

## ABSTRACT

*Augmented Reality is a technology combines virtual objects. Augmented Reality (AR) is also the latest technology that can be a solution for education can present virtual 3D objects in real form and presented in real time, so as to be able to present abstract concepts more real.*

*In this study, System which is feasible and effective for learning. In making learning applications using marker and markerless technology so that the camera on Android can capture the exact pattern and position. So the system will track shapes and recognize 3D objects. Recognized objects will appear on the android user's screen. In previous studies that only used AR technology using markers. Here added markerless AR technology which no longer requires the use of a marker to display 3D objects.*

*Based on the test results, all functions run 100% properly. With an average MOS value of 4.5 for the display of AR applications, a MOS value of 5 for AR application functions and a MOS value of 4.525 for the benefits of AR applications. The system is able to issue output objects perfectly. Marker recording by the system can be done at a distance of 10 – 100 cm for a marker size of 15 x 10 cm in light intensity in bright conditions making the marker recording process optimal, in dark light intensity the system cannot record the marker. The angle for recording a good marker shows 0° to 45°. AR applications are able to work well on Android smartphones. From the delay test by the AR application, it produces an average overall delay, the smallest delay on average is at an angle of 0° and a distance of 30 cm with a value of 0.59 s, while in low light conditions the smallest average delay is at an angle of 0° and a distance of 30 cm with value 0.65s.*

**Keywords:** *Augmented Reality, Android, Marker, Markerless.*