Towards minimizing space-time conflicts between site activities using simple generic algorithm – the best execution strategy

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Construction planners on every project are faced with a unique task of spatially organizing site activities with effective space utilization. This is a crucial planning exercise that if effectively rehearsed then can attribute to increased workers productivity, minimized construction accidents, improved delivery of project on time. One of the major issues in traditional project management tools is that they do not convey workspace occupied as the project progresses as well as space availability and needs. This paper presents a research investigation based on using generic workspace strategies which extends related research and analytical tools dealing with project space-time planning. In particular, a 4D (3D + time) visualization system has been developed which embeds simple Genetic Algorithm (GA) to search for the best execution strategy to optimize workspace conflicts between activities. The optimization approach specifies the main structure of a simple GA model to derive solutions near optimal (i.e. best execution strategies). The main three semantics of a construction activity execution used in this work mainly: (1) execution of work direction, (2) the activity work rate distribution type, and (3) quantity of work per week. It should be mentioned that these semantics were encoded within the genetic string structure for the chromosomes to achieve the effect of altering the execution pattern in search of minimum workspace usage. Among the other generic space strategies included is the product Assembly Sequence Constraints (ASC) which governs the construction logic dependencies. The work presented here concludes that the definition of an activity's execution pattern semantics is an important element in next generation 4D visualization tools. It plays a major part in facilitating realistic visualization and is an important feature to simulate interaction between site activities shaping the site in different ways. Further benefit of such approach is the ability to rehearse different 'what if' scenarios for coordinating site activities and to allow planners to better communicate project schedules. The difficulties and the opportunities that are addressed by the development of a visual planning 4D tool in this research are recognised. The paper presents an experimental execution patterns simulation run with results, and shows how they are used to minimize space-time conflicts. Finally, the paper highlights the added value from using the VRML approach, as there is greater demand for integrating CAD with VR technology.

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