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Enhancing Utilities Visualisation in Construction Works with Augmented Reality (AR)

- Industry Partner: Gammon Bachy Soletanche Joint Venture
- LTA User: Cross Island Line CR116 (CRL AMK Station) Project Team

Excavation works carried out during construction operations entail inherent risks as underground utilities are not visible from the surface. Any unexpected incident from excavation causing damage to underground utilities could result in major service disruptions.

To investigate and verify the location of existing utilities, trial trenches are typically carried out prior to excavation works to identify the details of the underground utilities, such as the type, depth and width of utilities. Information from the trial trenches is then consolidated into a 2D utility layout plan as a reference.

Image of a trial trench (left) and 2D utility layout plan (right)

Upon verifying the details of the utilities, physical utility markers are used to mark out the location of existing underground utilities. However, there are still limitations to this method of identifying utilities, such as:

- Utility markers may be tampered with, or accidentally shifted;
- Critical information, such as utility alignment, is not clearly displayed;
- Clustering of utility markers within the same area may cause confusion; and
- Utility markers are unable to be installed directly on footpaths and carriageways.

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Image of typical physical utility markers on site

Using Augmented Reality (AR) to Aid Visualisation of Underground Services

To aid the visualisation of underground utilities, LTA explored and adopted the use of Augmented Reality (AR) technology for more efficient identification of utilities on site.

Using the Augmented Visualisation of Underground Services (AVUS) system, the 3D Building Information Modelling (BIM) that was developed from the 2D layout plan, can be uploaded and viewed on site via AR using any mobile device (e.g. smartphones or tablets). This provides convenient access with centimetric accuracy, allowing easy viewing of the utility alignment on site, as compared to conventional physical utility markers. AVUS also provides easier reference of utilities' key parameters.

Image of the AVUS antenna (left) and AR visualisation of utility on site (right)

The AVUS offers several benefits over the conventional method to:

- Alleviate the reliance on typical utility markers installed on site above ground (these have inherent limitations that likely present inaccuracies);
- Easier referencing of the utilities against landmarks on site; and
- Clearer identification of utilities information such as type and depth of utility.