Floorplan to JSON Project Report

Team:

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Target: To convert floorplan given in image format to description of walls and their arrangement in JSON format so that the JSON file can be used as input for AapkaPainter 3d rendering software.

Steps Identified:

- Image processing part on image
    - Converting the image to negative (Walls white on black background) format.
    - Filtering out all the background other than walls by use of Thresholding.
    - Feeding the image thus generated to one of the algorithms mentioned below so as to detect the straight lines in the image.
- Converting the data received from first part in JSON format
    - Using the python libraries, the data received from first part is wrapped in required JSON format.

Algorithms Used:

- Hough Transform for line detection or
- Harris corner detection

Observations:

- Walls can be identified with sufficient accuracy only if a pattern is defined in the input images. i.e., the Image Processing algorithm can't be made generic supporting all the types of images.
- Since the floorplans consisting dark black walls constitute a major proportion of the graphic floorplans made (based on our own observation) , **Dark black walls** was taken as criteria for step 1 and step 2 of image processing part for filtering out the background of image.

- With above assumption in consideration, the present filtering works quite accurately, and the output images can be directly used as input of Line detection/Corner detection algorithm.

- **Hough Line Transform observations:**
  - The algorithm quite unpredictably detects some lines in image while it does not detect others. Even though examples for this particular algorithm given internet are quite astounding, similar results could not be verified practically.
  - Only way to use this algorithm in production level is to modify it, or find a pattern in which it is detecting the lines (so that the filtered image output can be adjusted accordingly). However such a pattern could not be identified currently. E.g. is given below.

Floor Plan - 20 x 30 Cottage
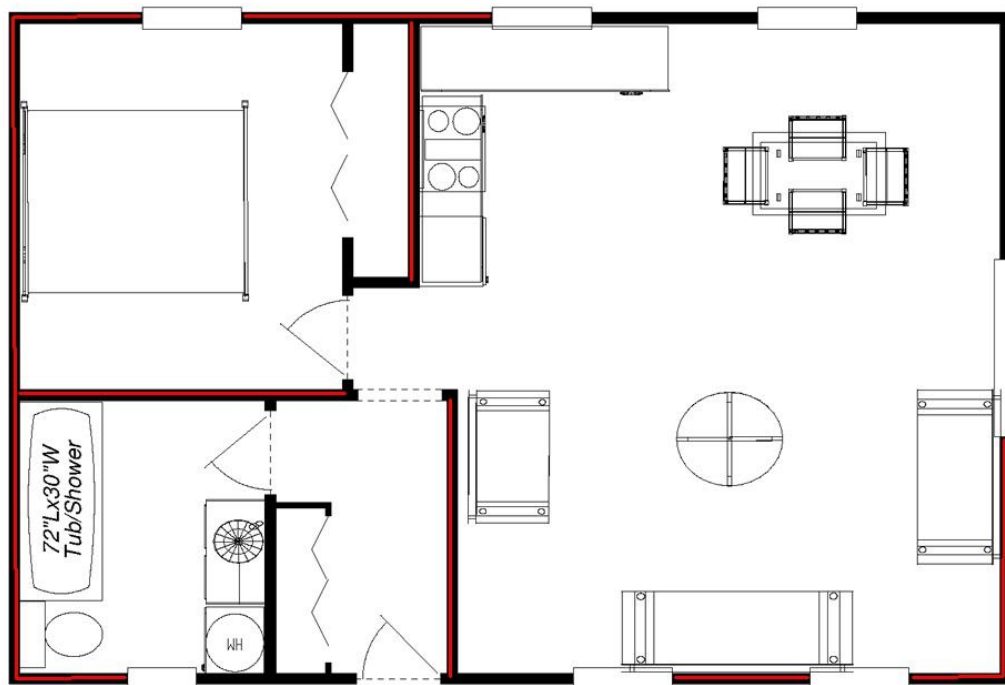
(Red highlighted walls are the only ones which are detected.)

- **Harris Corner Detection Observations :**
  - The accuracy of this algorithm for detecting corners was found more than that of Hough line transform.
  - Main problem observed in this case is, the position of corners in target corner area can't be ascertained. Since the walls in the image are of considerable thickness, the corners are detected somewhere in corner area based on mathematical calculation. This causes multiple lines to be detected between the corners, as all the corners falling on same wall, unfortunately do not fall on same straight line. Same can be observed in image attached below.
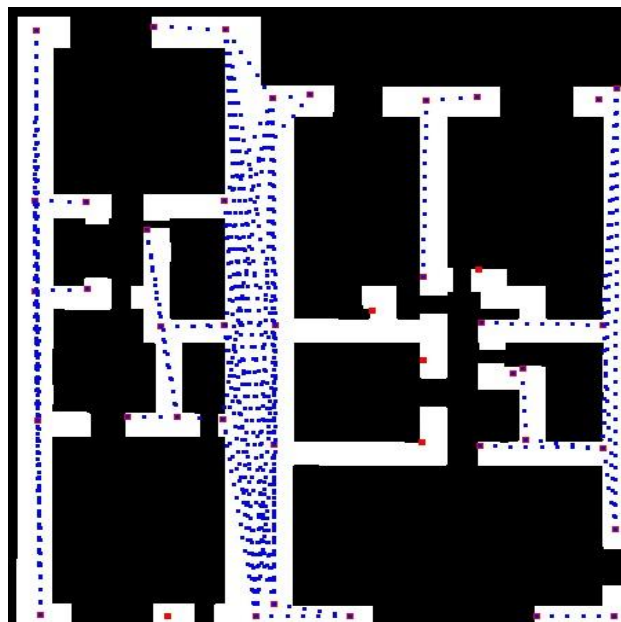
(Red dots being the detected corners and detected lines are in blue. Walls to be detected are white.)

  - Note that, immediate solution for above problem which comes to mind is reducing the thickness of the walls so as to reduce the corner area in which corners are detected. However this is found to decrease the accuracy of corner detection of algorithm.
  - However, above problem can be solved by adding a line filtering stage, where the lines which diverge from a point with very less angle

can be merged into one single horizontal or vertical line. Efforts are currently underway for this point.

o This algorithm can be used in practice after improvements, but still all the walls might not get detected.

- **Suggestions:**
    o Adding a line filtering stage as described above. (Currently underway)
    o Analyzing both the algorithms mathematically so as to find a pattern and reasoning behind the detected lines. So that the input to the algorithm can be suitably adjusted.
    o Trying to make combination of both the algorithms work together. Taking positive outputs from both.(Can become very clumsy)
    o With current accuracy, or even with the expected accuracy based on above solutions, it does not seem possible to completely automate the process on production level. Some user intervention might be necessary to draw/identify the undetected walls. This user intervention can be interactive and can use a simple GUI.
    o Only way to make whole process completely generic and accurate is incorporating machine learning.