

## **Remedial Module with Augmented Reality Application and IoT Monitoring for Remedial Students**

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**Abstract** : This trend shows that more students and teachers switch or adapt the learning method from a direct close-up in class into a whole virtual online style. This internet of things (IoT) technology can interact and connect with all electronic devices, thus reducing the inaccessibility gap towards other people far away from us. Remedial Education Program (REP) is one of the initiatives from the Ministry of Education (MOE) Malaysia that focus on helping remedial students that have a problem in reading, writing, and counting. Inside REP, the main crucial subjects in this program are the Bahasa Melayu, English, and mathematics. As for this case, the Bahasa Melayu is the one that will highlight. Remedial teachers that well train use the Guidebook as one of their sources to teach remedial students to overcome their problems. The objective is to create and analyze the effectiveness of the learning application towards remedial students and store and monitor the data results of that learning application through the cloud. Remedial Module Augmented Reality (ReModAR) application has two main menus for the remedial students to learn while playing with the modules which is the Pembelajaran and Pengujian. ReModAR idea comes from the collaboration with remedial teachers in the selected area around Batu Pahat, Johor, and PPD Batu Pahat. REP needs a new kind of interactive platform to cater to a different method to teach remedial students. ReModAR learning application has a conducive system of interactions that any user can use. Support for the android platform, ReModAR can easily be downloaded and install for any devices that use

the Android platform in general. Increasing the learning capability with the aid of psychomotor will guarantee the enhancement of remedial students learning and understanding. This learning application's friendly interface is easy to understand for the remedial students and kindergarten or usual primary school students.

**Keywords:** Remedial Education Program, Augmented Reality, Remedial Module Augmented Reality (Remodar)

## 1. Introduction

Education in Malaysia achieves a significant enrollment of about 90% throughout the year in every level of education. This shows that the education system introduced by the Ministry of Education (MOE) Malaysia can adapt to the change of a different generation to fit with their level of understanding. Without proper education, the idea to develop a nation will not be able to realize [1].

These days, the trend shows that more students and teachers switch or adapt the learning method from a direct close-up in class into a whole virtual online class. These trends happen because we have the proper technology like the internet of things (IoT) and the pandemic Corona Virus Disease (COVID-19). These IoT technologies can interact and connect with all electronic devices, thus reducing the gap of inaccessibility towards other people even though there are far away. While there is a pandemic, the learning can continue as usual with the assist of IoT [2].

## 2. Methodology

Using open-source software like Unity 3D, Vuforia, and Blender, the development of learning application becomes more accessible and painless to take for a task where Unity 3D is a platform to develop software or games. The Vuforia is the augmented reality (AR) software development kit that can support Unity 3D [3]. In contrast, the Blender creates a 3D object that suits the content inside the learning application. The learning application called ReModAR can be used or installed just for the android momentary due to still in a testing stage. ReModAR has two main menus for the remedial students to learn while playing the *Pembelajaran* as in Learning and *Pengujian* as in Testing. *Pembelajaran* contains selected modules based on skills in Figure 1(a) [4]. And it has AR marker cards to pair. As for *Pengujian*, users are exposed to a puzzle game's question type from the module to measure the learning effectiveness when they learn from *Pembelajaran* [5]. Both menus can tell remedial students to an interactive and user-friendly interface that suits remedial students' needs. ReModAR used AR marker cards thanks to the Vuforia and made learning more joyful and easy to understand. Figure 1(b) shows the flowchart of the development process to create ReModAR in a sharp point [6].

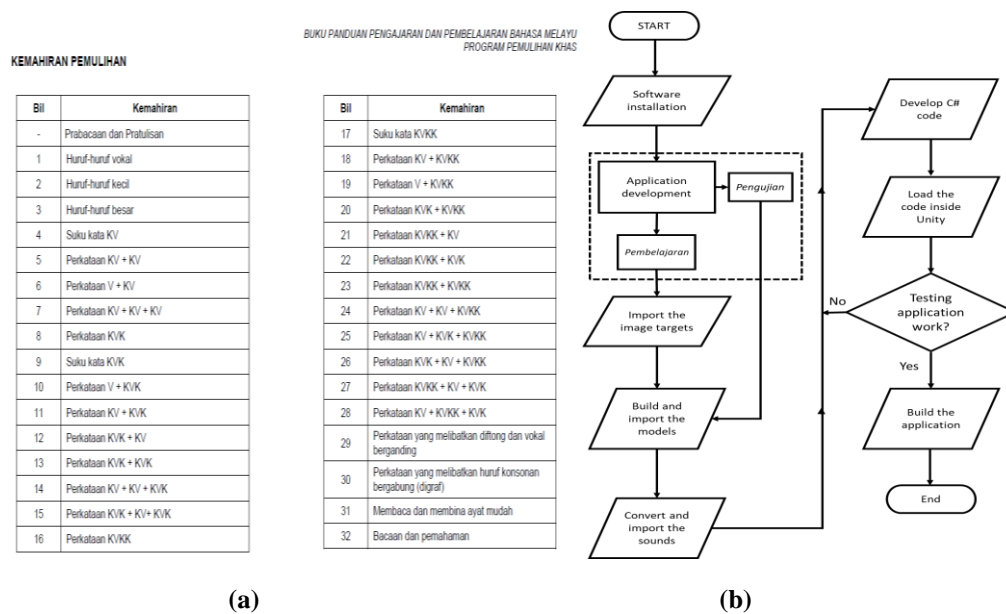


Figure 1: (a) List of skills inside Guidebook, (b) Development Process to Develop ReModAR

### 3. Results and Discussion

Figure 2 shows the interface of the ReModAR learning application where each menu has four modules. All of these modules are playable, and the user can select by scrolling to choose or touches the buttons. ReModAR's interface is relatively easy to use, even for children. The application also has a unique musical background that suits the hearing and additional haptic feedback whenever the user is pressing the menu or button, which helps increase the remedial students' awareness.



Figure 2 : (a) Scrolling button in *Pembelajaran*, (b) Main Menu, (c) Selectable button in *Pengujian*

For the *Pembelajaran*, the module has its group AR marker cards that can interact when these cards point at the camera. It will display or pop-up the 3D object that looks similar to those cards and has a button to activate audio of how the object spells and the sound effect. For the *Pengujian* menu, the game's question is based on the object that learns in *Pembelajaran*, and the user can drag and drop the alphabet that suits with image object given. The time is used to measure how much time is taken to answer each question, and it soon displays at the end of the question as shown in Figure 3, which will show as a score and also the user can also play the same question again if they want to or select a new one module to play.

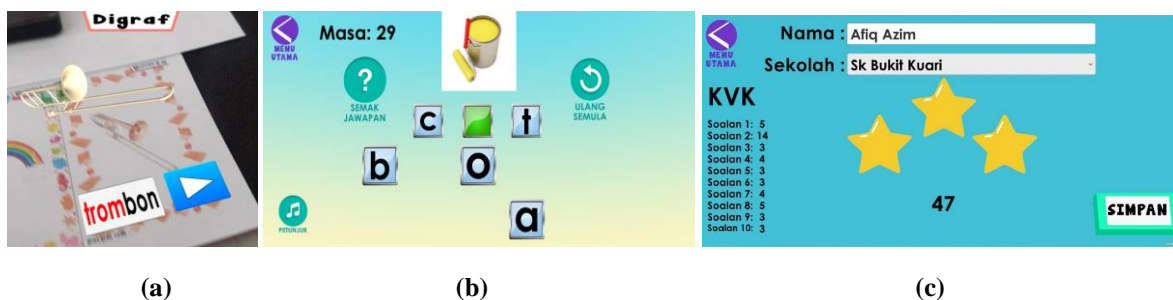


Figure 3: (a) 3D object pop-up, (b) Question in *Pengujian*, (c) Score Menu

For the testing towards remedial students, the answer's score for *KVK* results can be saved by fill up the user's name and which school are from, then press *simpan* to save it. The results now stored and can monitor just from the cloud provider thanks to the phpMyAdmin. The additional scores result can also been seen in Figure 4 which include *Digraf and KVKK* [7].

Delete	ID	Sekolah	Nama	Ujian	1	2	3	4	5	6	7	8	9	10
Delete	157	Sk Seri Bengkal	Nurul Fatin Nabilah	KVK	5	9	34	8	4	18	28	7	8	23
Delete	158	Sk Seri Bengkal	Muhammad Asyraaf Danisb	KVK	7	8	12	8	6	65	9	6	6	20
Delete	159	Sk Seri Bengkal	Adam Haziq	KVK	14	22	62	23	11	29	15	17	21	28
Delete	160	Pilih Nama Sekolah	Nur Farhah	KVK	11	31	7	8	8	7	9	5	11	8
Delete	161	Pilih Nama Sekolah	Nur Farhah	Digraf	5	3	3	8	8	5	13	3	2	2
Delete	162	Pilih Nama Sekolah	Alicia Beatrice Ak Runie Bunyau	KVK	7	7	9	10	4	11	12	5	7	6
Delete	163	Sk Pintas Puding	Alicia Beatrice	KVKK	6	8	5	6	6	9				
Delete	164	Sk Pintas Raya	Alicia Beatrice	KVK	5	3	2	5	5	3	3	4	5	5
Delete	165	Sk Seri Bengkal	Alicia Beatrice	KVKK	8	6	6	5	6	7				
Delete	166	Sk Pintas Raya	Muhammad Rafiq	KVKK	13	16	10	9	10	22				

Figure 4: Score's results that stored in phpMyAdmin

#### 4. Conclusion & Recommendation

This project can develop and demonstrate the learning application for the remedial students to use while learning. It shows how many remedial students like to use this learning application and learn something from it. A 3D object that pop-up during the scan of the AR marker cards resulting in the vital memorization of what the remedial students learn in a short time; thus, it also helps by how the object sounds in real life and how the object is spell-like. The ReModAR had the potential to expand by adding a new learning module based on the Guidebook and the ReModAR not just limit at remedial students but can also be played by kindergarten or primary students [8]. The cloud system itself can be more enhanced in terms of the results submission times can be seen at the cloud, more optimized in their system, and supported not just on the android platform.

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