

# CODENAME 47



An interesting line maze solving event

## Introduction

Agent 47 a genetically-engineered assassin created from the recombinant DNA of five of the world's most dangerous criminals. The fact that the DNA came from multiple ethnicities allows 47 to blend in to a certain degree in most places in the world, or at least not look immediately suspicious and out-of-place. Agent47 is an assassin-for-hire, whose flawless record places him in high demand among the wealthy and elite.

**Dr. Otto Wolfgang Ort-Meyer** the creator of 47, a brilliant but dangerous individual. Ostracized by the scientific community for his radical theories on genetic manipulation, Ort-Meyer ran a sophisticated lab hidden beneath a Romanian asylum. He used 47 to assassinate all of his enemy and finally 47 was given another assignment to kill someone, only then he finds out that it was a setup. Ort Meyer wanted to use the last hit to kill 47 as a way of eliminating the evidence. 47 escapes the trap and heads down into the Asylum to find Ort-Meyer. At this point Ort-Meyer sends all the other clones to kill 47. He kills them all and shoots Ort-Meyer.

At Pragyam12 we bring to you an opportunity to witness the professionalism of the perfect assassin, 47.

## Problem statement

Build an autonomous bot that can traverse a line maze. On the 1<sup>st</sup> arena depicting the asylum the bot is also supposed to **read** a 4bit binary code written on a wall and **display** it at another point on the arena to open a security door.

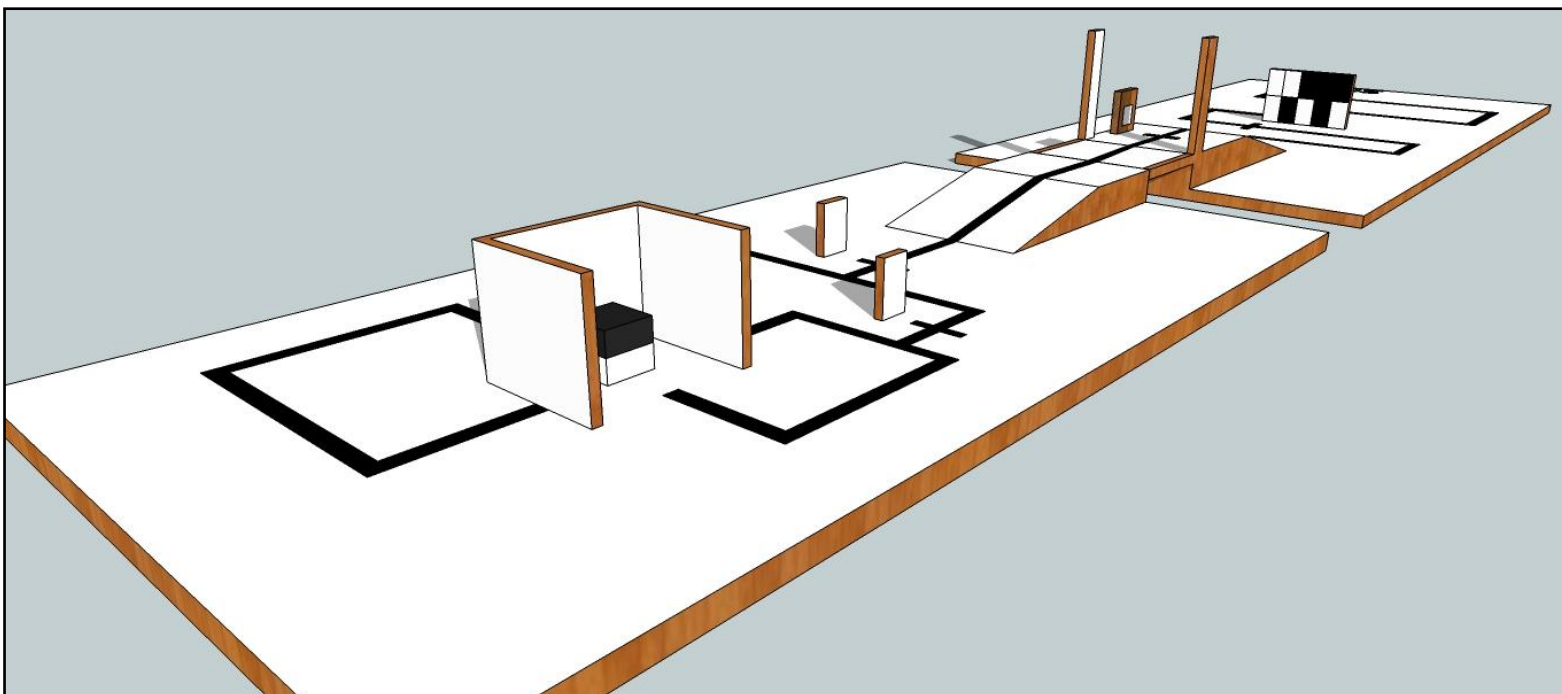
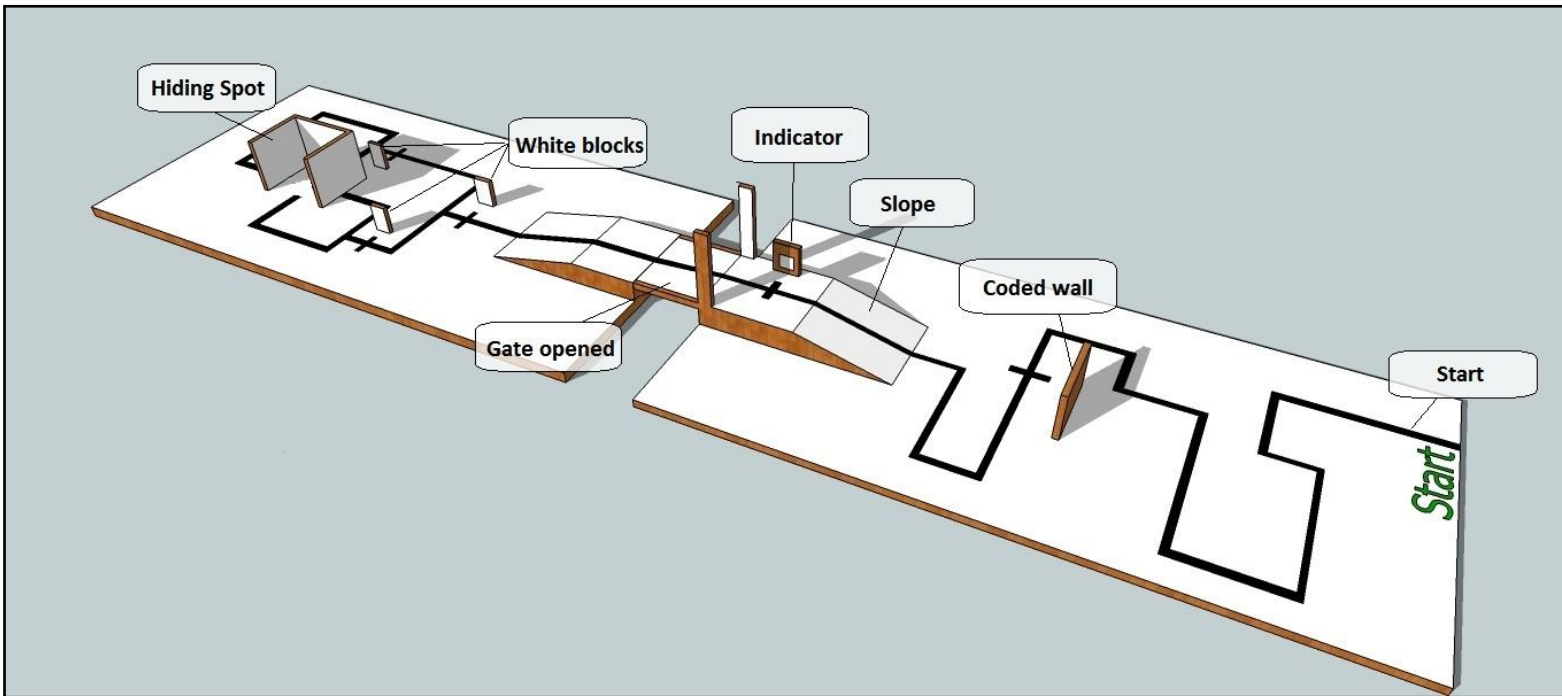
On the second arena depicting the guarded hidden lab, 47 is supposed to make his way to Dr. Otto's room, there are multiple ways to reach there but most of the areas are heavily guarded, the direction in which the bot should turn in order to avoid the guards is indicated by white blocks placed before the junctions.

## Arena specifications

The arena is divided into two parts Arena1 represents the Asylum and Arena2 represents the hidden lab where the target is hiding connected by a security door that can be raised and lowered.

1. Width of all lines: 3 cm.
2. All the lines are black, on white surface.
3. Dimension of wall:     height 120mm  
                                  length 200mm
  - a. The wall is placed near a straight portion of the track, 120mm away from it.
  - b. The wall is divided into five equal blocks (cells) as shown in the figure (2 rows x 5 columns) 60mm x 40mm.
  - c. The first column is white in color and is the start bit
  - d. From second column onwards the lower row indicates the change of bit using alternate black and white cells.
  - e. The code is on the upper row.
  - f. First cell represents the MSB (most significant bit) and the last cell represents LSB (least significant bit).
  - g. A black represents 1 while a white represents 0.
4. All the lines will be straight and the turns will be right angle turns.
5. There will be a gap of at least 20cm between any two consecutive branches/parallel tracks/arena edges.
6. Details of the slope
  - a. The slope angle will be 10 degrees.
  - b. The distance along the slope will be 400mm.
  - c. The length of the horizontal portion will be 300mm.
  - d. An intersection will be provided on the track to indicate the position of the security door lock.
  - e. The dimension of the intersection will be 100mm x 30mm, extending 35mm on each side of the track, the centre of the intersection placed 200mm from the top edge of the slope.

7. Arena 2 will also have 1 intersection before each junction.
8. All the intersections on the arena2 will also have the same dimension as that near the security door (see point 6.e)
  - a. White blocks (60mm width and 100mm high) will be placed in line to the intersection and 120mm away from the center of the track.
  - b. A white block on left/right determines that there is tight security on left/right track and bot should **not** turn left/right at the next junction.
  - c. White blocks on both the sides of the intersection indicate the bot should go straight at the next intersection.



## Bot specifications

- The robot should be completely autonomous.
- The robot should fit into a box of dimensions 20cm x 20cm x 20cm.
- The robot should be powered using batteries only, the power source will not be provided by the organizers.
- The maximum voltage between any two points on the robot should not exceed 12 volts.
- Hard coding of the bot at any point of time will lead to disqualification of team.
- Readymade sensor modules for line following and/or obstacle detection can be used.
- However if a team found using a readymade development board/ microcontroller boards, will not be allowed to participate in the competition.
- The robot directly or indirectly found damaging the arena will be disqualified immediately.

## RULES

### *General Instructions:*

- Maximum of 4 members per team. Participants from different branches/college can team up together.
- Participants have to bring their ID cards (issued by their college) they will be disqualified otherwise.

### *Event Instructions:*

- Each team will be given two trials.
- Teams will be provided calibration time (based on order of registration) before the event starts.
- All teams will have to submit their bots before the trial begins. Teams which arrive late at the venue will forfeit their first trial and will have to wait for the second trial.
- Once the bot is submitted, a team can make no changes to the hardware. However, you will be permitted to charge the batteries or make modifications to the program, between the two trials.
- The bot must be turned on (started) using only one switch. Using multiple switches will lead to disqualification.
- Time allotted for each trial will be 10 minutes.
- A team will be given a maximum of 3 restarts per trial, a team can ask for a restart only in the following cases
  - Technical malfunctioning.
  - The bot gets off the track.
  - The bot is unable to ascend the slope.
  - The bot is unable to show the correct code at the security gate.
  - The bot takes the wrong turn at the arena 2.
  - The bot hits either of the coded wall, the security door system or the white blocks.

## The game play (refer images.pdf )

The bot is supposed to start from the starting end of the Arena 1, read the code on the wall on the left marked by an intersection (**30 x 100mm**) (the intersection is placed starting with the wall), traverse the arena and finally display the code at the security door lock.

Once the code is successfully displayed the door will be lowered slowly by the organizers manually, an infra red indicator placed on the right will be automatically switched on after the security door is fully open, receiving a signal from the indicator, the bot is supposed to move further.

The participants can choose any method to display the code (LED, LCD etc.) at the intersection; however it is not supposed to display it before or after intersection.

The indicator will be a **4x4** array of IR LEDs starting **10mm** above the ground placed **120mm** away from the center of the track onto the right of the track.

Read points 8 and 9 on the arena specifications for details of the line maze in arena 2

Guided by the white blocks the bot is supposed to reach the main lab where the target is hiding, the target is indicated by a cube with top half white and bottom half black.

The target will be placed at a distance of **120mm** after the end of the track.

The bot has to stop before the target not touching it and sound a buzzer/continuously blink an LED indicating the assassination.

## JUDGING CRITERIA

- **20 points** will be reduced in case the bot is found to exceed the size constraint.
- **30 points** for reading and displaying the correct code at the door.
- **30 points** for reaching the slope and starting to climb it.
- Only in cases written above a team can **ask** for a **restart** with a loss of **20 points**.
- **10 point** is subtracted if the bot touches the coded wall, the security door system or the white blocks, a restart **may** or **may not** be asked. In case a restart is asked **20 extra points** will be subtracted.
- Each correct turn taken in Arena 2 will fetch **10 points** to the team.
- In case the bot hits the target **30 points** will be subtracted.
- **50 points** is awarded to a team on completion of the event.
- Each second saved out of 10mins (600 seconds) fetches **1 point** to the team.

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