PRESENTATION 7 · LEARNING WITH C

One of each

Iron, silver and gold, and a robot that counts what it collects using variables.

TheBotCup 2026 · AiBotCup Simulator



RECAP · PRESENTATION 6

Four branches found all the iron

IronLeft
dark on the left → Collect

IronRight
dark on the right → Collect

Ahead
wall close → turn left

Forward
otherwise drive

That robot collected **everything** it found. Today that is not good enough: it must **choose**.

PART 1

The mission: Session 7

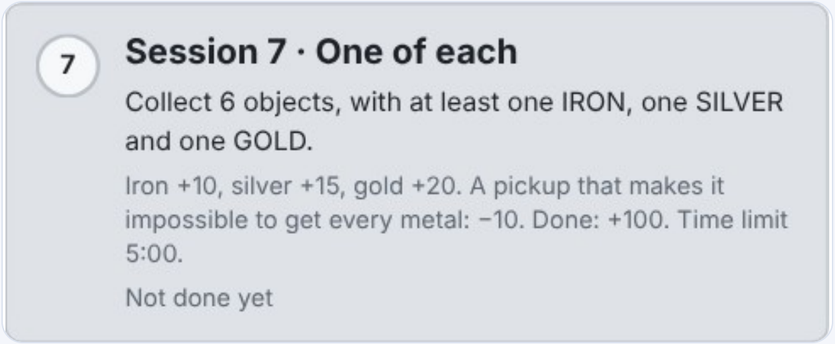
Six objects, every metal at least once

SESSION 7 · ONE OF EACH

Collect 6, with at least one of each metal

What happens	Points
Iron · silver · gold	+10 · +15 · +20
All 6 done, every metal	+100
A pickup that makes it impossible	−10, refused

Time limit **5:00**. The robot holds at most **6** objects.





THE FIELD

Three metals, mixed up

- **7 iron** · black
- **6 silver** · grey
- **6 gold** · yellow

Same field as Session 6: block in the middle, START at the bottom.

COLOUR SENSORS · FROM PRESENTATION 6

Tell the three metals apart

Metal	R	G	B
Iron	0 – 60	0 – 60	0 – 60
Silver	90 – 135	92 – 137	98 – 142
Gold	195 – 255	135 – 200	0 – 80
Floor	about 226	about 232	about 238

These ranges come from the simulator’s own tip. Floor never fits any of them.

PART 2

The main problem: counting

How many do I have already?

THE PROBLEM

Six places, and they can fill up wrong



Gold is still missing and only **one place** is left. If the next object is not gold, the mission becomes impossible: the simulator **refuses it, −10**.

The robot must know **how many of each** it already has.

WE TESTED IT · NO COUNTING

“Collect everything” lost points

What it did

Picked up 3 iron and 2 silver first. Then **one pickup was refused** because gold was still missing.

Score

It finished, but with **170** instead of 180: a −10 for the refused pickup.

On another field, or with other luck, it could be worse. The robot needs a **memory**.

THE IDEA

To count, the robot needs a number it can remember and change.

Sensors tell what is happening **now**. A counter remembers what happened **before**. In programming that is called a **variable**.

PART 3

Variables

The robot’s memory

WHAT IS A VARIABLE?

A labelled box that holds one number

It has a **name** (Iron) and a **value** (0, 1, 2...).

The program can **read** the value and **change** it.

It **keeps** its value every 60 ms tick, until you change it.



HOW IT WORKS · THE COUNTER

Read it in a condition, change it in an action

READ · in a condition

```
Iron < 2
```

True while Iron is 0 or 1.

CHANGE · in a branch

```
Iron = Iron + 1;
```

“New Iron is old Iron plus one.”

Iron: 0 → 1 → 2 … then **Iron < 2** is false: no more iron.

MAKE VARIABLES IN C

One line at the very top

```
1  // Session 7 · One of each
2
3  int Iron = 0; int Silver = 0; int Gold = 0;  // our counters
```

Outside Game1(): this line runs **once**, when the program is loaded.

Start at 0: no metal collected yet.

Names: letters, digits and _, starting with a letter. Not a sensor name.

USE VARIABLES IN A BRANCH

&& Iron < 2, then Iron = Iron + 1

```
24  void Game1() {
25      LED_1 = 0;
26      if (isIron(CSLeft_R, CSLeft_G, CSLeft_B) && Iron < 2) {                 // IronLeft
27          collect(); Iron = Iron + 1;
28      } else if (isIron(CSRight_R, CSRight_G, CSRight_B) && Iron < 2) {       // IronRight
29          collect(); Iron = Iron + 1;
```

Read: **&& Iron < 2**: the sensors say iron && we still want iron.

Change: **Iron = Iron + 1** right after **collect()**.

OUR RULE

Collect a metal only while its counter is below 2

2 + 2 + 2 = 6

Six objects can only happen as two of each, so there is **always one of each** and no pickup is ever refused.

PART 4

Step by step in C

Three counters, eight branches

STEP 1 · THE PLAN

Three counters, then 8 branches

Branch	Condition	Then	Counter
1 IronLeft	isIron(left) && Iron < 2	collect()	Iron + 1
2 IronRight	isIron(right) && Iron < 2	collect()	Iron + 1
3 SilverLeft	isSilver(left) && Silver < 2	collect()	Silver + 1
4 SilverRight	isSilver(right) && Silver < 2	collect()	Silver + 1
5 GoldLeft	isGold(left) && Gold < 2	collect()	Gold + 1
6 GoldRight	isGold(right) && Gold < 2	collect()	Gold + 1
7 Ahead	US_Front <= 20	−2 / 2, 700 ms	—
8 Forward	else	4.5 / 4.5	—

STEP 2 · LINES 5–15

Three functions that answer yes or no

```
 5  int isIron(int R, int G, int B) {
 6      return R <= 60 && G <= 60 && B <= 60;
 7  }
 8
 9  int isSilver(int R, int G, int B) {
10      return R >= 90 && R <= 135 && G >= 92 && G <= 137 && B >= 98 && B <= 142;
11  }
12
13  int isGold(int R, int G, int B) {
14      return R >= 195 && G >= 135 && G <= 200 && B <= 80;
15  }
```

return sends the answer back: true or false.

R, G, B: the three colour numbers we pass in, left or right.

Ranges from the colour table: iron dark, silver grey, gold yellow.

STEP 3 · LINES 17–22

collect(): the same as Presentation 6

```
17  void collect() {
18      WheelLeft = 0; WheelRight = 0;
19      LED_1 = 2;                              // flashing
20      LED_R = 255; LED_G = 0; LED_B = 0;      // red
21      Duration = 3200;                        // hold 3.2 seconds
22  }
```

Wheels 0: stop on the metal.

LED_1 = 2, red: the collect signal.

Duration = 3200: hold 3.2 s.

STEP 4 · LINES 24–29 AND 30–37

Six collect branches, one counter each

```
30      } else if (isSilver(CSLeft_R, CSLeft_G, CSLeft_B) && Silver < 2) {     // SilverLeft
31          collect(); Silver = Silver + 1;
32      } else if (isSilver(CSRight_R, CSRight_G, CSRight_B) && Silver < 2) {  // SilverRight
33          collect(); Silver = Silver + 1;
34      } else if (isGold(CSLeft_R, CSLeft_G, CSLeft_B) && Gold < 2) {         // GoldLeft
35          collect(); Gold = Gold + 1;
36      } else if (isGold(CSRight_R, CSRight_G, CSRight_B) && Gold < 2) {      // GoldRight
37          collect(); Gold = Gold + 1;
```

IronLeft, IronRight (lines 24–29): same counter, Iron.

Silver and **Gold**: same pattern, own counter.

LED_1 = 0 first: the LED is off unless we collect.

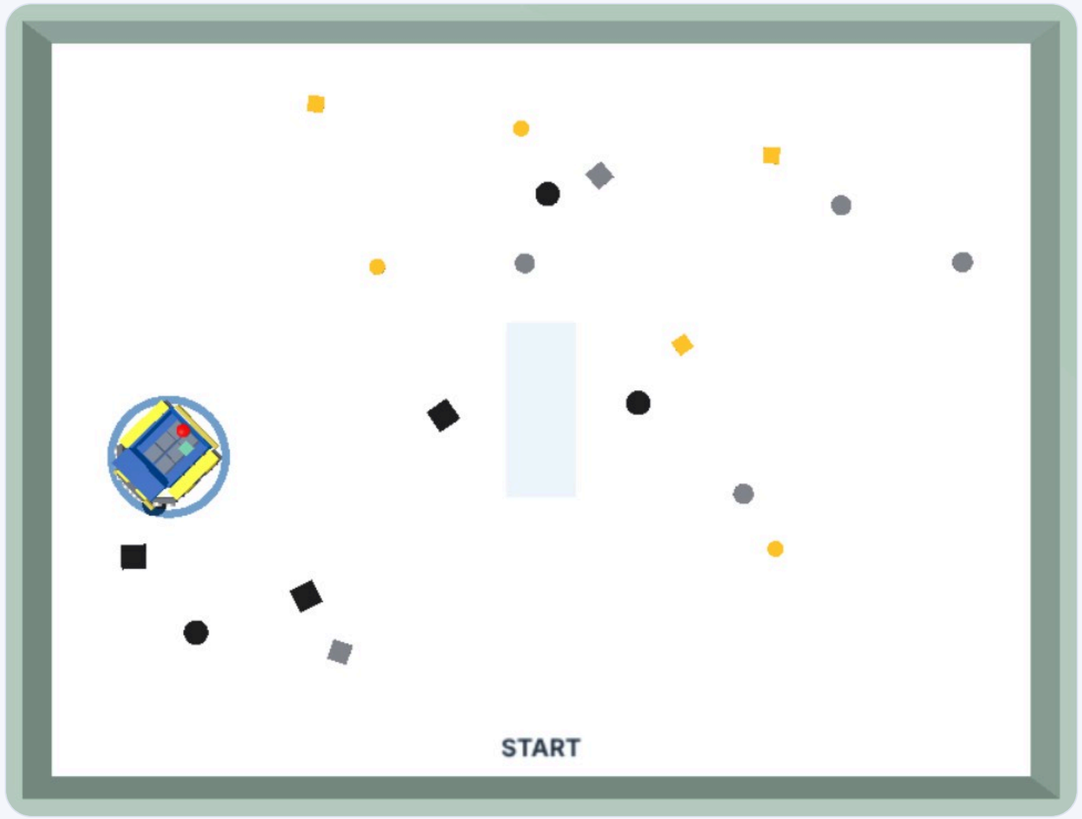
STEP 5 · LINES 38–44

Ahead and Forward, as in Presentation 6

```
38      } else if (US_Front <= 20) {                                    // Ahead
39          WheelLeft = -2; WheelRight = 2;
40          Duration = 700;
41      } else {                                                        // Forward
42          WheelLeft = 4.5; WheelRight = 4.5;
43      }
44  }
```

Collect branches stay on top.

A metal the robot no longer wants matches no branch above, so **Forward drives over it**.



STEP 7 · RUN

The first catch at 7.1 s

CSLeft reads **24, 22, 26**: isIron is true, and Iron is still 0.

IronLeft runs: collect(), then **Iron = 1**.

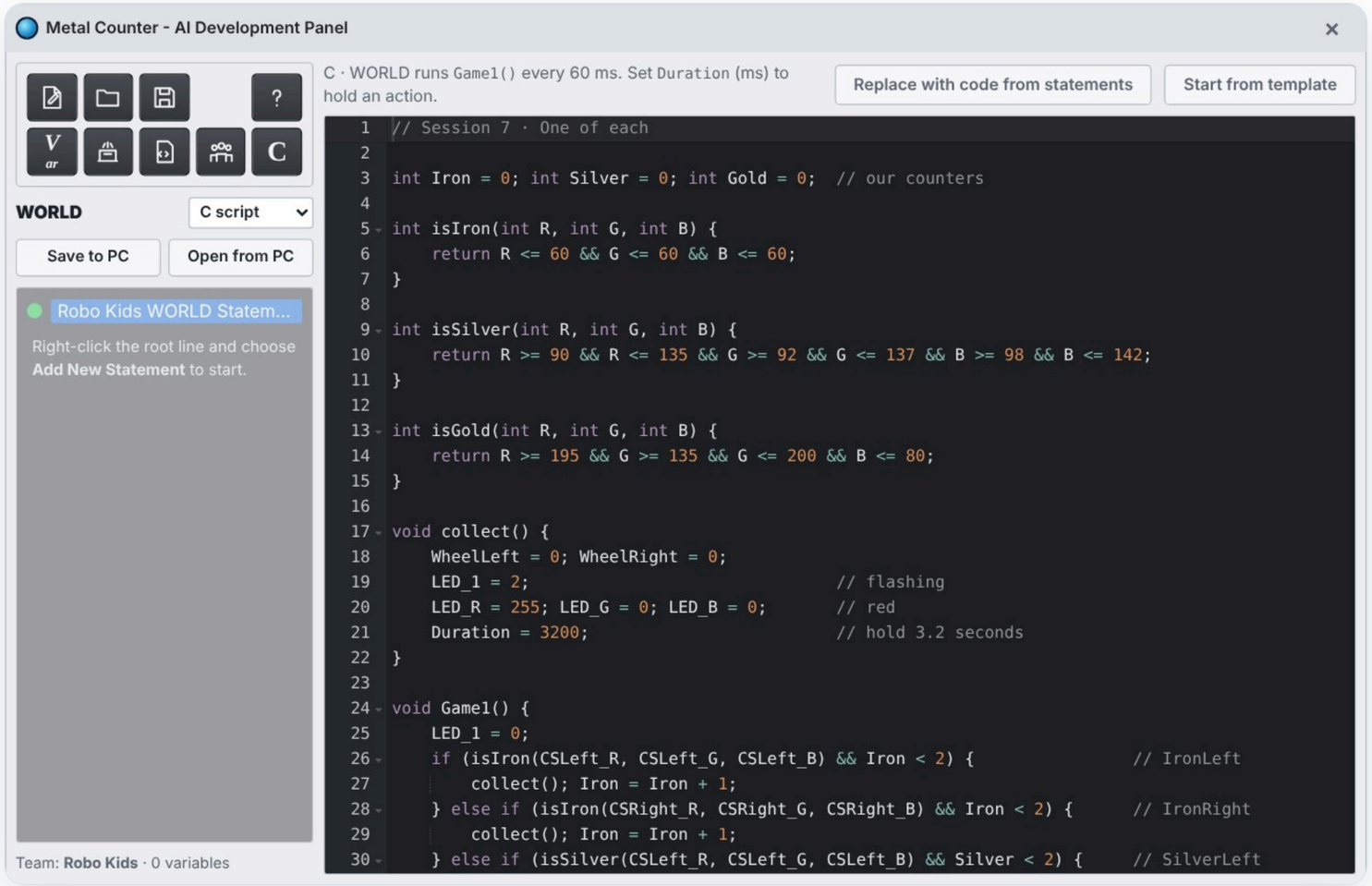
At the end the counters read **2, 2, 2**.

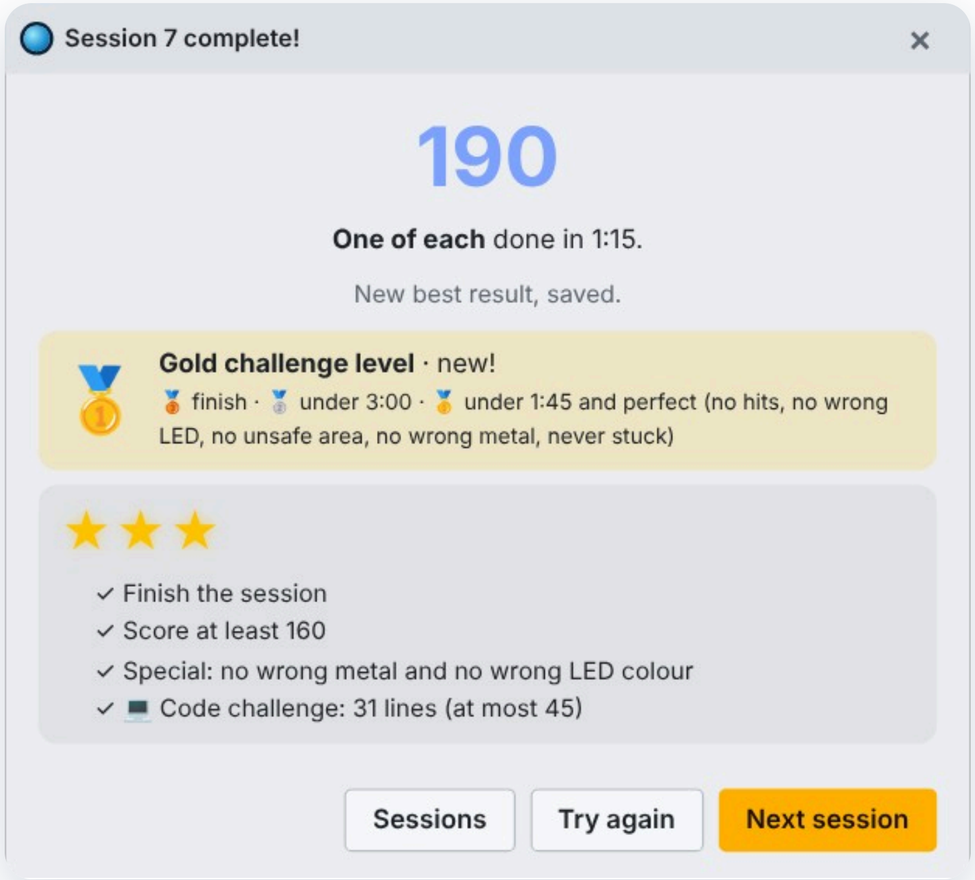
No pickup is refused: the counters stop at 2.

STEP 6 · BUILD AND LOAD

The whole program, built

1. WORLD menu: **C script**.
2. Type the program, name it **Metal Counter**.
3. Press **Build**, then **OK**.
4. Press **Load** on the BLUE side.





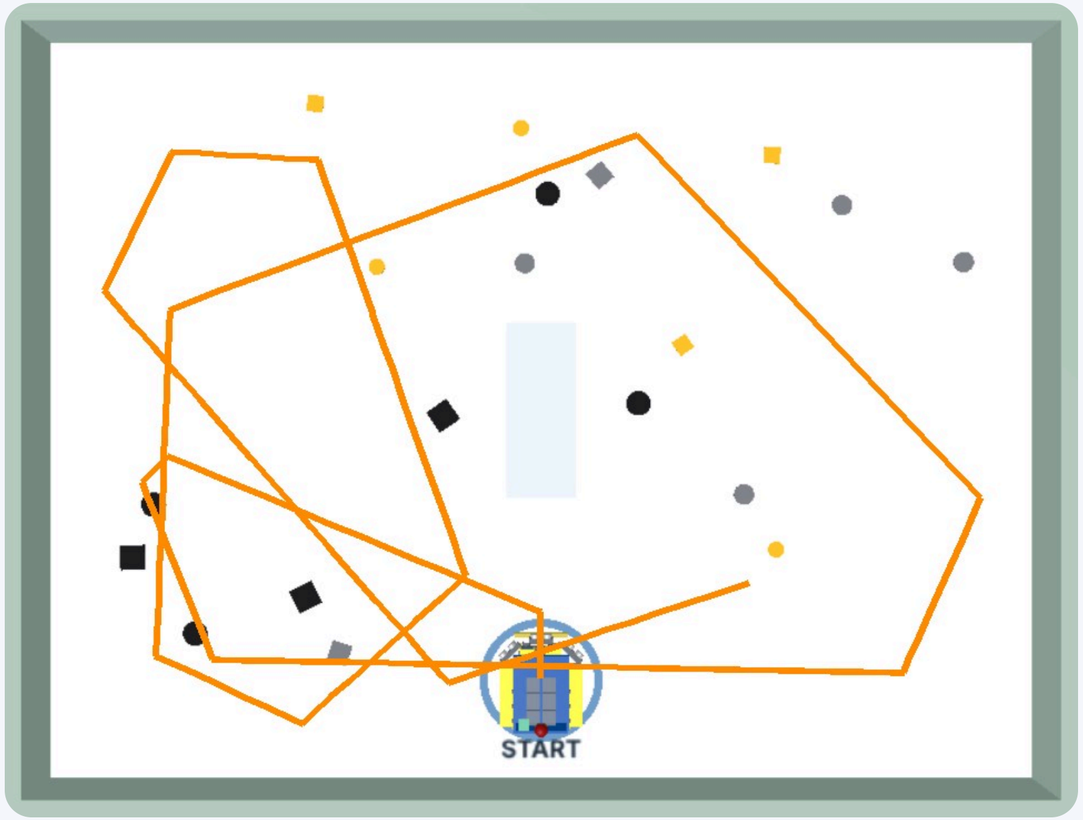
RESULT · TESTED

190 points in 1:15 · Gold

Score · 2×10 + 2×15 + 2×20 = 90, plus 100 = 190.

Medals · Silver: under 3:00 · Gold: under 1:45 and perfect.

Stars · no wrong metal · code challenge: 31 of at most 45 lines.



THE PATH · RECORDED

Two of each, then done

Order in our run: iron, silver, silver, iron, gold, gold.

Once a counter reaches 2, that metal is ignored.

The counters let the robot **choose**.

DID NOT WORK?

Check first, then tune carefully

What you see	What to do
Build error with a line number	; at the end of lines, { } matched, int before new variables
Counter never changes	**Iron = Iron + 1** inside the branch, after collect()
Counter is always 0 again	The counters must be at the top, **outside** Game1()
Collects a third of one metal	The **&& Iron < 2** part is missing
Never collects silver or gold	Check the ranges in isSilver and isGold
Old program still on the robot	Build again, then Load on BLUE

NEXT TIME

Presentation 8 · Two of each

Exactly two of every metal, and the simulator’s **own built-in counters**.