Augmented Reality (AR) Enabled Conversational AI for 3D Model Interaction

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Building Information Modelling (BIM): is the process of creating and managing digital information about a built asset (BIM Wiki, 2019).

A collaborative platform for the management of built assets from planning to construction to operation.

In the UK, the government has made it mandatory for Construction organisations to be BIM level 2 compliant.

That is, for any public project, they must always produce a collaborative 3D model of the asset equipped with adequate information to support construction and management of the asset.

However the challenge is that the information embedded in the model are usually not available on site.
Current Challenges

Currently, site workers are provided with 2D drawings

- Error prone with high risk of miscalculations
- Difficult to incorporate and track changes, revisions and update the model
- Lack of support for large scale collaboration on projects, both onsite and offsite

But there is a well developed 3D model of the asset possibly on a machine in the design office or in the cloud (BIM 360)

The major challenge is how to get support information to onsite workers effectively
Proposed Solution

- Integrate 3 key technologies i.e. BIM, Conversational AI and Augmented Reality (AR).
  - Conversational AI – for Voice Interaction with BIM model
  - AR for visualisation of BIM model

- Conversational BIM
Speech Recognition and Understanding e.g. Amazon Lex + AR Display e.g. Microsoft HoloLens + Helmet → Voice+AR enabled Helmet
Development Approach

**AWS Cloud Services**
Lex, Lambda, Polly, S3, Cognito, DynamoDB and Transcribe

**Autodesk Forge**
Model Derivative
Model Viewer
Cloud Storage (BIM 360 Docs)

**Unity**
Unity Reflect
Vuforia for 2D marker upload
UNDERLINING CLOUD SERVICES

- Amazon Cognito
- Amazon Polly
- Amazon Transcribe
- Amazon Lex
- Amazon API Gateway
- Amazon Simple Storage Service
- Amazon Route 53
- AWS Lambda
Demonstration

Query: User request for GFA of the model

Response: The GFA of the model is delivered to the user

Lex extracts the intent and recognizes that user needs model GFA

Lambda pulls the BIM model from Amazon S3 and compute the GFA

S3 stores the BIM model
Project Challenges

Challenges

- Interfacing with Files from Multiple BIM Providers
- Developing a Robust Corpus for Construction Industry
- Integrating Multiple Technologies into a Whole Product

Other challenges are generating precise utterances, intent resolution/conflict management, dynamic population of slot values etc.
Industry Partners

- **COSTAIN**
  - Demonstration Case Studies
  - Stakeholders Workshops
  - Software Testing

- **winvic**
  - Demonstration Case Studies
  - Stakeholders Workshops
  - User Interface Testing and Refinement

- **Geo Green Power**
  - Demonstration Case Studies
  - User Experience Workshops
  - User Interface Testing

- **ENABLE**
  - Cloud Infrastructure
  - Collection and Verification of data
  - Software Testing

- **TerOpta**
  - Cloud Application Testing
  - User Interface Testing
THANK YOU