollVal -= delta;
   rollVal = constrain(rollVal, 1000, 2000);
 }*/

/* //ПЕРЕД ЗАД
 if (sForward.ping_cm() <= toWall and sForward.ping_cm() != 0)
 {
```

```
    pitchVal += delta;
    pitchVal = constrain(pitchVal, 1000, 2000);
  }
  if (sBack.ping_cm() <= toWall and sBack.ping_cm() != 0)
  {
    pitchVal -= delta;
    pitchVal = constrain(pitchVal, 1000, 2000);
  }*/
  pitchVal = 1700;

  control(rollVal, pitchVal, throtVal, yawVal);
  delay(30);
  t += 30;
  Serial.println(t);
  Serial.println(throtVal);
}
```

Спейснет

Код программы на языке C++, обеспечивающий решение задач подтрека:

SputnikProg.ino

```
#define STEP_PIN 10
#define DIR_PIN 16
#define POWER_ENABLE_PIN 14
#define END_SWITCH1 3
#define END_SWITCH2 2
#define HC12_SetupPin 4
#define LEFT_DIR 0
#define RIGHT_DIR 1
```

```
#define GEO_CHANEL "AT+C056"
#define LED1 8
#define LED2 9

#define OFFSET_IN_STEP 100
#define STEP_IN_ROTATION 400
struct GEO {
  int x;
  int y;
  int grad;
};

GEO geo_data;
const int volt_pin = A0;
float Voltage;
int dir, rotation,offset;
long steps, i;
String str;
  char strbuf[15];
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  Serial1.begin(9600);
  pinMode(STEP_PIN, OUTPUT);
  pinMode(DIR_PIN, OUTPUT);
  pinMode(POWER_ENABLE_PIN, OUTPUT);
  pinMode(LED1, OUTPUT);
```

```
  pinMode(LED2, OUTPUT);
  pinMode(HC12_SetupPin,OUTPUT);
  digitalWrite(POWER_ENABLE_PIN, HIGH);
  digitalWrite(LED1, HIGH);
  digitalWrite(LED2, HIGH);
  delay(1000);
  digitalWrite(LED1, LOW);
  digitalWrite(LED2, LOW);
  Voltage = analogRead(volt_pin);

if(Voltage < 480 ){ // мониторинг напряжения
  while(1){

  digitalWrite(LED2, HIGH);
  delay(1000);

  digitalWrite(LED2, LOW);
  delay(1000);
  }
  }

  set_transmiter_chanel(GEO_CHANEL);
    move(RIGHT_DIR,10);
    offset = 0;
}

void loop() {
```

```
  // put your main code here, to run repeatedly:
 read_geo_data();
 if(geo_data.y < 350 && geo_data.y > 10){
  move(LEFT_DIR,1);
  Serial.println("left");
  offset++;
  }
   if(geo_data.y > 700 && geo_data.y > 10 ){
  move(RIGHT_DIR,1);
  Serial.println("right");
  offset--;
  }

sprintf(strbuf,"22;%04d",offset);
Serial1.println(strbuf);
Serial.println(strbuf);
}

void move(int dir, unsigned int rotation) {

  digitalWrite(
    POWER_ENABLE_PIN, LOW);
  digitalWrite(DIR_PIN, dir);

  steps = rotation * STEP_IN_ROTATION;

  doSteps(steps);
```

```
  digitalWrite(POWER_ENABLE_PIN, HIGH);

}

boolean isEndSwitch() {

  if (digitalRead(END_SWITCH1) == 1) {
    Serial1.println("END_SWITCH1 (Start)");
    rollBack(RIGHT_DIR);
    return true;
  }

  if (digitalRead(END_SWITCH2) == 1) {
    Serial1.println("END_SWITCH2 (Finish)");
    rollBack(LEFT_DIR);
    return true;
  }

  return false;
}

boolean isStopInSerial() {

  if (Serial1.available() > 0) {
    if (Serial1.readStringUntil('\n').toInt() == 0) {
      return true;
```

```
    }
  }

  return false;

}

void rollBack(int dir) {

  digitalWrite(DIR_PIN, dir);
  for (i = 0; i <= 100; i++) {
    doStep();
  }
}

void doSteps(long steps) {

  for (i = 0; i <= steps; i++) {

    if (isEndSwitch()) {
      return;
    }

    if (isStopInSerial()) {
      return;
    }
```

```
    doStep();

  }

  Serial1.println("STOP");

}

void doStep() {

  digitalWrite(STEP_PIN, HIGH);
  delayMicroseconds(500);
  digitalWrite(STEP_PIN, LOW);
  delayMicroseconds(500);

}
void set_transmiter_chanel(String set_chanel) {

  digitalWrite(HC12_SetupPin, LOW);
  delay(50);
  Send_command(set_chanel);
  digitalWrite(HC12_SetupPin, HIGH);
 delay(100);
}

void Send_command(String ATcommand) {
```

```
  Serial1.println (ATcommand);
  Serial.println (ATcommand);
  delay(100);
  if (Serial1.available() > 0)
  {
    str = Serial1.readStringUntil('\n');// LF
    Serial.println (str);
  }
}
GEO read_geo_data() {

while(1){
    if (Serial1.available() > 0) {

      str = Serial1.readStringUntil('\n');
      //str = "00;1019;0609;192";
      Serial.println(str);

      geo_data.x    = str.substring(3, 7).toInt();
      geo_data.y    = str.substring(8, 12).toInt();
      geo_data.grad = str.substring(13, 16).toInt();

      return geo_data;
    }
  }
}
```