

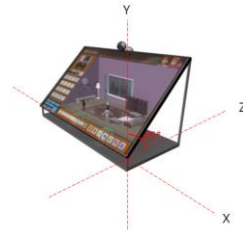








background contents rotation and position so the object maybe in a wrong position as its displayed.



**Fig. 8.** Inclination of TOLED Smart Learning System

$$\begin{bmatrix} X_C \\ Y_C \\ Z_C \\ 1 \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} & R_{13} & T_1 \\ R_{21} & R_{21} & R_{21} & T_2 \\ R_{31} & R_{31} & R_{31} & T_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} = T_{CM} \begin{bmatrix} X_M \\ Y_M \\ Z_M \\ 1 \end{bmatrix} \quad (1)$$



**Fig. 9.** Object Augmented

**3.1.3. Object Control Module.** In this system we using the marker cube for real word environment coordinate recognition and use the real word coordinates data to control the provided contents. In Smart For mobile device user easy to use when touch action received system using formula (2) to remapping user action to system

$$\rho' = \rho + d = T_\rho$$

$$\rho' = \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}, \rho = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}, d = \begin{bmatrix} \alpha_x \\ \alpha_y \\ \alpha_z \\ 1 \end{bmatrix}, T = \begin{bmatrix} 1 & 0 & 0 & -\alpha_x \\ 0 & 1 & 0 & -\alpha_y \\ 0 & 0 & 1 & -\alpha_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (2)$$



Fig. 10. Object Position Control

### 3.3 Cloud Serviced-based LMS System

In this paper, the system we provided, system cloud service structure are followed

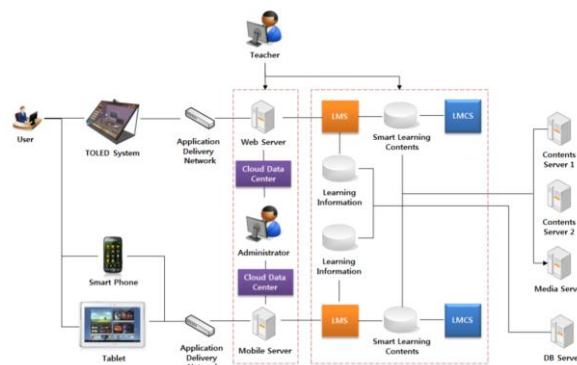


Fig. 11. Structure of Cloud Service

When the user using TOLED smart learning system, mobile device connect to AR smart learning software to confirm user education information from LMS(Learning Management System)[8] via web server and mobile server.

Based on confirmed user education information, the contents server will collected mash data of virtual object form contents database, when contents collection finished the object data will translate object data file to XML(Extensible Markup Language) object[9].

Through the web server and mobile server, the created contents we send to AR smart learning software and use the XML object data to created augmented object and rendered it.

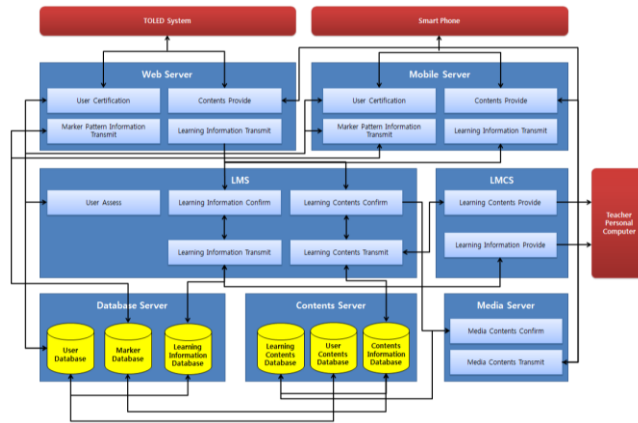


Fig. 12. Issue of TOLED Table



Fig. 13. AR Smart Learning System

## 4 Conclusion

In this paper, we suggest a system with less misrecognition smart learning system of AR-APM, by using advanced marker array detection method. And enhanced illumination environment of TOLED smart learning system to reduced external brightness interference for increase detection efficiency and display transparency.

In addition, user can connect the other user by using LMS system based on cloud service. Then user can using both TOLED smart learning system and the mobile device to connect online education service.

However, in this system if the network connection are not stable, it hard to keep service quality.

Next research project is about enhance rendering computing progress, using cloud server to rendering object for real time rendering data transmission.

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