

# Automated floor plan design, bill of quantities and integrated construction using property length, breadth and property facing for residentials

Rajesh Kumar Uba

Education:

Bachelors of engineering in Civil Engineering from Osmania University, Hyderabad India. Project Management Professional from San Diego State University, San Diego, USA

Current Work: Founder and CEO at IBT Const Planr Private Limited, India & iBuiltup Tech USA.

Previous Work: Cumming Corporation, Sunnyvale California, USA, 2016 - 2019 Planning Engineer - Al Futtaim Construction (AlFuttaim Carillion-previous) - Dubai UAE.

# **ABSTRACT:**

To produce interactive blueprints and bill of quantities using property length, breadth and property facing is a research program conducted by Rajesh Kumar Uba for over 2 years and has developed a software that produces an automated and editable floor plan design with detailed bill of quantities algorithm.

Design as the basis, IBT generates a detailed estimation, renders 3D, connects with resources and material suppliers, therefore making the construction process as an integrated construction using property dimensions. This technical paper details the procedure to build <u>automated and editable design</u>, with detailed estimation using the IBT proprietary algorithm.

# PRACTICAL APPLICATIONS

The algorithm of IBT to produce automated and editable floor plans is used in the residential construction industry. Currently manual process is involved using programmes such as autocad, sketchup, bluebeam and so on. The advanced software offers templates only to build the floor plan but not an automated and editable drawing blueprint. Thus helping the construction industry transform with automation and save time, cost and quality of output with options to choose.

# AUTHOR KEYWORDS

**IBT**: iBuiltup Tech is referred to as IBT in this technical paper.

**Algorithm:** The logic used to make the floor plan in the back end that generates a drawing plan for the user. **Part 1: Design** - The algorithm part is design, this helps the successive tasks of construction, therefore making the entire cycle of a project automated ie from design to handover.



**Part 2: IBT Partners -** Design as the basis, the IBT software generates detailed estimation, renders 3D for interiors, helps with material suppliers and construction workers and engineers plus plant and equipment needed for construction.

# **INTRODUCTION:**

We performed detailed research on simplifying building blueprints, estimation and construction process for over 2 years. This is not powered by artificial intelligence to generate drawings but solely on the algorithm developed for each specific property and is fetching results using software for the user using property length, breadth and property facing.

To design a floor plan and to print for a local city or municipal approval, engineers, architects, general contractors use autocad, civil 3d, bluebeam or sketchUp or other softwares that offers advanced technology with templates, and it still consumes time, cost and effort to compile all templates as per the requirements.

IBT offers an automated and editable floor plan browser based software application that helps users with design or a floor plan in less than a minute. The floor plan can be used to get municipal approval for construction. Customers like general contractors, engineers, architects, students, who can benefit more than a floor plan with IBT, with touch of a button, IBT generates a detailed estimate based on the design edited and locked.

Detailed estimates, rendered in 3D to see the interiors, are integrated with IBT and are defined as part1 of design.

# Part 2: IBT partners

The part 2 phase is related to construction workers that includes labor, staff, engineers, managers and all other resources who participate in the project. Part 2 also consists of material suppliers for the project. IBT algorithm helps connect with part 2 seamlessly ensuring accuracy, speed and great quality.

# **IBT information:**

Registered corporations:

India - Launched 05 2024 IBT Const Planr Pvt Ltd https://ibuiltup.in/

USA - To be launched - Oct/Nov 2024

IBT Tech <u>https://ibuiltup.com/</u>

Demo Video https://youtube.com/@IBT?si=5PtzDpMMg8KgsiBY

Industry - Building construction Product: Design & Construction software

This product is made useful for following users: General Contractors, engineers, architects, developers, real estate, construction vendors, aspiring direct home owners and construction workforce (daily workers, skilled and professionals)

# MAIN TEXT:

Part 1: IBT, automated and editable floor plan design : Algorithm based

1. IBT is a design based integrated construction software currently built using an algorithm that consists of room names, id, position, delete room and restore room. Each of them is coded or put into a syntax form, with each room coded with its position then grouped to form a complete floor plan. Please see page no7, Part A for algorithm.

2. Editable: While every room is movable using a mouse, each wall of the room can be editable using left controls.

3. Wall Controls: Doors can be formed using left wall controls. Using a toggle key, doors can be enabled and disabled. Doors can be placed wherever the user wants to position, length of doors can be controlled, this will be useful for the main door, bedroom door, bathroom door, store room etc.

4. Setbacks: Using IBT software, users can either enter setbacks as per local city guidelines in the data input screen or users can edit setbacks even after generating the floor plan. To further edit setbacks upon generating the floor plan, the right controls have a powerful option called setbacks (editable) this option helps users to position the setbacks on all four sides of the floor plan i.e., Left, Right, Back and Front.

5. Standardization of setbacks for users across the world: To maintain consistency as per user's perspective, that means, from the user's angle ie, at any time user looks at the laptop the same way, therefore, as per the research or questionnaire performed on few technical and non technical users, majority of the users prefer to see the floor plan as if they are facing their house standing in-front of the main gate and the second best view is the top view from the same position, in-front of the main gate of the floor plan. This main gate facing towards the adjacent road perpendicular to the floor plan.

- 6. Setbacks standards representation:
- a. front=bottom; b. back=back; c. left=left d. right=right.

7. Facing: As mentioned in the setbacks, facing is as per the main gate positioned adjacent to the main road and is referred to as the bottom side. The plot facing will face downwards or at the bottom at all times, IBT displays the floorplan.

Please note: Below is the screenshot of the floor plan size: 35ftx46ft East Facing.

nternational Journal of Scientific Research in Engineering and Management (IJSREM)

Volume: 09 Issue: 01 | Jan - 2025

SJIF Rating: 8.448

ISSN: 2582-3930



8. Room dimensions controls: This function can help users to increase or decrease the length or breadth of any room while it can also be done using mouse, there is an option to extend/drag or resize using right controls 'dimensions' using L (length)/B(Breadth) - or + can be used to control the dimensions.

9. Room dimensions controls are also located on the left hand side, at the top, referred to as room dimensions, here users can directly enter the distance to move the room.

10. Position controls are similar to dimensions and are located on the left and right side of the controls. While users can use a mouse to move the rooms, the controls enable fine positioning at exact location.

11. Wall thickness and color: All rooms: Users can directly change the thickness or color of all rooms at once. This feature is located on the left side control panel, just below 'dimensions'.

12. Built / Plot thickness and color: Users can directly change the thickness or color of plot wall or built wall at once. This feature is located on the left side control panel, just below wall controls.

13. Staircases: There is a library of staircases on the left side control panel at the bottom, users can choose desired staircase and position at the desired location within the floor plan.

### **Design integration with construction**

Summary: Design consists of floor plan whereas construction consists of detailed estimate, render in 3D and resources where customers can get men and material supply using this option.

All options like estimation, 3D render or resources/material supply can be found within the software as a button form, users can just click on the button to render the floor plan in 3D, also click on the estimation button to generate a detailed estimate and similarly for resources.

1. At IBT cross functional teams or stakeholders are integrated using the basis of design as the source to successive stakeholders. Successive stakeholders to design are estimators, building execution or general contractors, building materials, consultants, 3D rendering for interiors and exteriors.

2. Estimate, bid process is totally based on the design drawings, therefore iBT envisions saving time and cost for various small or other businesses and be the future of construction.

3. Process: IBT powered floor plans or blueprints are generated for the clients who access using property dimensions, like length, breadth, property facing and number of bedrooms.

4. IBT algorithm helps in converting any pdf (floor plan blueprint) or hand-drawn floor plan by the client into an editable drawing using IBT upon scanning.

5. Estimation, bid selection process will be much efficient with such IBT powered blueprints. Please see how estimation shows detailed bill of quantities based on property measurements using IBT's algorithm. <u>https://www.youtube.com/watch?v=8ZyKDCMFJYg</u>

# 6. Construction industry can therefore reduce wastages, rework, save paper (avoid print for reviews and corrections and approvals) and most importantly save money.

7. A demo video for the same is attached below for your reference: https://youtu.be/Pqm4JSStDgQ?si=bZqKQOsF0G3gyG9S

Please note: same video is also attached to the home page of ibuiltup.in and ibuiltup.com



Home page: <u>https://ibuiltup.com/</u>

Steps:

- 1. Click on Get Started button
- 2. Enter Client information



3. Enter Length, Breadth, Type, Facing

≱ Builtup					1	me About	Features	Pricing	<u>*</u>	•
	BASIC DETAILS		PLOT DETALS		BUILD DETAILS		1			
	(Dame)	- LENGTH	30	D BREADTH 45						
	Contraction of the second	· TYPE	independent Building *	F FACING East	~					
			Select Building Type Independent Building							
			Apartment Open Plotting							
	Previous					Next				
•										

4. Click next - Adjust building setbacks as per local city guidelines

L=Left; R=Right; F=Front and B=Back of the built-up property

Setbacks are for safety, sunlight, expansion or tenant improvement works in future, and access purposes.

5. Select floors from ground to Ground +5 floors or levels.

← → Ø ft ibuihup.com/drawing								\$	2	
🐼 Builtup					About	Features	Pricing	*		•
	BASIC DETAILS	PLOT DETALS		BUILD DETAILS						
		H L 3.80	H R 2.60							
	C Bullup	I F 3.80	IB 4.40							
		FLOORS Select Floors V Select Floors G								
		G+1 G+2 G+3 G+4								
	Previous	G+5			Finish					

6. Select number of bedrooms:





7. Click next for floor plans

← → C tt ibuiltup.com/drawing			x D 0
Builtup		Home About Features Prici	** 🛞 🚱
Builtup President		30 ft Gv Gv	Option1 Option2
Create Edit		res         P20           G131         12233           Bein         Bein           1233         1233	Floor: Ground Option: 1 Facing: EAST Bed: 3
		87 X 18 7 Beltoni 2 13 1 X 13 8	Length = 30.0 Breadth = 45.0 Total Area = 1350
			Builtup L = 27.0 B = 35.4 Builtup Area = 955.8
	68e 45 ft	Psert One#Boon 23.17 - 13.13.12.12	Setbacks L: 1.5 + R: 1.5 = 3.0 F: 5.2 C + B: 4.4 = 9.6
Please dick on a room to edit!		00/00	Position (1) (2) (2) (2)
		00y 2833 11X4 X2040	Dimensions L - + B - +
		65X52	Estimate
		Bargar 102X83 US542	Get Resources

- 8. Click options to see other patterns in the same dimensions.
- 9. Once edit is complete
- 10. Click on Estimate to get full estimation
- 11. Click on 'Get Resources' to find suitable resources in local areas.

Claims 1: Formation of an automated drawing floor plan using IBT algorithm as below: Example: 30x45 feet 3 bed 3 bath property.

### Part A: Algorithm:

- 1. if(plotBreadth>=35 && plotBreadth<=40){
- 2.  $const bedroom1 = {$
- 3. id:'E1B-bedroom',
- 4. name:'Bedroom-1',
- 5. length:builtLength \* 0.5,
- 6. breadth:builtBreadth \* 0.35,
- 7. position:{x:builtLength \*scale-builtLength \* 0.5\*scale,y:builtBreadth\*0.45\*scale},
- 8. walls:[

9.

{id:'e1b-bedroom-wl',side:'L',length:builtBreadth

 $0.35, thickness: 0.2, color: 'steelblue', has Door: true, door: {position: {x:0,y:0} }, has Opening: false, opening: {length: 1.5, position: {x:0,y:0} }, window: {length: 1.5, position: {x:0,y:0} }, opening: {x:0,y:0} }, openi$ 



10.	// {id:'e1b-bedroom-wr',side:'R',length:builtBreadth *
0.35,thicknes	s:0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5*
scale,position	:{x:0,y:0}},window:{length:1.5,position:{x:0,y:0}}},
11.	// {id:'e1b-bedroom-wt',side:'T',length:builtLength *
0.465,thickne	ss:0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5,
position: { x:0	y:0}},window:{length:1.5,position:{x:0,y:0}}},
12.	{id:'e1b-bedroom-wb',side:'B',length:builtLength *
0.5,thickness	$0.2, color: 'steelblue', has Door: true, door: \{position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: true, opening: \{length: 2, position: \{x: 10, y: 0\}\}, has Opening: \{x: 10, y: 0$
ion:{x:10,y:0	}},window:{length:1,position:{x:(builtLength*0.5)*scale,y:0}}}
13.	],
14.	status:'A'
15.	}
16.	
17.	const bedroom2={
18.	id:'E1B-bedroom-2',
19.	name:'Bedroom-2',
20.	length:builtLength * 0.5,
21.	breadth:builtBreadth * 0.45,
22.	position:{x:builtLength *scale-builtLength * 0.5*scale,y:0},
23.	walls:[
24.	{id:'e1b-bedroom-2-wl',side:'L',length:builtBreadth *
0.45,thicknes	s:0.2,color:'steelblue',hasDoor:true,door:{position:{x:0,y:(builtBreadth*0.3*scale)}},hasOpening:true,
opening:{len	gth:3*scale,position:{x:0,y:(2*scale)}},window:{length:1.5,position:{x:0,y:0}}},
25.	// {id:'e1b-bedroom-2-wr',side:'R',length:builtBreadth *
0.35,thicknes	s:0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5,p
osition:{x:0,y	:0}},window:{length:1.5,position:{x:0,y:0}}},
26.	// {id:'e1b-bedroom-2-wt',side:'T',length:builtLength *
0.5,thickness	0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5,po
sition: {x:0,y:	)}},window:{length:1.5,position:{x:0,y:0}}},
27.	{id:'e1b-bedroom-2-wb',side:'B',length:builtLength *
0.5,thickness	0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5,po
sition: {x:0,y:	$0$ },window:{length:1.5,position:{x:0,y:0}}}
28.	],
29.	status:'A'
30.	}
31.	
32.	const bedroom3={
33.	id:'E1B-bedroom-3',
34.	name:'Bedroom-3',
35.	length:builtLength * 0.37,
36.	breadth:builtBreadth * 0.31,
37.	position:{x:builtLength*0*scale,y:0},
38.	walls:
39.	// {1d:'e1b-bedroom-3-wl',side:'L',length:builtBreadth *
0.45,thicknes	s:0.2,color:'steelblue',hasDoor:true,door:{position:{x:0,y:(builtBreadth*0.3*scale)}},hasOpening:true,
opening: {len	$t:3*$ scale,position:{x:0,y:(2*scale)}},window:{length:1.5,position:{x:0,y:0}}},



0. {id:'e1b-bedroom-3-wr',side:'R',length:builtBreadth *
0.31,thickness:0.2,color:'steelblue',hasDoor:false,door:{position:{x:0,y:0}},hasOpening:false,opening:{length:1.5,p
osition:{x:0,y:0}},window:{length:1.5,position:{x:0,y:0}}},
1. // {id:'e1b-bedroom-3-wt',side:'T',length:builtLength *
0.5, thickness: 0.2, color: 'steelblue', hasDoor: false, door: {position: {x:0, y:0}}, hasOpening: false, opening: {length: 1.5, po
ition:{x:0,y:0}},window:{length:1.5,position:{x:0,y:0}}},
2. {id:'e1b-bedroom-3-wb',side:'B',length:builtLength *
0.37,thickness:0.2,color:'steelblue',hasDoor:true,door:{position:{x:10,y:0}},hasOpening:true,opening:{length:2,pos
tion:{x:10,y:0}},window:{length:1.5,position:{x:0,y:0}}}],
3. status:'A'}}

### Wireframe:



IBT's algorithm is technical and is achieved through manual interaction.

1. Upload an image of a floor plan in an image format like jpeg, png or others to iBT software.

2. OR, upload a hand drawn image of a floor plan with measurements to iBT software.

3. iBT software processes images into an editable floor plan in seconds/minutes. This editable floor plan can be estimated using the 'estimate' button and get resources using the button.

4. This process simplifies the bid process, avoids on screen takeoff and errors in estimation.

5. Helps small businesses grow and make money at a faster pace, saving their time and energy, clients can use time saved from manual drawing processes for their growth.



Upload rough sketch or a pdf to iBT software using below link:

# https://ibuiltup.com/



iBT software processes and forms an editable drawing as below, the drawing can be edited using mouse key, left and right functions.



### Estimation:

IBT generated a summary level estimate in three different formats as shown below: Estimates are connected to the design floor plan, as it gets edited, the algorithm changes the estimate as per the edits performed. Engineer or architect or user can tailor the estimate as per the budget, that meets their budget.

The three types of estimates are : Ginger (type A), Lemon (type B) and Melon (type C).

The detailed estimate shows till the house interiors, or bathroom fixtures or kitchen fixtures to help users to perform edits until satisfied. Please see Image name: kitchen plumbing below.



SJIF Rating: 8.448





nternational Journal of Scientific Research in Engineering and Management (IJSREM)

Volume: 09 Issue: 01 | Jan - 2025 SJ

SJIF Rating: 8.448

ISSN: 2582-3930

Kitchen	35 days	24 Nov	'22	11 Jan '23	Mod Kitchen	₹ 93,975.00
Kitchen work	2 days	24 Nov	/ '22	25 Nov '22	Kitchen Wall Tile	₹ 50.00
Brickwork	5 days	28 N			Brickwork = Clay	₹4,500.00
Plaster Brickwork	1 day	05 D	Click	on a task	Plaster : PPC Cer	₹100.00
Door Frames	2 days	06 D	to kn	ow more	Doorframe Woo	₹ 2,000.00
Window Frames	1 day	08 D	at	bout it	Woodframe[1]	₹1,000.00
Ventilator	1 day	09 D			Ventilator - Prec	₹1,000.00
Plumbing	4 days	12 D			Plumb Material:	₹ 15,000.00
Pull Wire - Electrical	2 days	16 Dec	:'22	19 Dec '22	Electrical	₹ 2,400.00
Shelves - Steel and Concrete	1 day	20 Dec	:'22	20 Dec '22	Woodwork - 2 Cl	₹ 20,000.00
Install Countertop - Stone	1 day	21 Dec	:'22	21 Dec '22	Granite - Counte	₹ 10,800.00
Flooring - Tiles/Granite	4 days	22 Dec	:'22	27 Dec '22	Floor Granite/Gr	₹4,225.00
Surface Preparation - POP Wall	1 day	21 Dec	:'22	21 Dec '22	POP Wall Plaster	₹4,500.00
Woodwork - Plywood/Solid	10 days	28 Dec	:'22	10 Jan '23	Woodwork - 2 Cl	₹ 20,000.00
Install Door - Kitchen	2 days	28 Dec	:'22	29 Dec '22	All Other Doors[	₹ 6,000.00
Install Door Lock - Handle Lock	1 day	29 Dec	:'22	29 Dec '22	Labor	₹ 800.00
Painting	1 day	11 Jan	'23	11 Jan '23	Painter	₹1,600.00

Kitchen Plumbing

# Kohler Brand - material image - cost - specifications as per its owners page



Product Specifications		
Category	Kitchen Faucets	
Brand	Kohler	
Finish	Chrome	
Product Installation		~
ධ Replacement & Returns		~

https://decure.in/products/kohler-wall-mounted-regular-kitchen-sink-mixer-cuff-k-37315in-4-cp-with-swinging-spout-in-c hrome-finish

Image name: kitchen plumbing

### Part:2 Partners: (Integrated Construction)

Construction stakeholders, suppliers, materials and daily workers and developers/owners have equally facing issues finding each other in a skillful manner along with the rates and facing employment issues from daily labor to all levels of work.

Integrated approach : At IBT customer gets design, estimation, resources, suppliers, interiors and all needful for a home construction. Customers come with basic inputs like length and breadth and are presented to customers with finished products, helping customers at every step of the technical process with our partnering services.



# Partners Sign Up

a.Architects, Civil Engineers other Engineers:

b.Students/ Intern/ On job training

c.Daily Workforce or staff

d.Materials suppliers including plant and machinery required for construction.

e.Landlord or the client who wants to build a house.

IBT generates employment using its integrated formulae, a marketplace like amazon for the construction industry meeting human resource needs of employers.



Daily labor or workforce is not organized, leaving the daily labor without insurance by the temporary hired employers for daily works and maintaining low quality life, low pay scale and missing the hygiene impacting their direct family. In Spite of contributing their (labor) skills and existence to the country, lacking dignity of labor and living standards. This phenomenon also impacts countries growth, therefore IBT is totally committed to fix such issues, promising all levels of construction staff excel and live better living standards.

IBT partners algorithm works in favor of resources of all types, providing them jobs based on availability, this functionality is another algorithm that assigns staff using a timer, the staff accepts the job only if willing. Also there is a great flexibility with IBT partners algorithm that helps the staff to work in multiple construction sites in a day or per week.

End of IBT Manuscript



# **References:**

National building code of India part 3 development control rules and general building requirements. Link to the National Building Code of India Part 3:

https://hsiidc.org.in/uploads/assets/170202029704170101891503NBCChapter3.pdf

- 8.2 Residential Buildings; 8.2.1.1 Front open space; 8.2.1.2 Rear open space; 8.2.1.3 Side open space.
- Table 4 Side and Rear Open Spaces for Different Heights of Buildings (Clause 8.2.3.1)
- B-20 Accessible housing; B-20.1 Exterior, Entrance and Access within the Building; B-20.2 Interior; B-20.3 Bedroom ; B-20.4 Living Room ; B-20.5 Toilet or Sanitary Room ; B-20.6 Kitchen.
- IS 800-2007 STEEL CODE

https://dn790009.ca.archive.org/0/items/gov.in.is.800.2007/is.800.2007.pdf

• IS 456: Plain and Reinforced Concrete - Code of Practice https://archive.org/details/gov.in.is.456.2000