Enhancing Textbooks using Augmented Reality

Department of CSE
Jyothi Engineering College
Thrissur

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Department Mission & Vision

Vision

- **Creating eminent and ethical leaders in the domain of Computational Sciences through quality professional education with a focus on holistic learning and excellence**.

Mission

- **To create technically competent and ethically conscious graduates in the field of Computer Science and Engineering by encouraging holistic learning and excellence.**
- **To prepare students for careers in Industry, Academia and the Government.**
- **To instil Entrepreneurial Orientation and research motivation among the students of the department.**
- **To emerge as a leader in education in the region by encouraging teaching, learning, industry and societal connect.**

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Our Team

GROUP MEMBERS

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GUIDE

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Github Repository Link
https://github.com/iamrnsh/Group-16

Project Abstract

1. Augmented Reality based Android app that detects the 2D images in the textbook and augments contents like 3D models, videos etc.

2. Providing study materials like notes, presentation, textbooks, etc. in an organised way.

3. The system aims to:
   a. Help students to understand the concepts in the textbook in a short time

   b. To promote self-study among student

   c. To ensure interaction of students in the study process

Project Objectives

1. Reduce **Cost** by utilising resources that are available for free as well as low cost

2. Provide better **Customer Experience** by improving UI/UX of the system

3. Reduce the loading time for modules and thus improve the **Performance** of the system

4. Only necessary information is collected from the user and it only stored in their local devices. Thus ensures the **Privacy.**

5. Collect proper feedback from the users to improve the **Quality** of the system.

- Video lessons of topics provided in a website. Students can access them by scanning the QR code.
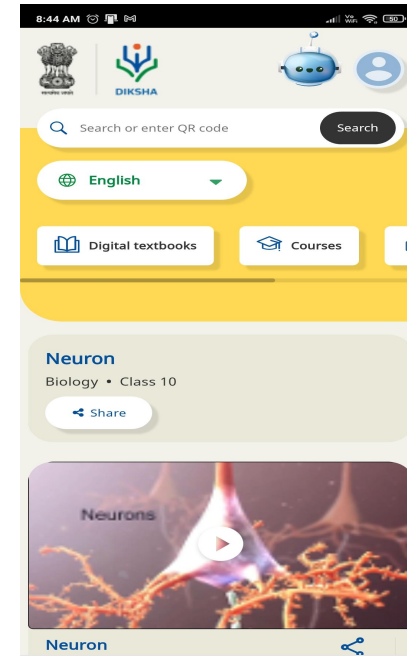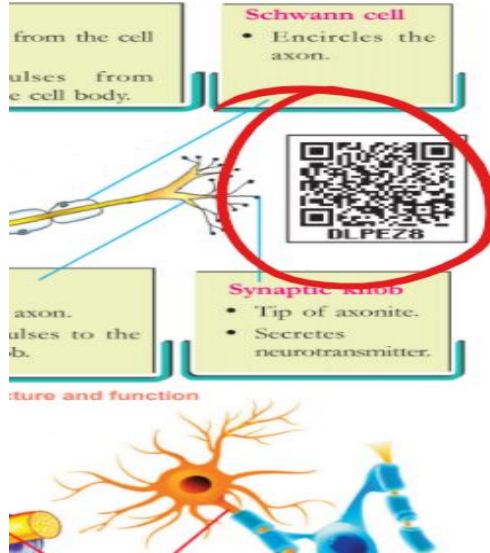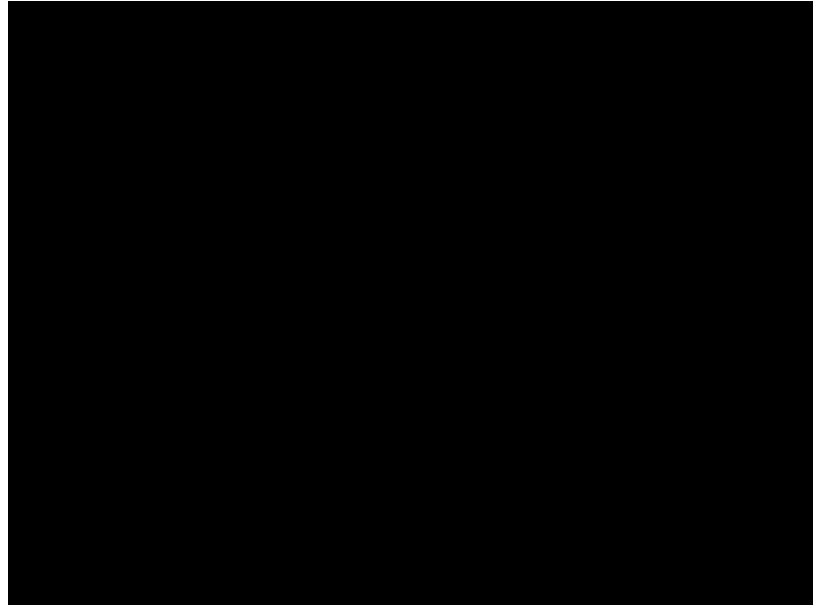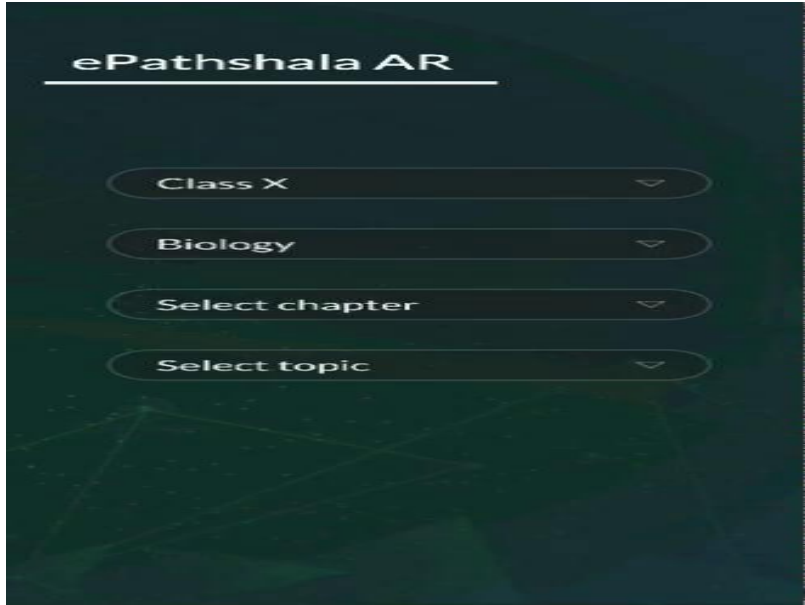
Advantages

1. Students can understand topics through videos
2. QR codes help students to get video corresponding to the topics

Disadvantages

1. Online mode. Students need to connect to the internet every time they want to study.
2. No interaction from students.
3. Contents are unorganised
4. Most people prefer using apps than the website.

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- AR based App that shows 3D models and audios on the top of 2D image in textbook.
- Developed by NCERT with collaboration from Elixar system

Advantages

1. Students can understand topics in more interesting way
2. Students get 3D view of 2D images
3. Audio lesson give more information about the topic

Disadvantages

1. Available only for NCERT syllabus
2. Contents are very low
3. No guides to using the app
4. No other resources like study materials
5. Only for class 9 and 10

"**Education and knowledge based augmented reality (AR)**" by Hamada, Salwa.

1. This paper is mainly deals with augmented reality and also representing a sample AR system for teaching Arabic vocabulary Concepts to children in kindergarten.

2. AR enhances a user's perception of and interaction with the real world.

3. It discusses how AR is different from VR. The concept of AR evolved as an extension or variation of VR.

4. Deals with applications of AR. Mainly focusing on Educational system.

5. Different components of AR : Display and Tracking System, Marker, Mobile Computing Power.

"AR lab: Augmented reality app for chemistry education" by da Silva, Bruno Rogério, J. H. Zuchi, L. K. Vicente, L. R. P. Rauta, M. B. Nunes, V. A. S. Pancracio, and W. B. Junior.

1. In this paper they proposed a novel tool for chemistry glassware learning using AR app for android devices.

2. It shows 3D models of lab flasks with important description about each flask and its use and also features a quiz mode where users can test what they learned and share results with their teacher.

3. The app was developed in Unity with Vuforia SDK.

4. The main purpose of this paper is develop a software, focused on students, which help them to assimilate the equipments used in a chemistry lab and their respective functions.

Literature Study

"Web AR: A promising future for mobile augmented reality—State of the art, challenges, and insights." *by* Qiao, Xiuquan, Pei Ren, Schahram Dustdar, Ling Liu, Huadong Ma, and Junliang Chen.

1. It talks about Various technologies that make Web AR possible

2. It also discuss about various implementation approaches of Web AR like Self-contained approach and Computation outsourcing

3. The challenges in front of Web AR is also discussed

4. The paper compares Web AR with other Mobile AR approaches

Literature Study

"**ARKit and ARCore in serve to augmented reality**." by Oufqir, Zainab, Abdellatif El Abderrahmani, and Khalid Satori.

1. This paper compares the ARkit and ARCore

2. Both of them are AR SDK

3. Apple's ARkit is the SDK is only for developing apps for iPhone, and iPads.

4. Google's ARCore SDK support more device than ARkit

5. We are developing our app using Google's ARCore

CREATING TECHNOLOGY
LEADERS OF TOMORROW
ESTD 2002

"Marker tracking for video-based augmented reality." by Gao, Yan-Fei, Heng-You Wang, and Xiao-Ning Bian.

1. Working Principle of Marker-Based AR

   a. The live video of real scene captured.

   b. Image processing.

   c. If image found (specific shape), it will be matched

   d. Position and direction of camera can be calculated.

   e. Virtual fig is drawn.

   f. Final output - virtual fig and image of real world.

2. This paper explain process of marker-based AR application

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Description of the Proposed system

1. Marker-based AR Android App

2. Developed using Google ARCore

3. Uses Unity 3D to develop the Android app

4. Augmented Image API used in the ARCore

5. There will be other study materials like Notes, videos that can be downloaded and viewed

6. The cloud storage services like Google Drive, Dropbox etc. used for storing pdf, pptx files. The video files are hosted in youtube.

1. The app is based on the SCERT syllabus

2. The user can use the app both online and offline

3. The details of user only stored in their local storage

4. The app available in both English and Malayalam

5. The app ensures user interaction by providing quizzes, points etc.

6. The app running cost is very low
   a. Youtube is free
   b. Cloud storage is cheap
   c. Study materials are already available in various platforms like Samagra, Dhiksha, First bell by It@School etc.

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Functional Requirements

1. The user should be able to download the application from a trusted store for free.
2. The user should be able to update the application either directly from the app or from a trusted store. The user should be notified of this.
3. The user should be able to login to the application. If he/she is not registered there should be an option to that.
4. The user should be directed to the home screen or the dashboard of the application immediately after login for the ease of accessing the features of the application.
5. The user should be directed how to use the application. For that there should be good manuals or proper documentation that can be accessed from the home screen.

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Functional Requirements

1. Allows the user to change to language of his choice.
2. Ask user to access the camera
3. Recognize markers
4. The content corresponding to the markers should be placed on top of the marker
5. The user should be able to access the study materials easily and efficiently from the home screen of the app.

Nonfunctional Requirements

1. Performance Requirements
2. Safety Requirements
3. Security Requirements
4. Software Quality Attributes
   a. Adaptability
   b. Reliability
   c. Availability

Modules

1. **Authentication**
   a. Include processes like sign up and sign in
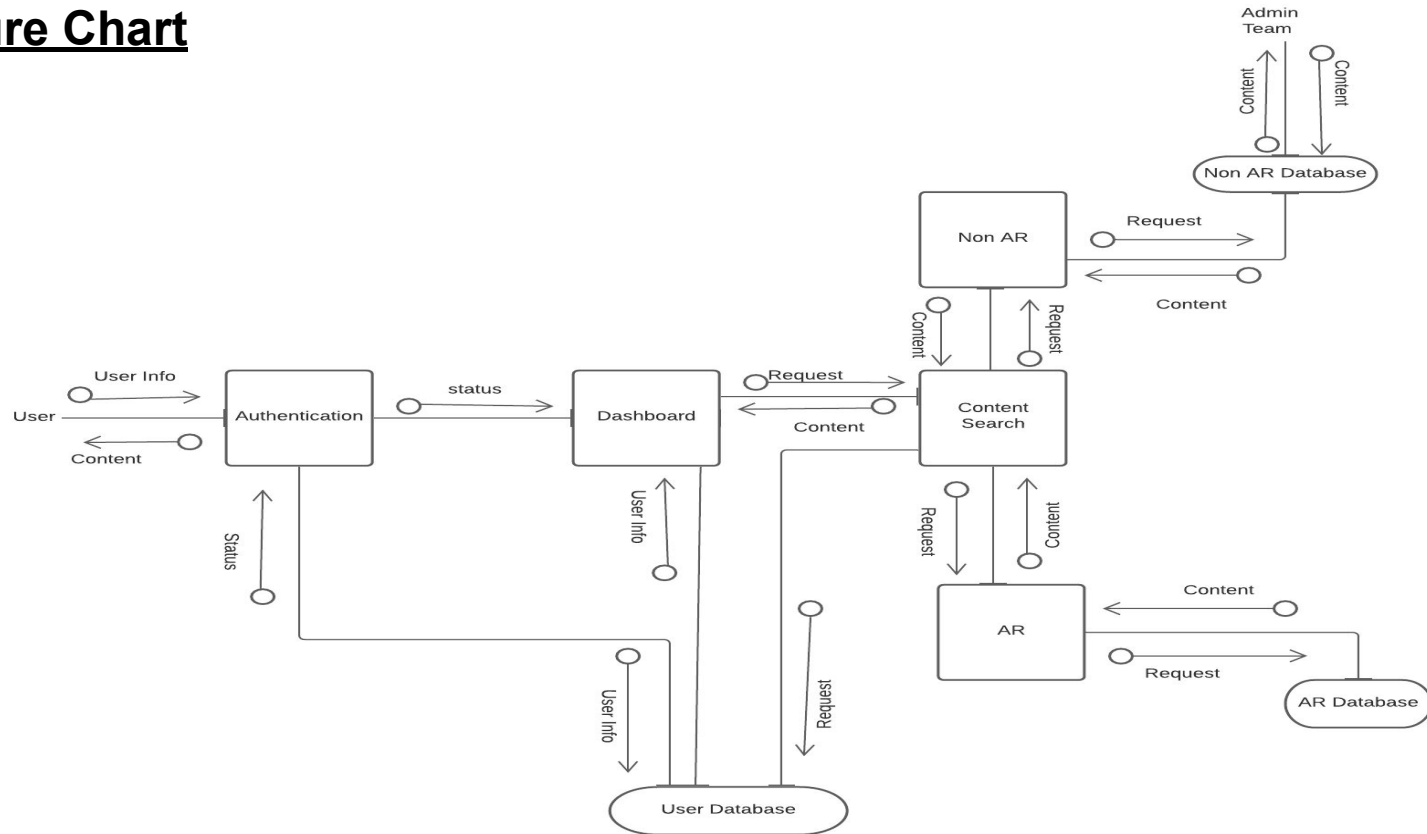   b. Collecting information like class, medium etc

2. **AR Content**
   a. Marker-based AR
   b. Uses Google's ARCore
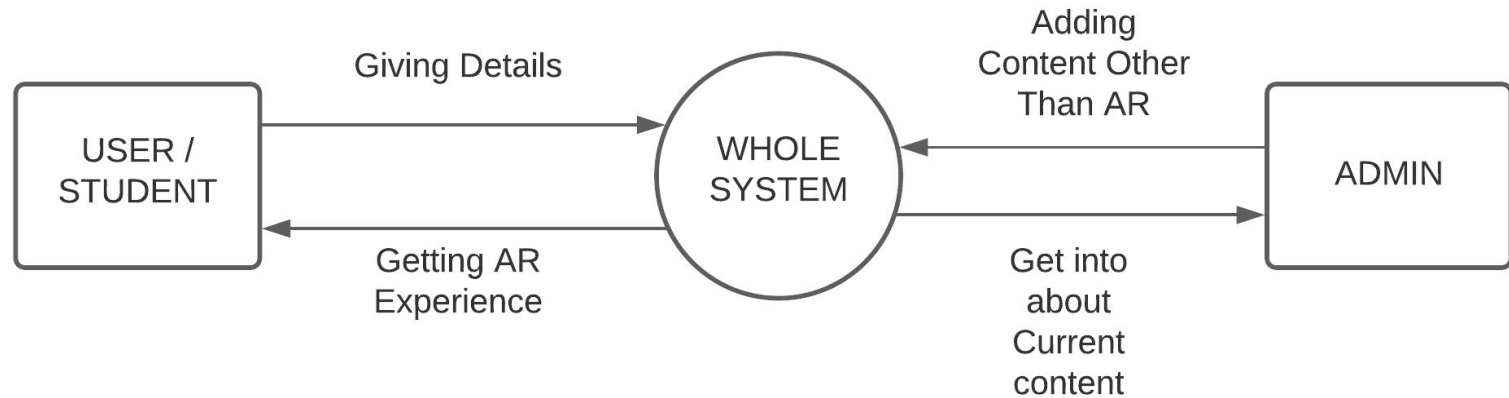   c. Augmented image API in ARCore for marker recognition and tracking

3. **Non -AR contents**
   a. Collecting and linking non-AR contents from various website like Samgra, Dhiksha etc.
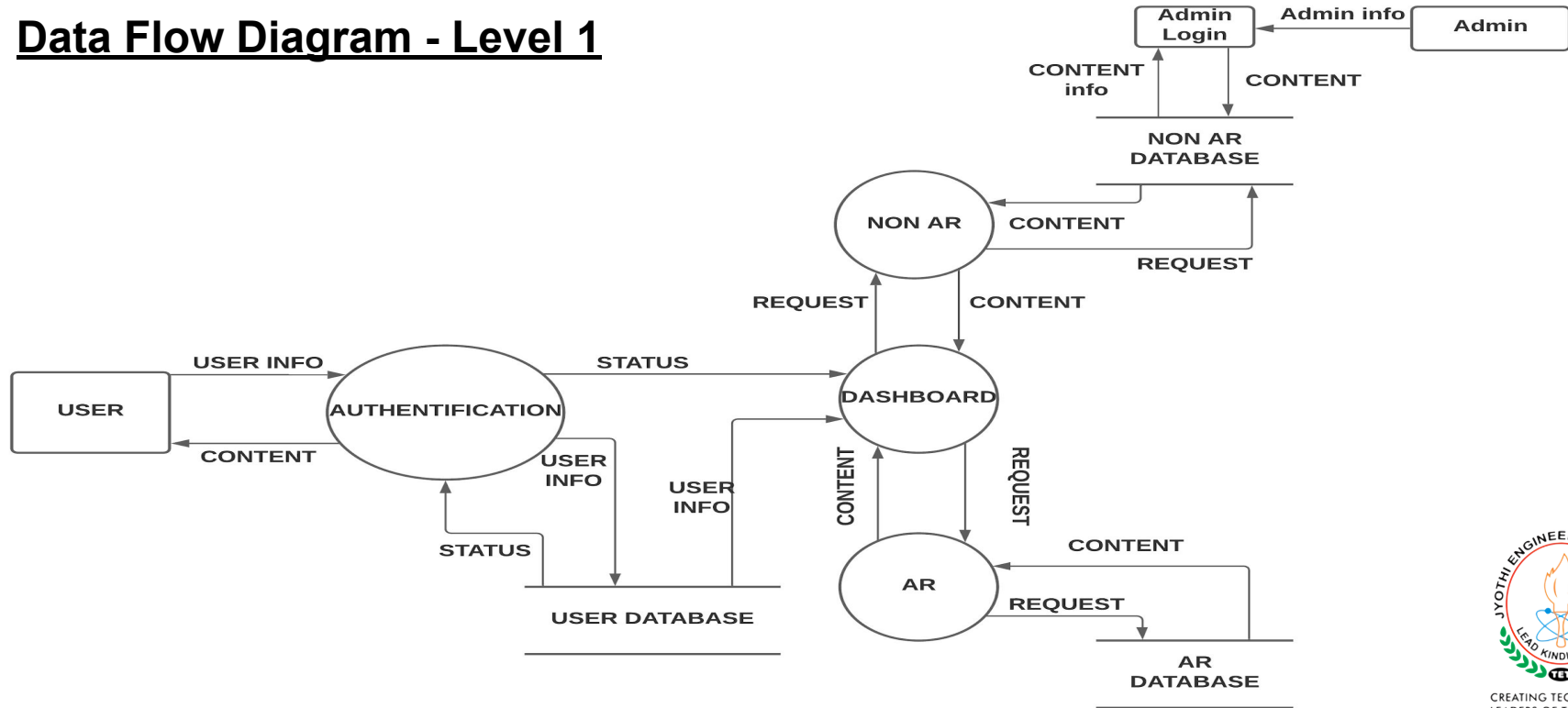   b. Developing a portal for Admins to upload newly available materials
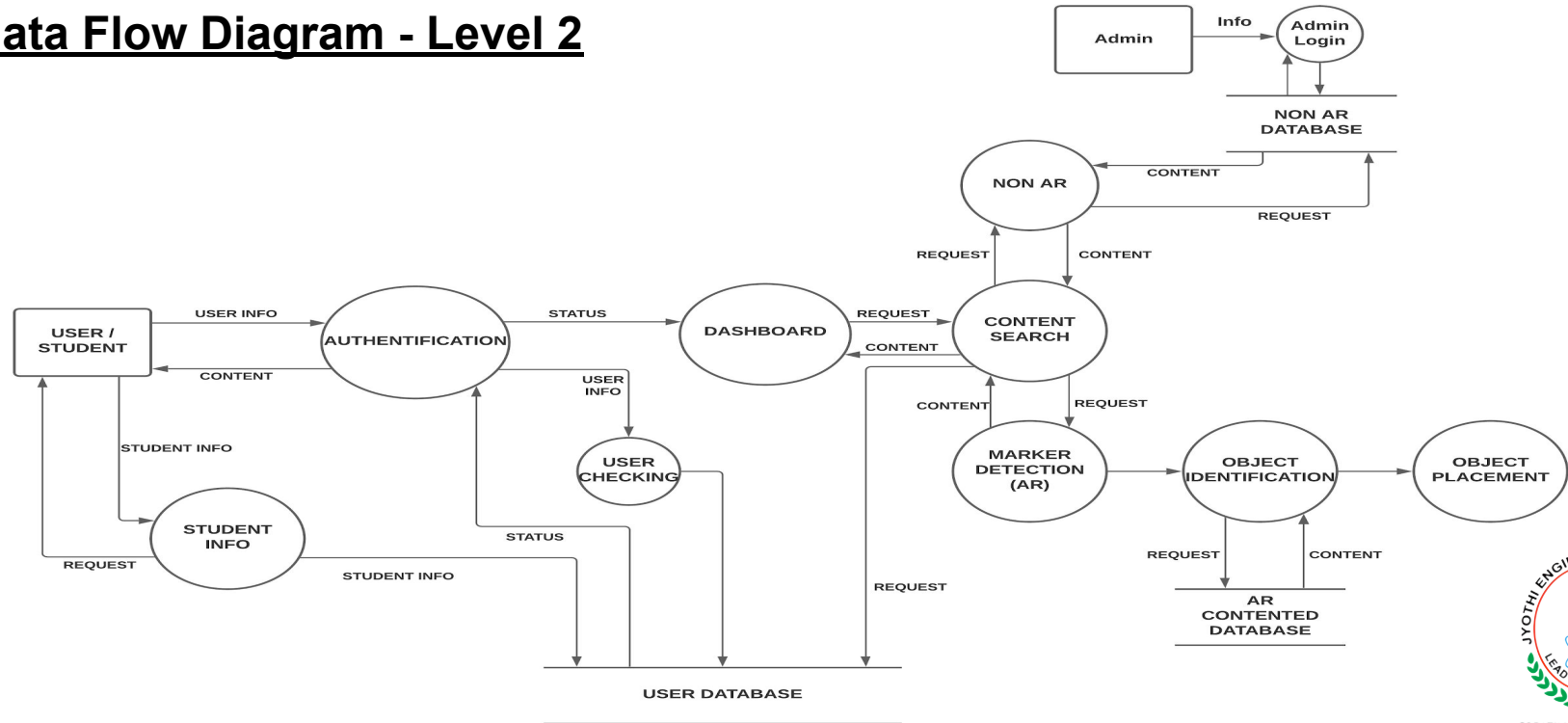
Structure Chart
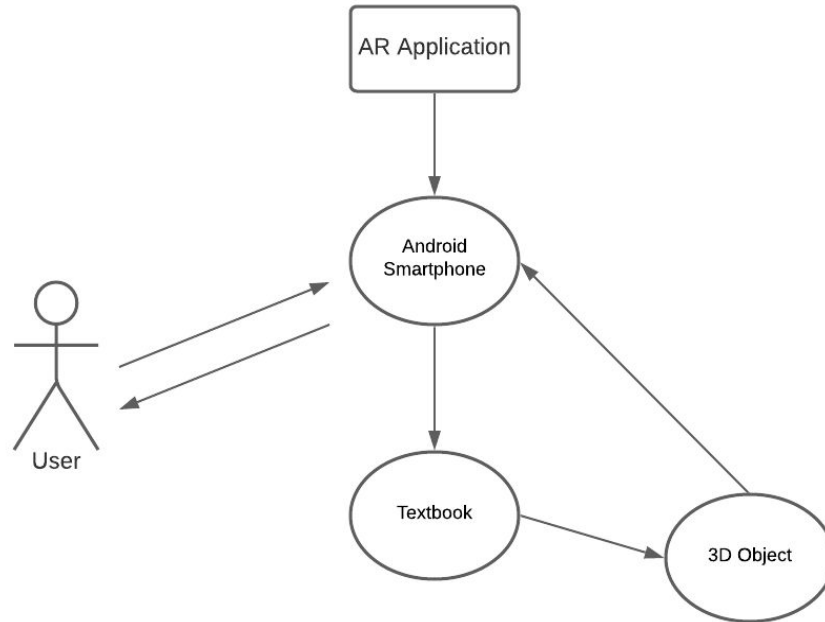
Data Flow Diagram - Level 0

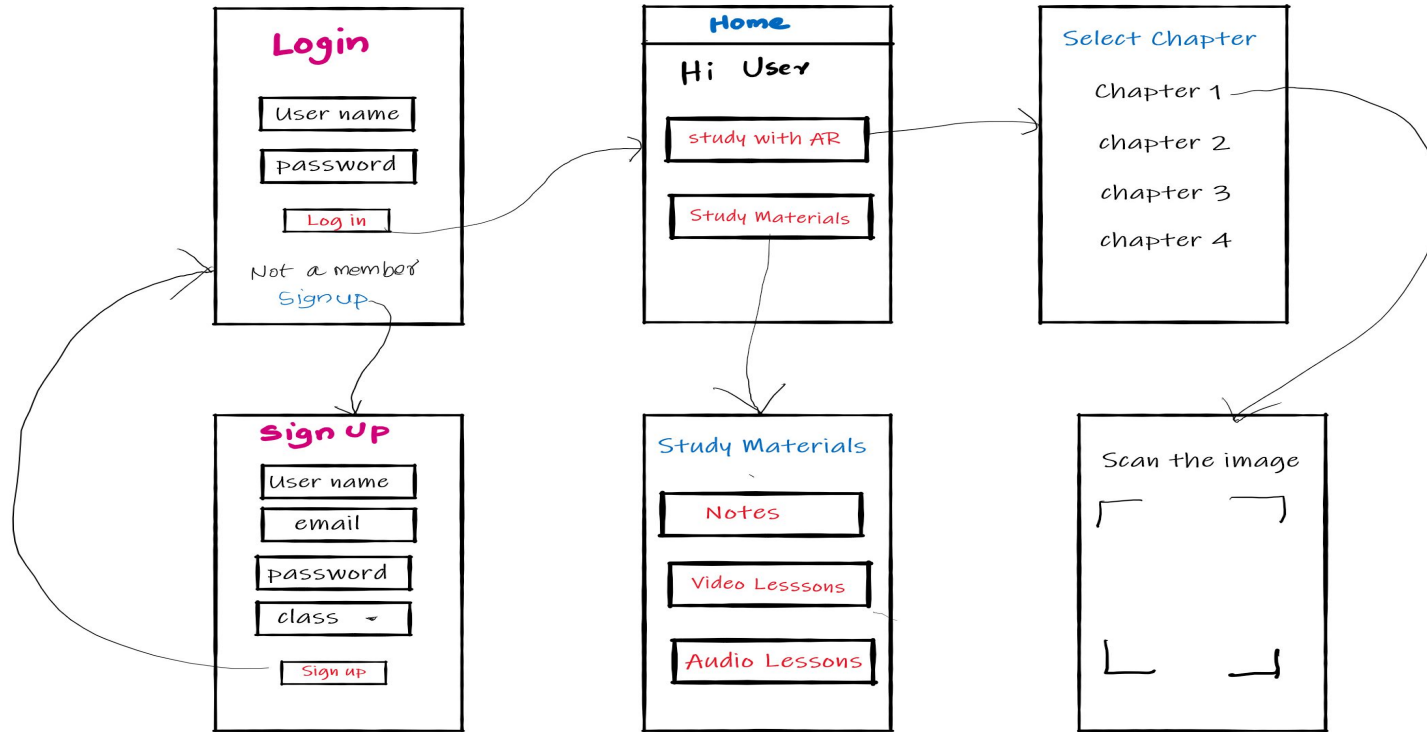## Data Flow Diagram - Level 1

Data Flow Diagram - Level 2

UML - Interaction Diagram

User Interface Wireframe

1. Students able to understand the concept in a short time

2. Students does not want to spend a lot of time to collecting study materials

3. Students able to understand textbook without a guide

COURSE OUTCOMES

- The students will be able to analyse a current topic of professional interest and present it before an audience.

- Students will be able to identify an engineering problem, analyse it and propose a work plan to solve it.

- Students will have gained thorough knowledge in design, implementations and execution of Computer science related projects.

- Students will have attained the practical knowledge of what they learned in theory subjects.

- Students will become familiar with usage of modern tools.

- Students will have ability to plan and work in a team.

Course Outcome							
		C418.1	C418.2	C418.3	C418.4	C418.5	C418.6
Program Outcome	1	3	3	1	3	-	-
	2	3	3	2	3	3	3
	3	3	2	3	2	-	1
	4	2	3	1	3	-	3
	5	2	1	2	3	3	3
	6	3	-	3	2	3	3
	7	2	1	2	3	2	1
	8	—	2	1	1	3	2
	9	3	3	3	1	1	1
	10	3	2	2	3	2	3
	11	2	1	1	3	1	2
	12	1	3	1	3	2	3

Figure: **CO-PO Mapping**

1. Building - Develop the app using Unity 3D and ARCore SDK(Coding).

2. Testing - The products defects are reported, tracked, fixed and retested until the product reaches a quality standard

3. Deployment - Once the product is tested it will be published in the app stores

CONCLUSION

1. Existing System - The textbooks contain QR for video lessons

2. The Proposed system augment 2D images in the textbook with 3D objects, videos, audios etc.

3. Also, each 3D models and video lesson contain interaction from students (quizzes and points)

4. Other Study materials like notes, video lessons, are also provided.

5. The system developed using Google ARCore SDK and Unity 3D engine.

REFERENCE

1. Riya Aggarwal and Abhishek Singhal.-"Augmented reality and its effect on our life" in 2019-2020 International Conference on Intelligent Systems and Computer Vision (ISCV),pages 1–7. IEEE, 2020.

2. Xiuquan Qiao, Pei Ren, Schahram Dustdar, Ling Liu, Huadong Ma, and Junliang Chen."Web ar: A promising future for mobile augmented reality—state of the art, challenges, and insights.",Proceedings of the IEEE, 107(4):651–666, 2019

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4. Salwa Hamada - "Education and knowledge based augmented reality (ar)", in Intelligent Natural Language Processing: Trends and Applications, pages 741–759. Springer, 2018.

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Thank You

Any Query?