Improving & Modernizing Construction

- **Construction projects** [1]:
  - 40% are late
  - 50% over budget
  - 30% fail to meet expectations

- **Rework** [2]:
  - costs 5% to 20% of the contract value
  - contributes to 52% of the cost growth
  - increases the schedule overrun by 22%

50% of the rework due to design changes
Demand for Visualization of the Final Outcome

- Error Reduction
- Time Efficiency
- Cost Reduction
- Customer Satisfaction
Building Information Modelling (BIM)

Benefits:

• Improved coordination
• Clarity in task requirements
• Reduction in inconsistencies
Augmented Reality (AR)

Microsoft Hololens:

- Head-Mounted Display (HMD) unit or a Wearable Windows 10 computer
- The user can interact with holograms using gestures or voice commands
- Creates a 3-D model of the surrounding environment
Problem Statement

• Exterior envelope
• Isolation of every floor
• Creation of Holograms
Use Case (AMC)

• 127 MB
• 778,000 faces
• Extensive U shape
Semantic Isolation of Every Storey

- Iterative process
- Identification of relationship among entities
- Grouping of the entities of the same object
- Writing of the objects that belong to the corresponding floor
Isolation of the exterior part

• Creation of a Bounding Box & its Population with 3D points
• Raycasting & Distance Check
• Inclination Raycasting
• Split of the Model
• Semantical Enrichment

+$CGAL$
Exterior Part: Bounding Box & 3D Points
Exterior Part: Raycasting

End Point

ID_6
ID_5
ID_4
ID_3
ID_2
ID_1

Start Point

Maximum distance

Minimum distance

ID_1
ID_6
Exterior Part: Inclination Raycasting
Exterior Part: Inclination Raycasting

Start Point

Several End Points
Exterior Part: Split of the Model
Exterior Part: Semantical Enrichment

Objects Isolated Semantically

Exterior Obtained by the Algorithm
Holographic Scene & Hologram Manipulation
Results: Menu
Results: Floor
Results: Color Highlighting & Metadata Visualization
Results: Grow Functionality
Results: Rotate Functionality
Results: Transportation of the Hologram
Results: Exterior Envelope
Results: Exterior Envelope
Conclusions

• Intuitive perception of the design

• Precision of the exterior shell depends on the number of points, rays & cores and complexity of the model

• Inclination raycasting facilitates the exterior extraction

• Dynamic interaction with holograms is possible (resizing, rotating and positioning the model)

• Hololens still has certain limitations
Thank You
References


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