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This thesis began with noticing the need for more flexible architectural layouts that can better meet the user's needs and enhance their spatial experience. The issues that arise from rigid architectural layouts leave little chance for quick upgrades and pose limitations on user comfort. This becomes very important, particularly for people with restricted physical mobility. Many of them experience psychological regression, and mental, cognitive, and emotional decline in environments that remain constantly the same.

On the other hand, the architectural industry has lagged behind others when it comes to using various robot types for building. Robots to this day have been only used as fabricators for 3D printing or pick and place or building assembly. However, robots can be smart and programmed to perform a wide range of tasks automatically. This makes them a good candidate to create environments that need to be able to change. To use the potential of robots to create flexible architectural layouts, this thesis in particular focused on using swarm robots that act as building blocks that can be installed, dismantled, updated, refurbished, and partially recycled. The use of wood and shoji paper for making 90% of the robot block panels, adds value to the design for circularity purposes. This, in addition to the fact that there will be no need for heavy construction, building destruction, and renovation can potentially reduce carbon

footprint and the environmental impact of the design in the building industry to a large degree. The creation of architectural layouts with fully or partially automated robot teams like swarm robots, can solve the problem of inflexibility and its influence on the well-being of users. By providing the user with a layout generation map, the user can select between design options for their specific needs of the time and the robot teams can build up that space for them automatically from that point on. The social impact of this thesis is, related to its consideration of:

1-User well-being
2-Circularity of the design
3- Reducing environmental impact

The challenges of this study mainly came from its innovative nature which meant the lack of any similar research in the field of architecture. The problem of pattern formation with a swarm of robots is still a hot topic in the field of robotics and it majorly has yielded the forming of simple graphical or geometrical patterns, line formation, and clustering. The swarm robot types that have been used in the literature are all small circular robots that act like points in a space which makes building different shapes with them a lot easier. In addition to the challenge of changing the design of the swarm to fit into the creation of practical architectural layouts, a multitude of other challenges like considerations about the area, spatial adjacency, spatial relationship, circulation and flow of space users, the timing of task initiation, the transition states between each new robot state and task, task division, the degree of local and global knowledge of each robot, space navigation, and navigation system had to be taken care of.

The current study, analyzed different existing methods to create flexibility in architecture and tried to implement them in the methodology process. As explained in the previous chapters, the outcome of the experiments suggests that using a fully autonomous swarm robotic system in architecture to build various spatial configuration is neither ideal nor efficient. Therefore, use of a hybrid system with some degree of human control is suggested to achieve more optimal outcomes.

This study, was able to setup and run simulations for possible architectural layout configurations by the designed swarm robots, on Python, on an abstract level. However, the research aims to now contextualize the findings of the previous steps in real life scenarios, which will be the focus of this thesis from p4 to p5. The process will start by giving an architectural plan to multiple architects and ask them to draw hand sketches of their desired spatial configuration within the given flooplan. The floorplan, is then given to the algorithm which programs the robots to build that particular configuration automatically everytime without the need to change the setup for each drawing.