Observation + motion model

```
% Define the colors
colors = {'green', 'red', 'white', 'blue'};

% Perception probability =  [correct incorrect]
p_O_given_C = [0.999 0.001*(1/3)];

% The probability of each adjacent cell was the previous cell of the
% current cell
p_prev_cell = 1/4;
```

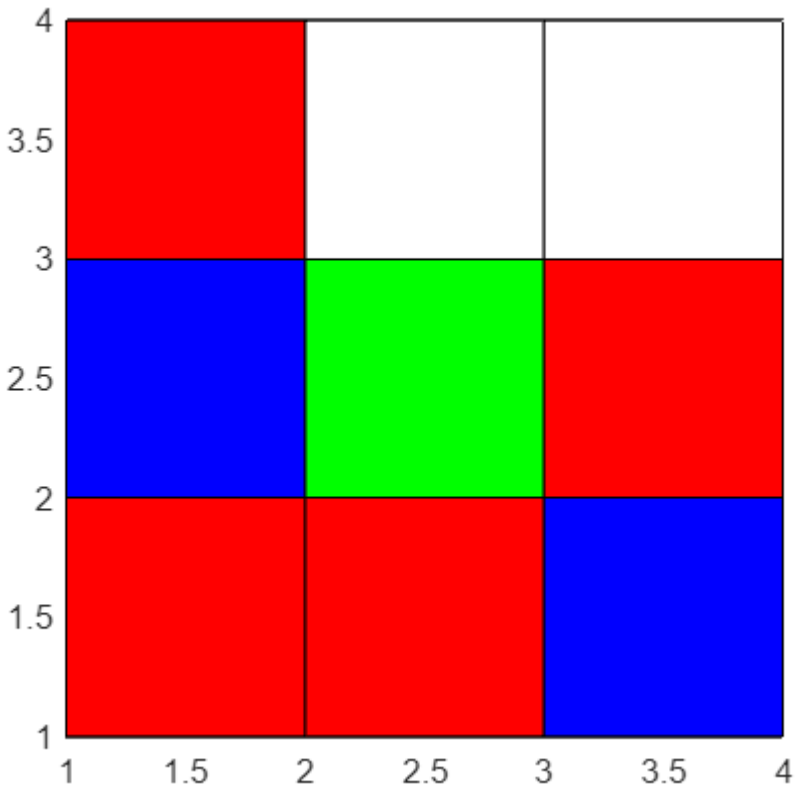
Making the map

```
% Define the size of the map
length = 3;
width = 3;

% Initialize the map with probabilities
map = ones(width, length) * 1/(length*width);
cells = cell(width, length);

% Plot each grid with its color
for i = 1:width
    for j = 1:length
        color_index = randi([1,4]); % Generate a random index between 1 and 4
        rectangle('Position', [j, i, 1, 1], 'FaceColor', colors{color_index}, 'EdgeColor', 'k')
        cells{i,j} = colors{color_index};
    end
end

% So the stored data match the figure
%cells = flipud(cells)
cells = rot90(cells, 3);
axis([1, length+1, 1, width+1]);
axis square;
```




```
% We generate ten real color sequence called O_n from the map, representing
% the observations we make as the vehicle moves. This is to verify the
% algorithm, and stay unknown to us in real life.
%O_n = {cells{3,3}, cells{2,3}, cells{1,3}, cells{2,3}, cells{3,3}, cells{3,2}, cells{3,1}, cel
```

Simulating the model

```
format long
% Assume the initial observation is blue
O = 'blue';
step = 0;
% Init normalized factor
eta = 0;

% Before any movement, calculate the map probability.
for i = 1:width
    for j = 1:length
        if strcmp(cells{j,i}, O)
            map(i,j) = p_O_given_C(1).*map(i,j);
        else
            map(i,j) = p_O_given_C(2).*map(i,j);
        end
        eta = eta + map(i,j);
    end
```

```
end


disp(['Current cell color: ', O]);
```

```
Current cell color: blue
```

```
disp(['Current step: ', num2str(step)]);
```

```
Current step: 0
```

```
% Normalize
map = map./eta
```

```
map = 3×3
   0.997337770382695   0.000332778702163   0.000332778702163
   0.000332778702163   0.000332778702163   0.000332778702163
   0.000332778702163   0.000332778702163   0.000332778702163
```

```

```

```
% Once the moving starts, iterate until a cell has probability >= 0.9999

current_position = [3,3];
% Define the possible movements: up, down, left, right
movements = [0 1; 0 -1; -1 0; 1 0];
max_prob = 0;
n = 1;
while max_prob < 0.9999
    current_color = cells{current_position(1), current_position(2)};
    disp(['Current cell color: ', current_color]);
    disp(['Current step: ', num2str(n)]);

    eta = 0;
    for i = 1:width
        for j = 1:length
            sum_previous_steps = 0;
            % Compare the color of the cell and observation to choose
            % proper probability for color perception
            if strcmp(cells{j,i}, current_color)
                map(i,j) = p_O_given_C(1);
            else
                map(i,j) = p_O_given_C(2);
            end

            % Calculate p_C for cells inside the map
            if 1 < j && j < length && 1 < i && i < width
                sum_previous_steps = map(j-1,i)+map(j+1,i) + map(j,i-1) + map(j,i+1) ;
            end

            % Calculate p_C for cells at the edges
            if 1 < j && j < length
```

```
            if i == 1
                sum_previous_steps = map(j-1,i)+map(j+1,i) + map(j,i+1);
            elseif i == width
                sum_previous_steps = map(j-1,i)+map(j+1,i) + map(j,i-1);
            end
        end
        if 1 < i && i < width
            if j == 1
                sum_previous_steps = map(j,i-1) + map(j,i+1) + map(j+1,i);
            elseif j == length
                sum_previous_steps = map(j,i-1) + map(j,i+1) + map(j-1,i);
            end
        end

        % Calculate p_C for cells in the corners
        if i == 1
            if j == 1
                sum_previous_steps = map(j+1,i) + map(j,i+1);
            elseif j == length
                sum_previous_steps = map(j-1,i) + map(j,i+1);
            end
        end

        if i == width
            if j == 1
                sum_previous_steps = map(j+1,i) + map(j,i-1);
            elseif j == length
                sum_previous_steps = map(j-1,i) + map(j,i-1);
            end
        end
        % Update the probability of the cell
        map(i,j) = map(i,j).*p_prev_cell*sum_previous_steps;
        eta = eta + map(i,j);
    end
end

map = map./eta
max_prob = max(map(:));

% Choose a random direction for movement
% Update the current position
% Check if the new position is within the grid
in_map = false;
while in_map ~= true
    direction = movements(randi([1,4]), :);
    new_position = current_position + direction;
    if new_position(1) >= 1 && new_position(1) <= width && new_position(2) >= 1 && new_posi
            current_position = new_position;
    end
end
```

```
    n = n+1;
end
```

```
Current cell color: blue
Current step: 1
map = 3×3
   0.166667226696993   0.000125074543762   0.166667226696993
   0.249861913628039   0.000132017857218   0.166667237698481
   0.000013899359354   0.166625533829938   0.083239869689223
Unrecognized function or variable 'new_position'.
```

```

```