**Advanced AI-Driven Architectural Design System for Dynamic Floor Plan Generation**

The Advanced AI-Driven Architectural Design System for Dynamic Floor Plan Generation is an innovative solution that leverages AI technologies, including Conditional Generative Adversarial Networks (CGANs) and Convolutional Neural Networks (CNNs), to create professional, customizable residential ground floor plans based on user requirements. Users input details such as total area, number of bedrooms, bathrooms, kitchens, lounges, garages, and lawn preferences, and the system generates optimized, color-coded floor plans in real-time. Designed for 5 Marla, 10 Marla, and 20 Marla plots, the plans adhere to standard dimensions and are exportable in formats like DXF, PNG, and SVG, enabling seamless integration with CAD tools and easy sharing. The system focuses exclusively on residential ground floor layouts for now, ensuring accessibility for both professionals and non-experts.  
we have work on its dataset and data pre-processing.

**1. System Overview**

* **Name:** Advanced AI-Driven Architectural Design System for Dynamic Floor Plan Generation.
* **Purpose:** To generate professional, customizable residential ground floor plans automatically.
* **Core Technology:** Leverages AI, specifically Conditional Generative Adversarial Networks (CGANs) and Convolutional Neural Networks (CNNs).
* **Target Audience:** Both architectural professionals and non-experts.
* **Current Scope:** Exclusively focused on **residential ground floor** layouts.

**2. Functionality & User Interaction**

* **User Input:** Users provide requirements such as:
  + Total Area (implicitly via plot size selection)
  + Number of Bedrooms
  + Number of Bathrooms
  + Number of Kitchens
  + Number of Lounges
  + Number of Garages
  + Lawn preferences
* **Generation:** The system generates optimized floor plans in real-time based on the inputs.
* **Adherence:** Plans adhere to standard dimensions relevant to the selected plot size.

**3. Supported Plot Sizes & Dimensions**

* The system is designed for specific standard plot sizes:
  + **5 Marla:** 25' x 45'
  + **10 Marla:** 35' x 65'
  + **20 Marla:** 50' x 90'
* **Image Output Specifications:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Plot Size** | **Dimensions (Feet)** | **Total Area (Square Feet)** | **Size (in)** | **Resolution (px)** | **DPI** | **Aspect Ratio (Width:Height)** | **Bit Depth** |
| 5 Marla | 25' x 45' | 1,125 sq ft | 6.338 x 11.338 | 608 x 1088 | 96 | 0.559 | 24 |
| 10 Marla | 35' x 65' | 2,250 sq ft | 8.833 x 16.344 | 849 x 1570 | 96 | 0.541 | 24 |
| 20 Marla | 50' x 90' | 4,500 sq ft | 12.583 x 22.594 | 1209 x 2170 | 96 | 0.557 | 24 |

|  |  |  |
| --- | --- | --- |
| **Plot Size** | **Resolution (px)** | **Aspect Ratio (Width:Height)** |
| 5 Marla | 608 x 1088 | 0.559 |
| 10 Marla | 849 x 1570 | 0.541 |
| 20 Marla | 1209 x 2170 | 0.557 |

**4. Floor Plan Visualization (Color Coding)**

* Floor plans use a specific color scheme to denote different room types and elements.
* **RGB Color Mapping:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr.** | **Room Type** | **Color Name** | **RGB Value** |
| 1 | Bedroom | Red | RGB(255, 0, 0) |
| 2 | Bathroom | Blue | RGB(0, 0, 255) |
| 3 | Kitchen | Orange | RGB(255, 165, 0) |
| 4 | Drawing Room | Green | RGB(0, 128, 0) |
| 5 | Garage | Brown | RGB(165, 42, 42) |
| 6 | Lounge(Sitting Area) | Yellow | RGB(255, 255, 0) |
| 7 | Backyard | Lime Green | RGB(50, 205, 50) |
| 8 | Stairs | Teal | RGB(0, 128, 128) |
| 9 | Store(Storage Room) | Purple | RGB(128, 0, 128) |
| 10 | Open Space | Cyan | RGB(0, 255, 255) |
| 11 | Prayer Room | Crimson | RGB(127, 127, 127) |
| 12 | Staircase | Violet | RGB(153, 51, 255) |
| 13 | Lobby | Magenta | RGB(255, 0, 255) |
| 14 | Lawn | Turquoise | RGB(64, 224, 208) |
| 15 | Dining | Pink | RGB(225, 192, 203) |
| 16 | Servant Quarters | Indigo | RGB(75, 0, 130) |
| 17 | Passage | Olive Green | RGB(128, 128, 0) |
| 18 | Laundry | Lavender | RGB(230, 230, 250) |
| 19 | Dressing Area | Coral | RGB(255, 127, 80) |
| 20 | Side Garden | Gold | RGB(255, 215, 0) |
| 21 | Library | Amber | RGB(255, 191, 0) |
| 22 | Walls | Black | RGB(0, 0, 0) |
| 23 | Door | Mahogany | RGB(128, 0, 0) |

**5. Data Management & Pre-processing**

* **Dataset:** Consists of floor plan images used for model training.
* **File Naming Convention:** A structured naming convention is used for data files:  
  [PlotSize][FloorLevel][PlanType][FP Sr. #][Version].[Extension]
* **Example:** 5Marla\_GF\_FP\_001\_V01.png
* **Metadata Extraction:** Information is extracted directly from the file names:
  + PlotSize: e.g., "5Marla"
  + FloorLevel: e.g., "GF" (Ground Floor)
  + PlanType: e.g., "FP" (Floor Plan)
  + FP\_Number: e.g., "001" (Floor Plan Serial Number)
  + Version: e.g., "V01"

**6. System Output & Export Formats**

* **Primary Output:** Generated color-coded floor plan image.
* **Export Options:** Users can export the generated plans in multiple formats:
  + **DXF:** For compatibility with CAD software (e.g., AutoCAD).
  + **SVG:** Scalable Vector Graphics format.
  + **PNG:** Portable Network Graphics raster image format.

let me explain images are:  
**Directory Setup**  
Ensure your dataset is organized according to the structure we discussed:  
dataset/  
├── 5\_marla/  
│ └── \*.png  
├── 10\_marla/  
│ └── \*.png  
└── 20\_marla/  
└── \*.png

DPI = 96  
Aspect Ratio = average of all floor plans = 0.552  
Aspect ratio = width(px)/height(px)  
Pixel to Area conversion:  
Area per pixel = Total area/Total no. of pixels

Normal image dimensions for models are in square as 512 x 512, but in our case FP are not in square so we need to keep in mind aspect ratio and resize all FP into one rectangular dimension for efficient model training.

### Optimized Problem Statement:

The floor plans in our dataset are rectangular with varying aspect ratios, and we aim to standardize their dimensions for efficient model training without distorting their layout. While traditional models often require square images (e.g., 512x512), floor plans are naturally rectangular. To maintain the structural integrity and details of the designs, we chose to standardize the floor plan dimensions to **512x927**.

### Solution:

We selected **512x927** as the standardized resolution because:

* **Aspect Ratio Preservation**: This dimension maintains the **natural aspect ratio(i.e., 0.552)** of the floor plans, ensuring that their proportions (width to height) are not distorted.
* **Model Efficiency**: The chosen resolution balances **computational efficiency** and **image detail**. It provides sufficient pixel information for the model to learn intricate floor plan features while minimizing processing overhead.
* **Practicality**: The 512x927 resolution is an optimal trade-off between preserving the floor plan layout and fitting within the model’s input size requirements, ensuring effective and efficient training.

This approach allows for **accurate model training** on floor plans while maintaining the original structure and layout in a computationally efficient manner.