# PIXELATE

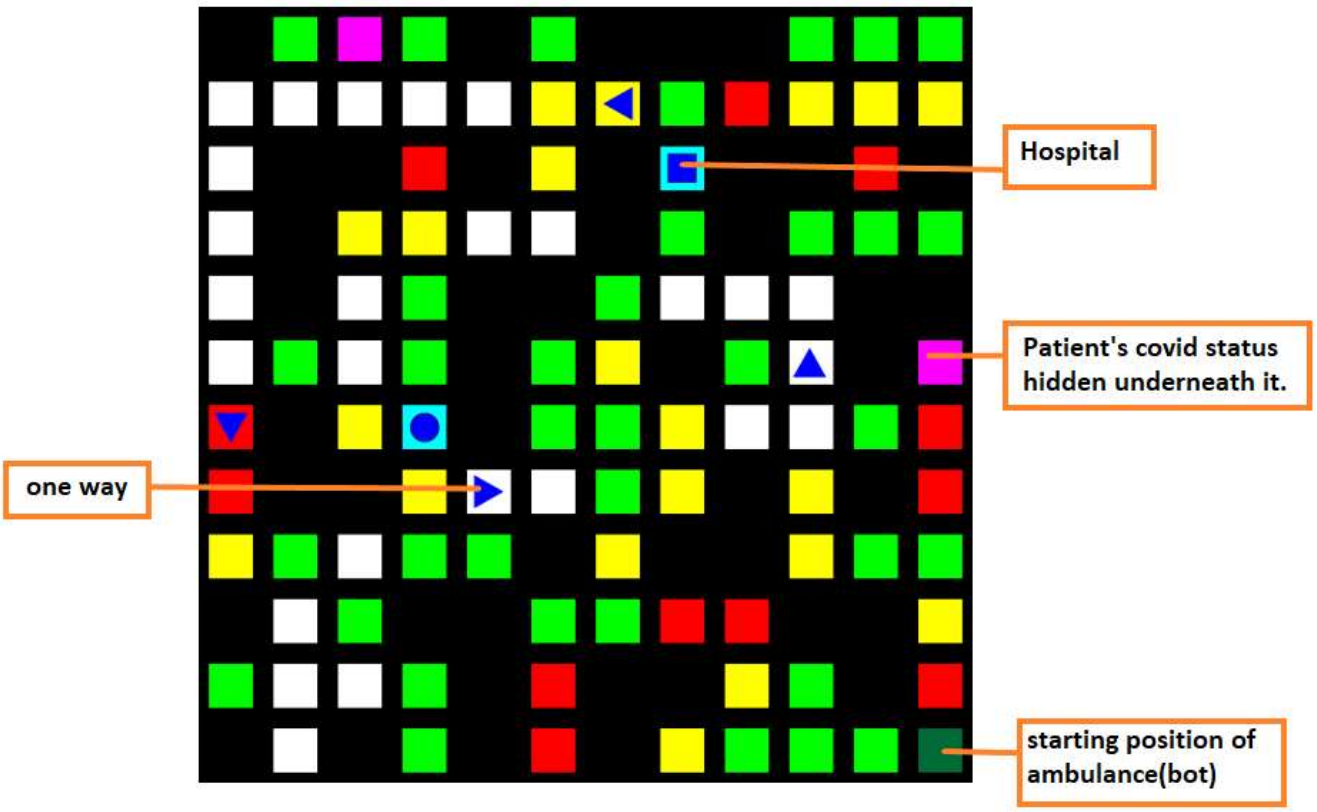
## TASK :

Every disease is a story. It has a beginning, middle and, hopefully, an end. Some illnesses are little more than anecdotes or riddles. Others are parables and allegories. A few grow into epics, containing a multitude of episodic tales, one leading on to another. The novel coronavirus, which is responsible for COVID-19, sounds like something out of science fiction.

It is impossible to ignore the widespread fear, disruption, unemployment and hardship that the coronavirus has unleashed on the world. The death toll is tragic and seems to be rising in a merciless curve.
Travel has been severely restricted. Most of us are quarantined, locked-down or subjected to curfews in an effort to slow the progress of this disease.
However the country, city, villages are medical departments and the police department stood in the front line to hold the virus at its slowest pace. The staff would go to any calls received from any end of the city to go check the person and join him at the hospital. For ambulances to reach the requirement increasing, it needed to be fast, so the solution is to avoid traffic and go to the destination as soon as possible.

The task now is to go to the patient location received from the source, identifying whether the patient is contacted with coronavirus which would spread rapidly in the society. So if the patient has Covid symptoms take the patient to a related hospital. Make sure you take a look at the traffic along the path so that patients can be collected and dropped at the hospital ASAP.

Now, Ambulance services seek the help of your amazing Image Processing skills.


Hospital
Patient's covid status hidden underneath it.
one way
starting position of ambulance(bot)

# ARENA DESCRIPTION :

The arena contains 12X12 square grids each of which contains following:

***Patient location:*** There are two locations. They are represented by pink colored tile. Under each pink color, blue square and blue circle are hidden representing the status of the patient (covid/ non-covid).

***Hospital:*** There are two hospitals. They are represented by blue square and blue circle shapes on light blue tiles, for each patient (covid/ non-covid)

***Heavy traffic:*** They are represented by red colored tiles.

***Intermediate traffic:*** They are represented by yellow colored tiles.

***Low traffic:*** They are represented by green colored tiles.

***No traffic:*** They are represented by white colored tiles.

***One-way:*** They are represented by blue triangle shapes on red/yellow/green/white tiles.

The bot(ambulance) has to start from the lowest right corner (dark green colored tile).

The bot has to end the task by delivering both the patients to their respective hospitals i.e., at blue circle or at blue square.

A video feed from the overhead camera will be provided to the team. The team's computer should autonomously instruct their bot throughout the arena in simulation world.

# GAMEPLAY:

## QUALIFYING ROUND:

- Complete the point 1 of the Game Procedure.
- There are no points for this round.

## FINAL ROUND:

- Carry out the full task as specified in the game procedure.

## GAME PROCEDURE:

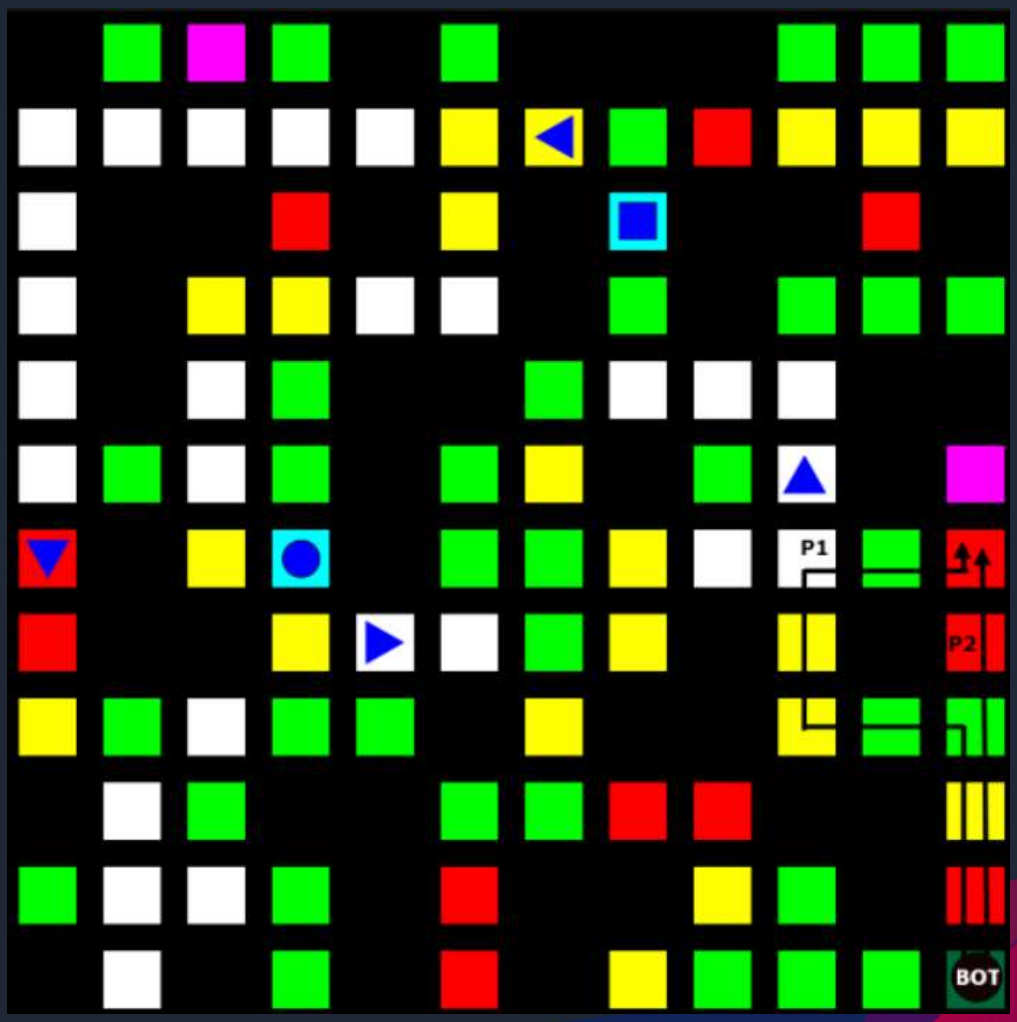
- The problem is divided into two tasks:
    1. Move the ambulance to the **patient locations** (pink tiles) in order to reveal the Covid status of the patients, i.e. the patient is having covid symptoms or not having covid symptoms, which are hidden underneath that location.
    2. Deliver the patients to their respective **hospital** following the rules described below.
- The arena has different traffic in different places represented by red, yellow, green, white tiles showing **heavy**, **intermediate**, **low**, **no** traffic respectively.
    - As red tiles are heavy traffic areas so in order to cross one red tile the bot (ambulance) takes **4** units of time.
    - The yellow tiles have slightly less traffic than red one hence the ambulance takes **3** units of time to cross each tile.
    - The green tiles have low traffic hence the ambulance moves fast and it takes **2** units of time to cross each tile.
    - As white tiles have no traffic at all hence the ambulance takes only **1** unit of time to cross each tile.
- As it is a matter of life and death for the patient, the bot (ambulance) needs to take as **minimum time** as possible so it needs to take a path with the lowest value of overall time taken.

- There are also **one-ways** (blue triangle shapes on red/yellow/green/white tiles) in the arena. The bot can only move in one direction on these tiles represented by the head of the triangular shapes.
- The bot(ambulance) has to start from lowest right corner (green tile)
- The bot first needs to move to the patient location (pink tile) following the above rule. The Covid status of that patient is hidden underneath it. This step will reveal the covid status of the patient which was earlier concealed.
    - The status symbol of the patient matches with the symbol of the respective hospital (blue square and blue circle on light blue tile).
- After knowing the status of the patient, the bot needs to deliver the patient to the respective hospital following the rule to take **'minimum overall time taken path'**.
- The bot needs to stop one node before the patient location in order to reveal the covid status. The path to the hospital should start from the patient location (pink tile) i.e. it should move through the pink tile.
- The bot should also stop one node before the hospital. The path to the next patient's location should also start from the hospital itself.
- The rule to take **'minimum overall time taken path'** has to be applied for every motion with keeping track of one-ways.

# EXAMPLES:

In the following pages few situations have been described by means of some examples in order to get a thorough understanding of the problem statement

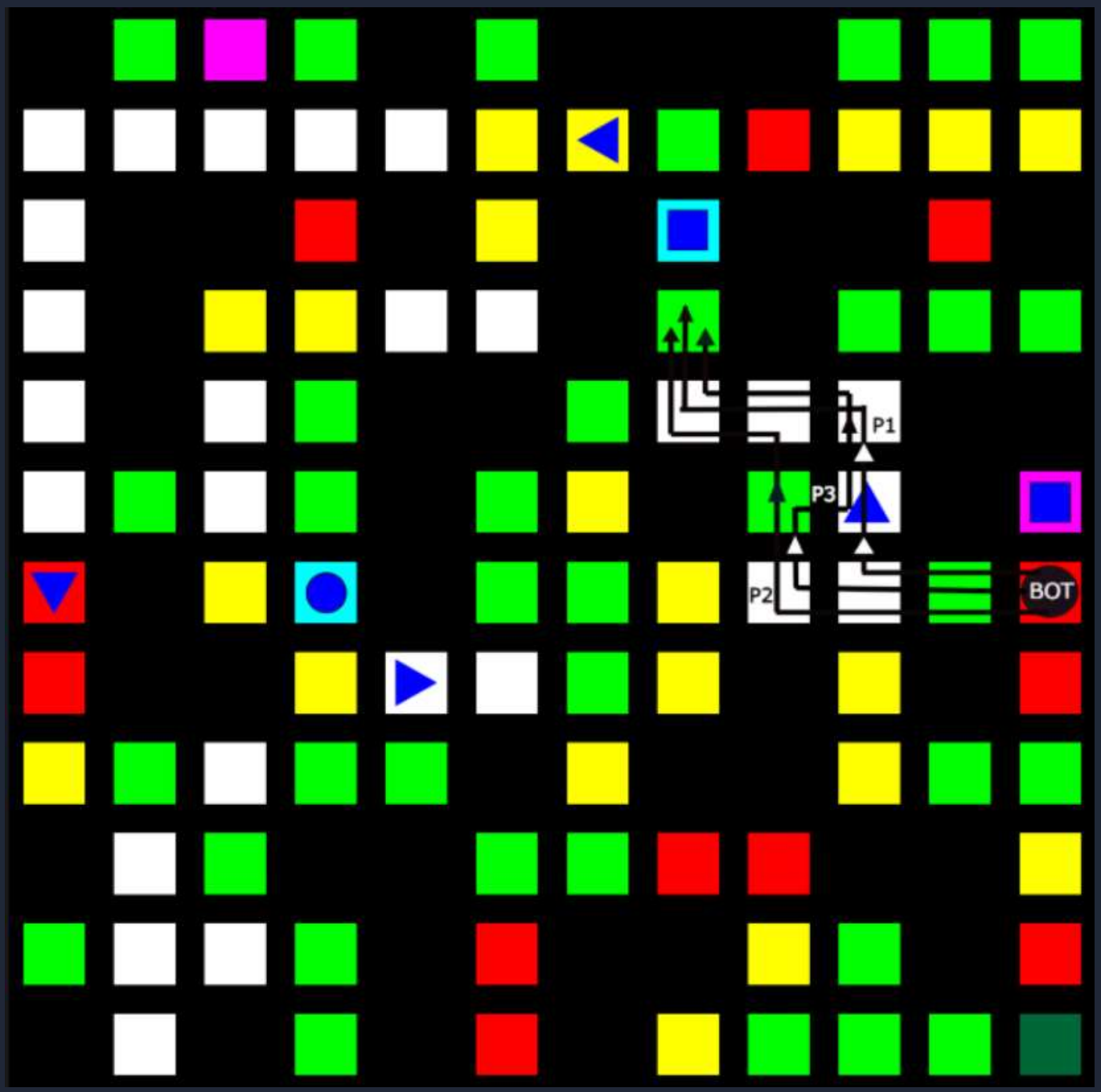
In this case, the bot is currently placed at the starting position i.e. *bottom right corner*. It has to reach the **red** box just before the **pink** square (*patient*) while traversing a path with **minimum cost**. In the image given below two such possible paths **P1** and **P2** are being considered. Now if the bot takes path **P1** then total cost will be (4+3+2+2+3+3+1+2 =) **20** while on the other hand if bot takes path **P2** then total cost will be (4+3+2+4+4 =) **17**. Therefore *P2 is a VALID* path among the two paths P1 and P2 considered below.



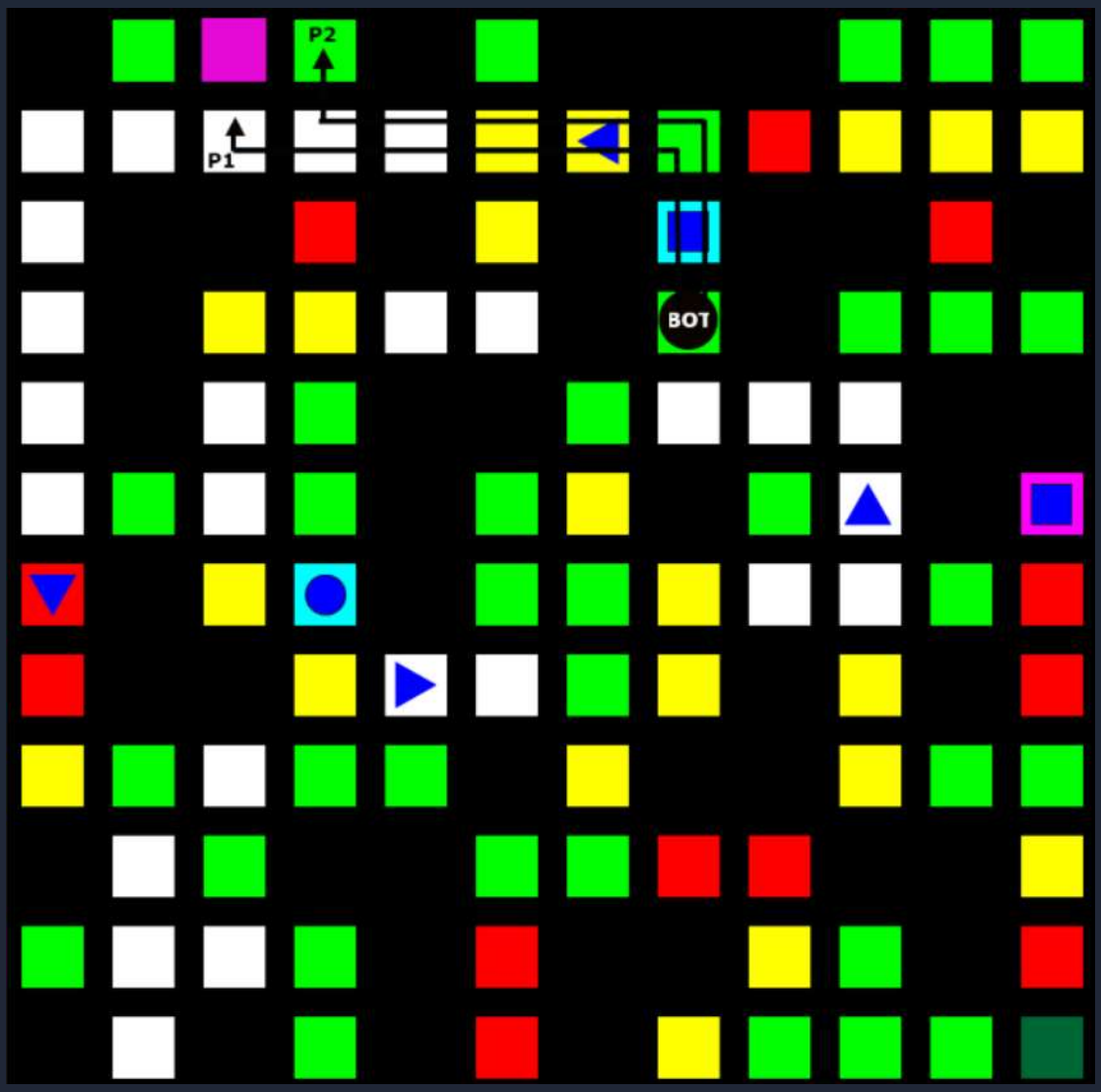
In the next iteration , the **shape** (*below the pink square*) **will be revealed**. According to the shape, bot has to travel to the **green** square just before the **blue** square (*hospital*) with the **same shape** as that of the revealed one. As shown below three paths **P1** , **P2** and **P3** are considered. If the bot takes path **P1**, then the total cost will be (2+1+1+1+1+1+2 =) **9** while on the other hand if the bot takes path **P2**, then the total cost will be given by (2+1+1+2+1+1+2 =) **10** whereas if the bot considers path **P3** then it has to bear a cost of (2+1+1+2+1+1+1+1+2 =) **12** . Therefore the more optimal path in this case is **P1** while paths **P2** and **P3** will be considered INVALID.

**NOTE** : As explained in the problem statement, **white square with blue triangle** denotes **ONE WAY** i.e. it can be approached only in a particular manner described below with help of some situations.

| Correct | Correct | Incorrect |
|---|---|---|


P1
P3
P2
BOT

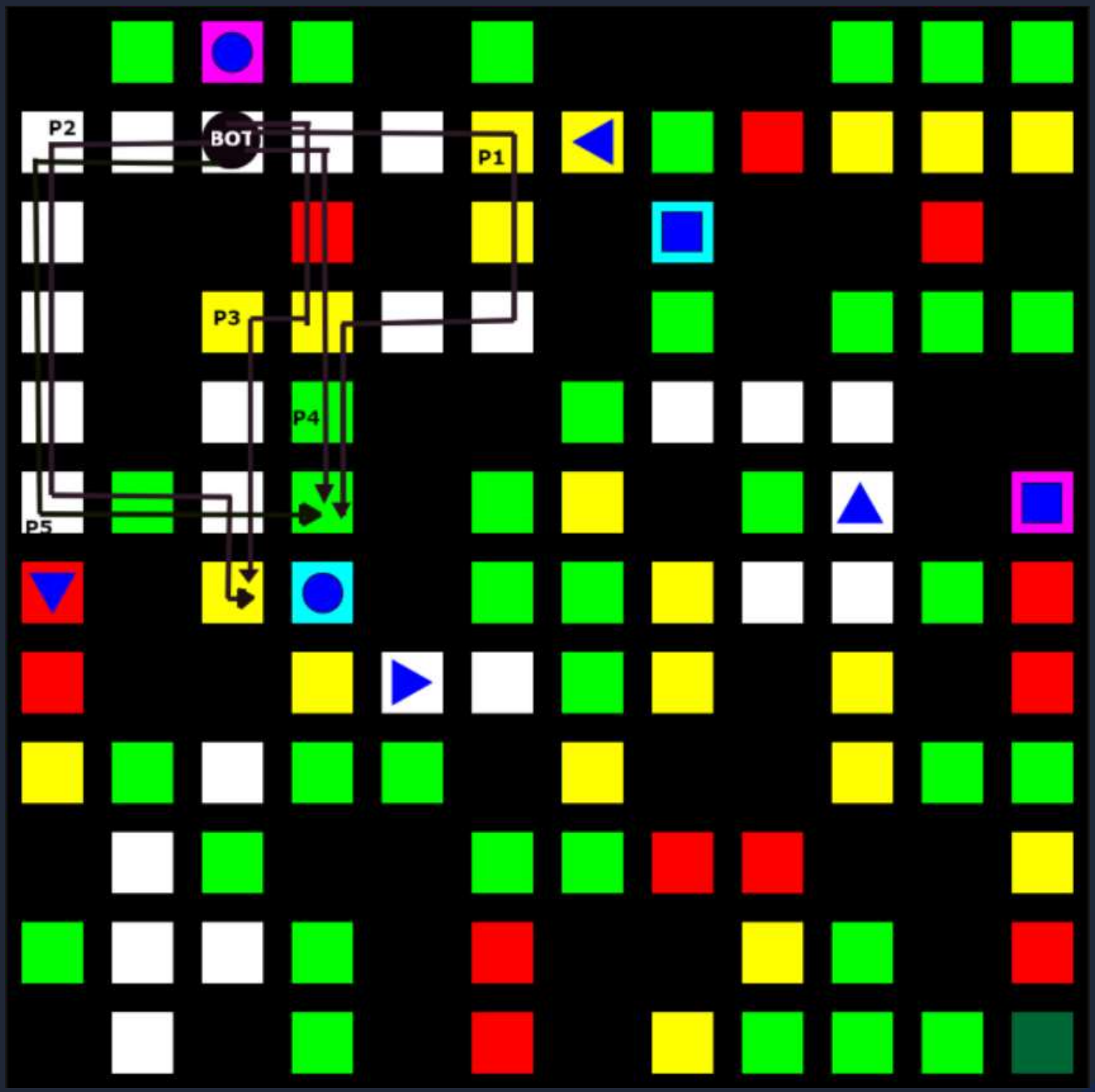
Now the bot explores the remaining **pink** square (*patient*). Situation shown below demonstrates possible paths from the current position of the bot to the neighbouring positions of the **pink** square (*patient*) . If bot takes path **P1** then it has to bear a cost of (0+2+3+3+1+1+1 =) **11** while on the other hand if bot goes for path **P2** then cost for it will be (0+2+3+3+1+1+2 =) **12**. Clearly path P1 appears to be a more optimal choice rendering path P2 INVALID.



Once the shape behind the **pink** square (*patient*) is disclosed, bot need to reach **blue** square (*hospital*) with the corresponding shape. Situation shown below demonstrates 5 possible paths from the current position of the bot to the destination. Table given below summarises costs bot has to bear if it takes any of the given paths

| Path | Cost |
|---|---|
| P1 | (1+1+3+3+1+1+3+2+2 ) = 17 |
| P2 | (1+1+1+1+1+1+2+1+3) = 12 |
| P3 | (1+4+3+3+1+1+3) = 16 |
| P4 | (1+4+3+2+2) = 12 |
| P5 | (1+1+1+1+1+1+2+1+2) = 11 |

As evident from the table above it can be concluded that path P5 is the most optimal choice among the paths considered.


P2
BOT
P1
P3
P4
P5

# SCORING:

## AWARDS:

• 500 points will be awarded for each patient to the teams for placing each patient successfully on its respective destination following the correct path.

• 1000 points will be awarded to the team on completion of the problem statement successfully.

• Additional Points will be awarded on the basis of $(n)^2/t$

where

n=number of blocks being travelled until the path is correct

t= time required to traverse n blocks.

## PENALTIES:

• In case the bot ignores the one way sign, a penalty of 100 points will be deducted from the total score (every time the bot ignores the one way).

# Event Rules:

- Participants will have to run the bot in simulation on PyBullet, a python library on their PCs. Participants will have to share their screen on Google Meet where they will be judged online. Participants will be provided with the PyBullet arena and the robot, and the required functions to control the robot.
- The robot should work purely on image processing-based principles. Each team will be given 10 minutes for calibration and 25 minutes for the final run (this does not include the time for Qualifying round).
- The robot should be started by a single click or single command issued by participant.
- Only 3 restarts are allowed in the final round with a penalty of 50 points.
- The final codes must be submitted to the event coordinator.
- A sample picture of the arena would be made available prior to the event.
- It will be the participant's responsibility if there is any data misinterpretation of image of the arena taken by the overhead camera due to obstruction by the body of the robot.

**Note:**

- The arrangement of the Hospitals and Patients might be different from the one depicted in the sample image during the final event.

# Rules:

## Eligibility:

• All students with a valid identity card of their respective educational institutions are eligible to participate in the event.

## Team Specification :

• A team may consist of a maximum of 3 members. Members of a team can be from different educational institutions.

# General Rules:

- Each team can have a maximum of 3 participants.
- Each member should carry a valid Student ID Card.
- Team should report to their mentor 30 minutes before the start of the event.
- The organizers reserve the right to change the rules as they deem fit. Change in rules, if any, will be highlighted on the website and notified to the registered participants.
- The decision of the organizers shall be final and binding.

## CERTIFICATION POLICY:

- The top three teams will be awarded a certificate of excellence.
- All teams qualifying the first round will be awarded a certificate of participation.
- Disqualified teams will not be considered for any certificates.

## CONTACTS:

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