MTSFB TR 013:2023

TECHNICAL REPORT

AI-IoT BASED INTERACTIVE CHILDREN EDUCATIONAL APPLICATION

Preface

Malaysian Technical Standards Forum Bhd (MTSFB) has awarded Universiti Teknikal Malaysia Melaka the Industry Promotion and Development Grant (IPDG) to implement the Proof of Concept (PoC) of the AI-IoT Based Interactive Children Educational Application. The duration of this PoC is for 10 months starting April 2021. The PoC is carried out in Little Caliphs Ayer Keroh.

This Technical Report outlines the objectives, benefits, scope of work, methodology and result analysis.

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Abbreviations

For the purpose of this Technical Report, the following abbreviations apply.

AI	Artificial Intelligence
App	Application
ID	Identification
IoT	Internet of Things
LC	Little Caliphs
LED	Light Emitting Diode
MCO	Movement Control Order
SOP	Standard Operating Procedure
TV	Television

AI-IoT BASED INTERACTIVE CHILDREN EDUCATIONAL APPLICATION

Executive summary

Early children educational offers opportunity to stimulate children's mind in a fun way. Children tend to get bored faster especially when they are not involved in an active learning session. Mobile devices may be an obvious way to attract children's attention. However, integrating this technology in the learning process is not easy. Some kindergartens that were equipped with mobile devices only uses YouTube in the learning process in classroom. Thus, this Proof of Concept (PoC) was introduced to enable interactive learning session for children.

This PoC uses deep learning Artificial Intelligence (AI) based on image classification and object detection to develop vocabulary and mathematics skills enhancement application with the integration of Internet of Things (IoT) platform. AI-IoT application which embedded into the PoC has the potential to revolutionize how the children learn especially in early education. This PoC allow the children need to physically move and interact with their environment to complete the tasks. All the activities done are recorder in the cloud which can be monitored through the database management application.

This PoC achieved more than 90% accuracy for each category. As a conclusion, the children are able to fully utilise the current technology with an interactive learning session instead of using other passive applications in the market. For future work, this PoC can be part of IoT use cases in standards development and more features can be added to cater for special children and other education levels.

1. Background

The innovation of an AI-IoT Based Interactive Children Educational Application called 'Learn with IMAN' is intended for usage in educational sector which focus on the early childhood education. It can help to stimulate children's brain with the concept of 'play' and 'learn' with an interactive application. Learn with IMAN is an Android application integrated with AI and through IoT platform. The purpose of Learn with IMAN is mainly to involve children with a fun and interactive implementation of learning process through exposure of technology without being affected by gadget addiction problem.

During the Movement Control Order (MCO) due to COVID-19 pandemic in year 2020 and 2021, most kindergartens offer online learning, where the children learn by themselves at home through online platforms such as Google Classroom, Telegram, etc. However, the focus of the children is no longer the same as learning in classroom with their teachers and friends.

In view of the strict Standard Operation Procedure (SOP) in the kindergartens which limited the activities of the children, they are not allowed to play and learn amongst them like they used to. It is crucial to prepare for any possibilities and online learning that can be considered as the new normal. Thus, an educational mobile application that is integrated with AI and IoT platform was developed, which will allow an interactive learning session in the classroom and even at home. This system consists of 2 types of applications and the reward system.

The first application is a quiz application called as Learn with IMAN for children with 2 different modules which are vocabulary and mathematics that related to various topics. The second application is a management application called as IMAN Management App that is specifically for teachers to manage students' account, monitor children's progress and rewarding them for their achievement. The reward system is a physical device connected to the applications that dispenses rewards to students who success in answering the quiz given.

2. Objective

The objectives of the PoC are as follows:

a) to develop an interactive educational application that uses AI Deep Learning Image Classification and Object Detection Models based on the kindergarten's syllabus;

b) to integrate with the IoT platform for reward system and student's progress monitoring; and

c) to implement and study the effectiveness of the developed application for the usage during the classroom session and home learning.

3. Target groups and benefits

No	Target groups	Benefits
1	Children	To help control gadget addiction caused by the passive application where the children need to actively move around and interact with the environment while completing the tasks
2	Kindergarten	To provide an interactive learning platform for the children which integrates current technology and student-teacher interaction
3	Parents or guardians	To assist parents and guardians in providing a proper education materials and activities for the children at home

4. Scope of work

The site selected for this PoC was Little Caliphs (LC) Ayer Keroh, Melaka. This site is selected because LC has 18 years of experience in the industry focusing on children development through a balanced learning process with formal and informal learning, which is aligned with the PoC's objectives. The duration of this PoC is for 10 months starting April 2021.

Validation exercise was conducted as well in LC kindergarten with involvement of students, parents and teachers. About 30 students in total from 4 to 6 years old are involved during the testing and validation process.

The scope of work includes:

a) to develop an educational mobile application using Android Studio with a fun and user-friendly interface;

b) to develop the educational application content based on LC Ayer Keroh syllabus;

c) to develop the first module of vocabulary using the AI deep learning approach image classification model;

d) to develop the second module of mathematics using AI deep learning approach object detection model;

e) to integrate reward system with IoT platform and real time monitoring by the teacher; and

f) to study the effectiveness of the developed application for the usage in the classroom session and home learning.

5. Methodology

5.1 System architecture

Learn with IMAN system architecture is shown in Figure 1. The architecture includes the development of the application to the IoT integration.

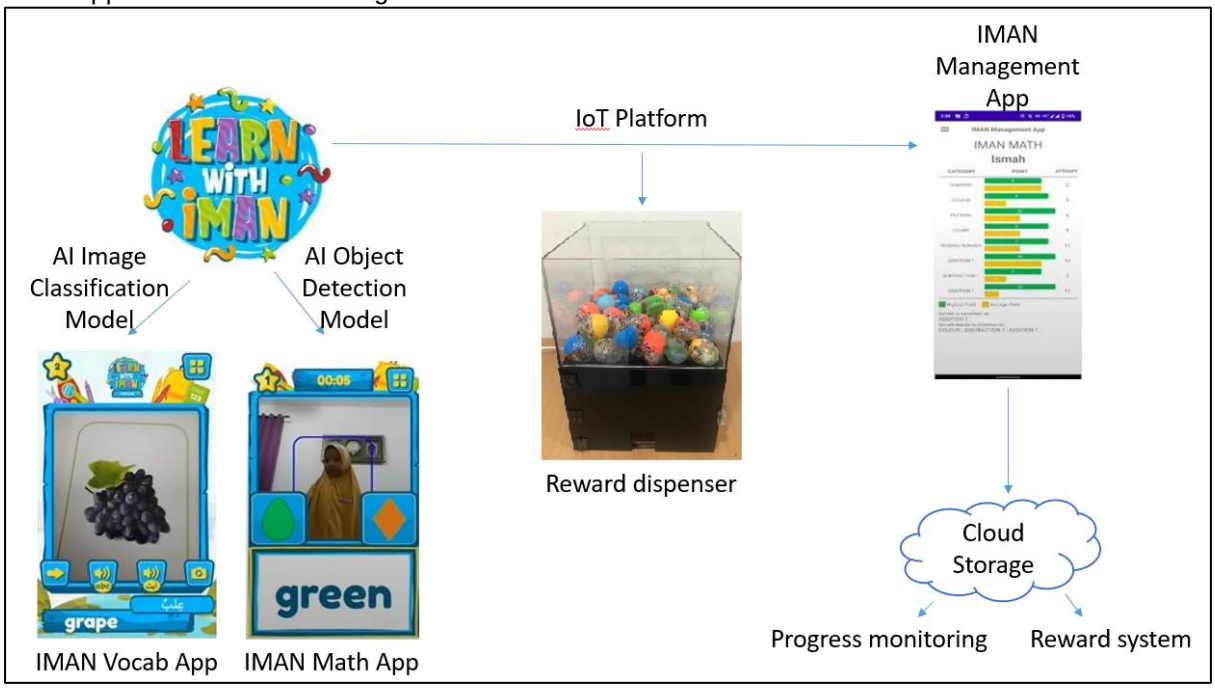


Figure 1. Learn with IMAN system architecture

Figure 2 illustrates the block diagram of the project which involves the integration of IoT and AI structure.

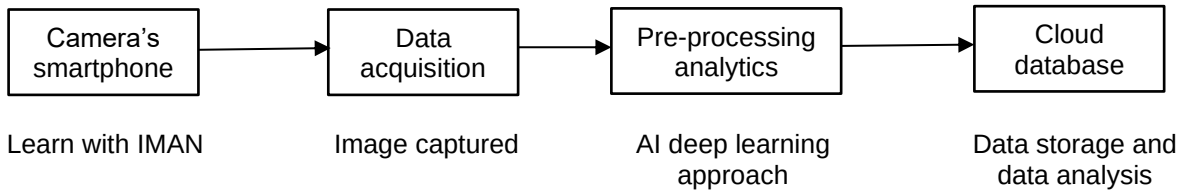


Figure 2. AI-IoT integration structure

The IoT architecture used in this system is divided into 3 layers which are the application layer, network layer and physical later. In application layer, it involved 2 applications which are Learn with IMAN application and IMAN Management App. Android platform is chosen for the application development of this PoC for its huge user base and more affordable devices, while TensorFlow is used to train the deep learning model. TensorFlow is an end-to-end open-source platform for deep learning that will be used to enable the AI ability of the application. 2 different modules are developed based on the image classification and object detection models, namely IMAN Vocab App and IMAN Math App. The trained models are integrated with the mobile application. Learn with IMAN is installed on children's smartphones or tablets while IMAN Management App is installed on teacher's tablet. Both applications communicate with each other through the network layer.

The network layer is responsible for connecting the application to the Google Firebase as the PoCs' cloud database. Firebase provides reliable, scalable and real-time data synchronisation and secure

cloud database solution that can handle the demands of an educational system. All of the activities done by the students through Learn with IMAN App will be immediately synced to the cloud database, which can be accessed through the IMAN Management App.

While the physical layer consists of the reward dispenser that is connected to the network layer via Bluetooth. Once the children completed answer the question correctly, the IMAN Management App send the signal to the reward dispenser to dispense the reward for the children to collect.

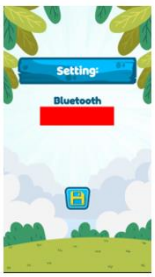
5.2 First module: IMAN Vocab App

Image classification is a process of predicting what an image represents. With enough training data, which often up to thousands of images for each class, an image classification model can learn to recognise any images if they belong to any classes that it has been trained on. The first module is developed for vocabulary enhancement. The kindergarten syllabus is used to specify all the item names needed for the application. Almost a thousand images for each item were collected and deep learning technique for image classification is applied to train the model to recognise the classes based on the specified items. Then, the model was integrated with the application to give the AI the ability for the application to recognise all the items specified.

This module is divided into 4 key interfaces as shown in Table 1.

Table 1. IMAN Vocab App key interfaces

No.	Interface	Description
1	Login authentication 	The children need to log in to start the application. The teacher needs to register the students' names through the IMAN Management App. Identification (ID) and passcode will be provided for the children to log in.
2	Main interface 	The category of each theme is shown. The content is developed based on the LC Ayer Keroh's syllabus, where they have different themes for each month of the year.
3	Setting interface	This setting is to enable the Bluetooth connection to directly connect to the reward dispenser.

		
4	Learning interface 	The vocab of each item appears in both English and Arabic languages. The user needs to pronounce the item before starting to find the item requested. The beep sound indicates the wrong answer, while the compliment sound indicates the correct answer.

The contents of the first module, IMAN Vocab App is categorised into 10 themes. Each theme contains 10 items. The module is based on the syllabus of LC Ayer Keroh as shown in Table 2.

Table 2. The content of IMAN Vocab App

No	Theme	Item
1	Body parts	Ear, elbow, eye, feet, hair, hand, lips, nose, teeth and tongue.
2	Vegetable	Bell pepper, broccoli, cabbage, carrot, cucumber, eggplant, onion, potato, pumpkin and tomato.
3	Fruit	Banana, corn, grape, mango, pineapple, star fruit, strawberry, watermelon, apple and orange.
4	Food	Bread, cake, candy, chicken, chocolate, egg, ice cream, milk, pizza and sausage.
5	Home	Oven, pot, refrigerator, spoon, stove, toaster, bowl, cup, cutting board and kettle.
6	Classroom	Bin, chair, chalk, clock, duster, fan, file, marker pen, table and whiteboard.
7	School bag	Book, eraser, pen, puncher, ruler, school bag, scissor, sharpener, stapler and paper clip.
8	Animal	Cat, cow, crab, duck, elephant, fish, giraffe, horse, rabbit and snake.
9	Occupation	Astronaut, chef, doctor, engineer, farmer, fireman, judge, pilot, police and soldier.
10	Transport	Aeroplane, bicycle, boat, bus, car, helicopter, hot air balloon, lorry, submarine and train.

The children need to capture the image of the items using the phone or tablet's camera. The application will recognise the captured image and notify the children whether it is the correct answer or not.

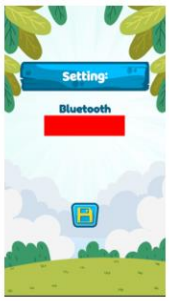
5.3 Second module: IMAN Math App

The second module focuses on mathematical skills enhancement used AI deep learning object detection model. An object detection model is supposed to detect if a known object is recognised as present and its location in a frame. The model will be trained using transfer learning techniques to recognise a person. The device's front camera is used to detect the children's movement using this model.

This module is divided into 4 key interfaces as shown in Table 3.

Table 3. IMAN Math App key interfaces

No.	Interface	Description
1	Login authentication 	The children need to log in to start the application. The teacher needs to register the students' names through the IMAN Management App. ID and passcode will be provided for the children to log in.

2	Main interface 	The category of each theme is shown. The content is developed based on the syllabus of LC Ayer Keroh, where they have different themes for each month of the year.
3	Setting interface 	The setting is to enable the Bluetooth connection to directly connect to the reward dispenser and to select the number of questions.
4	Learning interface 	The children need to answer the question by moving to the left or right.

The IMAN Math App is categorised into 10 different themes. The questions of each theme will appear randomly, depending on number of questions being configured in the setting interface. The themes are based on the mathematics topics learned in LC Ayer Keroh as shown in Table 4.

Table 4: The content of IMAN Math App

No.	Theme
1	Count
2	Missing number
3	Addition 1
4	Subtraction 1
5	Addition 2
6	Subtraction 2
7	Time
8	Compare
9	Colour

10	Pattern

The question will be asked depending on the theme chosen. The children need to move to the left or right to answer the question. The TensorFlow object detection model enables the application to detect the children's movement. The red notification will be given to the wrong answer while notification with green colour will appear if the answer is correct.

5.4 Reward system

The block diagram of the reward dispenser is presented in Figure 3 which involves an IoT concept where the data receives are from the application wirelessly and stored in the database. The microcontroller works as the brain of the system where it able to dispense the reward in the form of a mini toy in a capsule.

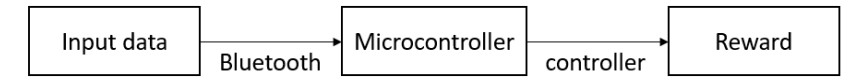


Figure 3. Reward dispenser block diagram

Figure 3 shows the general process of dispensing the rewards where the input data is referred to data received from IMAN Management App that are connected through Bluetooth connection through IoT platform.

The reward will be ready to be dispensed by the microcontroller which controls the reward dispenser system. The reward will be released through the line actuator and the user can collect their rewards at the reward dispenser. The details of the reward dispensing process are presented in Figure 4.

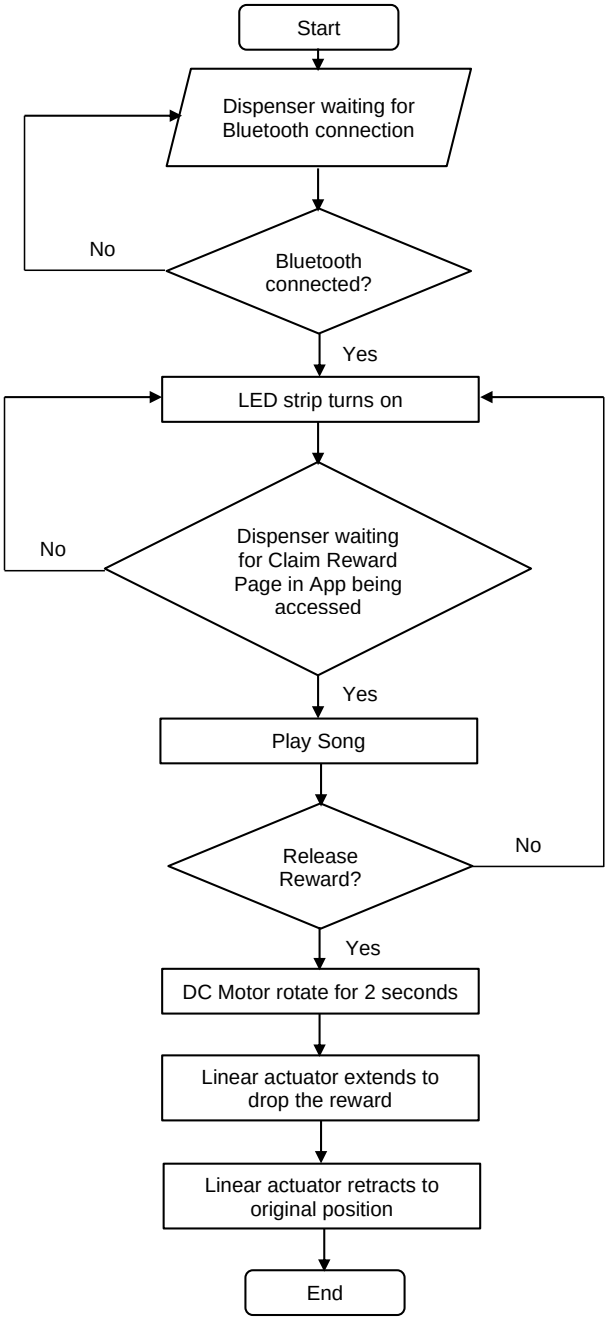


Figure 4. Reward dispensing process flowchart

The Light Emitting Diode (LED) strips and music are installed in the reward dispenser to make it more attractive. The notification will be displayed via the IMAN Vocab App, IMAN Math App or IMAN Management App to indicate that the reward has been dispensed. Figure 5 shows the prototype of the reward dispenser.

Figure 5. Prototype of reward dispenser

The main components inside the reward dispenser are a microcontroller, a controller and a Bluetooth module. The reward dispenser requires the power supply to turn it on.

5.5 Application system integration

The specific functional of IMAN Management App as a database are as follow:

a) Children registration

The teacher needs to create new class and register each child in class. The ID and passcode will be generated and the children need to log in to the IMAN Vocab App or IMAN Math App using the given ID and passcode.

b) Progress monitoring

Both IMAN Vocab App and IMAN Math App are integrated with the IMAN Management App. All activities done using all the IMAN Apps will be stored and can be monitored through the IMAN Management App. A simple analysis will be provided based on topics whether the children is excellent or requires improvement.

c) Reward system

If any of the IMAN App is not connected to the reward dispenser, any completed activities will still be stored in the IMAN App as the Firebase has built-in support for offline data persistence. The rewards will be accumulated and can be redeemed once the IMAN App is connected to the reward dispenser via Bluetooth.

Figure 6 shows the key interface of IMAN Management App. The teacher needs to select the class to view the data stored in the database from the dropdown of SELECT CLASS menu and click OK. The teacher can also add new class from either the drop down of SELECT CLASS menu or plus sign at the bottom right of the application.

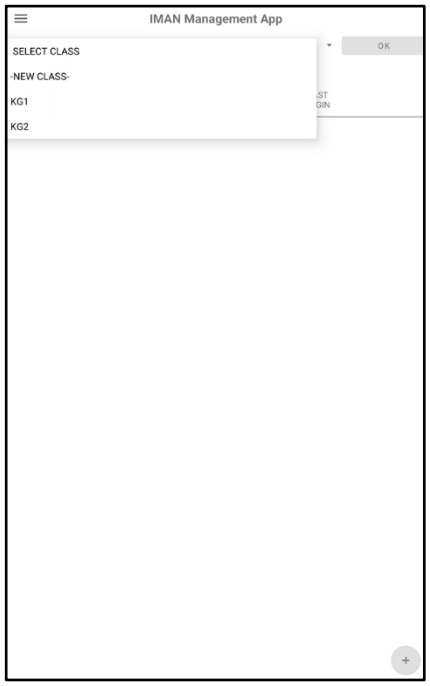


Figure 6. Key interface of IMAN Management App

6. Findings

The detailed findings from the PoC conducted in LC Ayer Keroh can be divided into 3 main stages as follows:

a) Stage 1: Application development.

b) Stage 2: Project testing and refinement.

c) Stage 3: Final integration.

6.1 Stage 1: Application development

Learn with IMAN application has successfully developed with 2 different modules, which focus on vocabulary and mathematics skills enhancement respectively. Figure 7 demonstrates the proof of functionalities of the first module, i.e. IMAN Vocab App. The sound and image notification will pop up once the user gets the correct answer. The menus of different themes are displayed and user can choose according to the current topic.

Figure 7. IMAN Vocab App sound and image notification

IMAN Vocab App can help the children to revise their vocab learning at home as well. With minimal supervision from parents, this application can enhance their vocabulary knowledge through interactive learning. At the same time, the teachers were able to observe the children's performance remotely. The data that has been captured from IMAN Vocab App include the student's progress and the point awarded to complete the tasks. Figure 8 shows the sample of data captured from the IMAN Management App on the activity done in IMAN Vocab App.

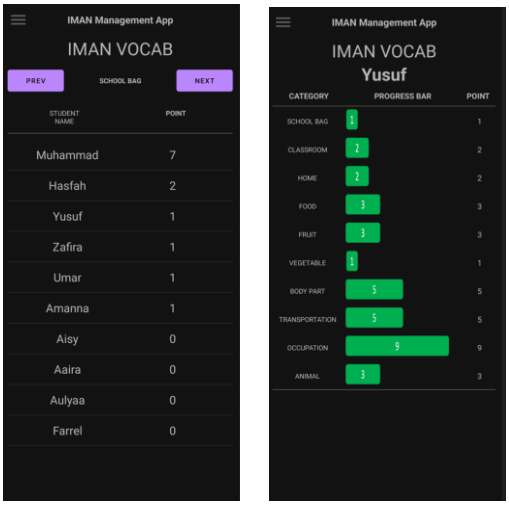


Figure 8. Sample of data stored from activity done in IMAN Vocab App

Figure 9 illustrates the proof of functionalities of IMAN Math App. After the user logged in, the user can select the category of mathematics skills to try on. The student will need to move to the left or right to answer the question. Green colour indicate the correct answer. The data that has been captured from IMAN Math App include how many times the user tried to answer the questions and the point that is given after completing the questions. Figure 10 present the sample of data that has been captured from IMAN Management App on the activity done in IMAN Math App.

Figure 9. Example of functionalities of IMAN Math App

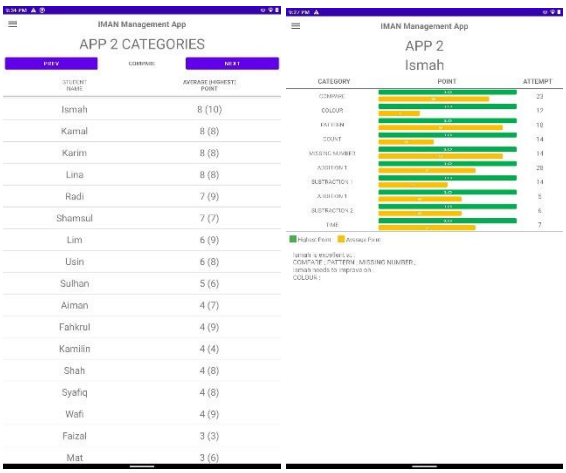


Figure 10. Sample of data stored from activity done in IMAN Math App

IMAN Management App is intended for teacher's monitoring purposes. All the data from both IMAN Apps can be monitored through IMAN Management App. To register a new student, the teacher needs to create the passcode for children to log in to the IMAN module application. The menu consists of Students' Profile, IMAN Vocab, IMAN Math, Claim Reward and About Us. Figure 11 shows the menus interface of the IMAN Management App.

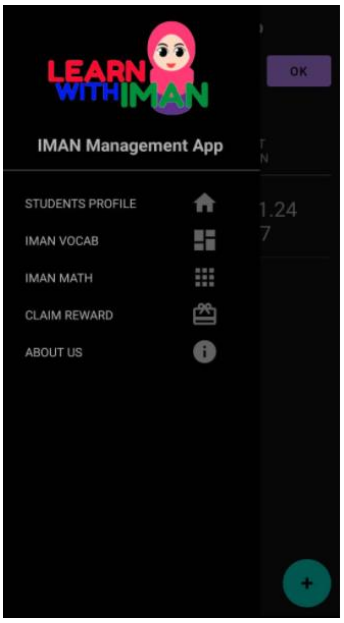


Figure 11. Menus interface of IMAN Management App

6.2 Stage 2: Project testing & refinement

Project testing was conducted in 3 stages at LC Ayer Keroh as follows:

a) First testing was conducted with the implementation of the Learn with IMAN applications only. The purpose of this stage is to prove the functionality of the application and to gather the feedback from the teacher for any improvement needed.

b) Second testing was conducted with full integration between all the IMAN Apps and reward dispenser. The purpose of this stage is to fully implement the system for teaching and learning in the classroom.

c) Home learning was conducted where selected parents are asked by the teacher to try out the application at home. The parents downloaded the application through Google Play Store and logged in using the given ID and passcode. The parents gave the feedback through an online feedback form.

The collected data from all the testing is shown in Table 5.

Table 5. Site testing data

Stage	Teaching & learning approach	No. of students involved (age)	IMAN Vocab App functionality	IMAN Math App functionality
1	Hide and seek	3 (4 years) 3 (5 years) 4 (6 years)	Yes, but need to add pronunciation feature	Yes, but need something to avoid other students to distract
2	Song play and stop	15 (4, 5 and 6 years)	Fully functional. Adding Arabic language feature requested by teacher	Fully functional with app casting to Television (TV)
3	Home learning	2 (4 years) 4 (5 years) 3 (6 years)	Fully functional	Fully functional

Based on the data gathered from all the site testing, all the IMAN Apps are functioning well and suitable to be implemented in teaching and learning session both in classroom and at home. The feedback from teacher is taken for application improvement. Pronunciation and Arabic language features are added into IMAN Vocab App as part of the app improvement.

Figures 12 and 13 demonstrate the testing conducted at LC Ayer Keroh.

Figure 12. First stage of application testing

Figure 13. Second stage of application testing

6.3 Stage 3: Final integration

Learn with IMAN Apps integrate with each other through IoT platform while the reward dispenser can be connected to IMAN Apps through Bluetooth connection. It can be either redeemed directly from IMAN Vocab App, IMAN Math App or IMAN Management App. Figure 14 demonstrates the redeem process through IMAN Management App.

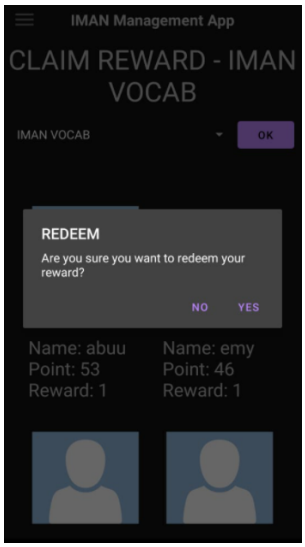


Figure 14. Reward redemption system from IMAN Management App

Table 6 presents the results of reward dispenser connection in 3 attempts each for final integration testing.

Table 6. Reward dispenser connection

Learn with IMAN Apps	Bluetooth connected	Reward redeemed
Vocab App	1	1
	2	1
	3	0
Math App	1	1
	2	0
	3	1

Management App	1	1
	2	1
	3	0

As can be seen from Table 6, the reward is sometimes failed to be redeemed. This is due to a block during the rotation of motor at the centre hole and the toy capsule is unable to drop to the dispensing area. To counter this problem, a feature of redeem notification will pop up. If the reward is unsuccessfully redeemed, the user shall click the 'No' button and reward dispenser will try to dispense again. It can be seen in Figure 15.

Figure 15. Reward redemption notification

6.3 IoT end to end solution in PoC

The IoT platform is involved from the design up to the support process as shown in Table 7.

Table 7. IoT solution in PoC

IoT Architecture	IoT Solution
Application Layer	• Kindergarten provides the program syllabus and any specific design requirement to embed into Learn with IMAN App content. • Learn With IMAN designed based on the design requirement and syllabus provided by kindergartens. • IMAN Management App developed for teacher as children's' monitoring system. • Children needs to log in using username and password generated by teacher to start using Learn with IMAN App. • Teacher can monitor the children's progress through IMAN Management App where it provides simple analysis of student's achievement for each topic. • Additionally, the list of students who eligible to claim their reward can be shown.

Network Layer	• Google Firebase cloud database is used to store the children's answer, marks and progress which can be accessed by the IMAN Management App. • Firebase provides secure data storage and data is encrypted while in transit and at rest.
Physical Layer	• Reward dispenser is developed that dispense rewards to the students who achieved certain level of completion. • Microcontroller and motor are used as a brain or reward dispenser. • Bluetooth is embedded for wireless connection.
Security Consideration	• Learn with IMAN and IMAN Management App are secured by login credentials generated by the teacher to ensure only authorised users can access to the application. • Student information and progress are stored in a cloud database which protected by Google Firebase's security protocols. • The reward dispenser is secured using Bluetooth authentication. It only accepts signals from IMAN Management App through Bluetooth connection to prevents unauthorised users from accessing the reward dispenser.
Support	• Teacher can feedback anytime if any issue of problem occure. The fixes will be pushed through Internet or Google Play Store to update the application

7. Results analysis

7.1 Training accuracy of image classification

For image classification using deep learning approach, the dataset is divided into training, validation and testing dataset. The data analysis of the training accuracy of the application gave higher numbers for each theme. The training accuracy achieved more than 90% for all the themes. Figure 16 depicts the analysis of training accuracy that covers all the themes in IMAN Vocab App.

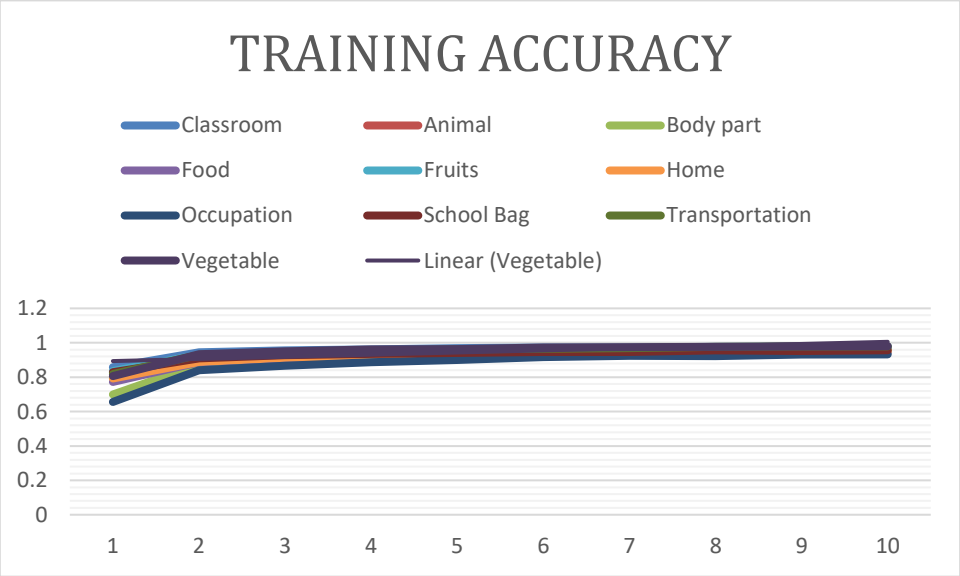


Figure 16. Training accuracy of all themes in IMAN Vocab App

The sample for a theme for comparison of validation and testing accuracy was shown in Figure 17.

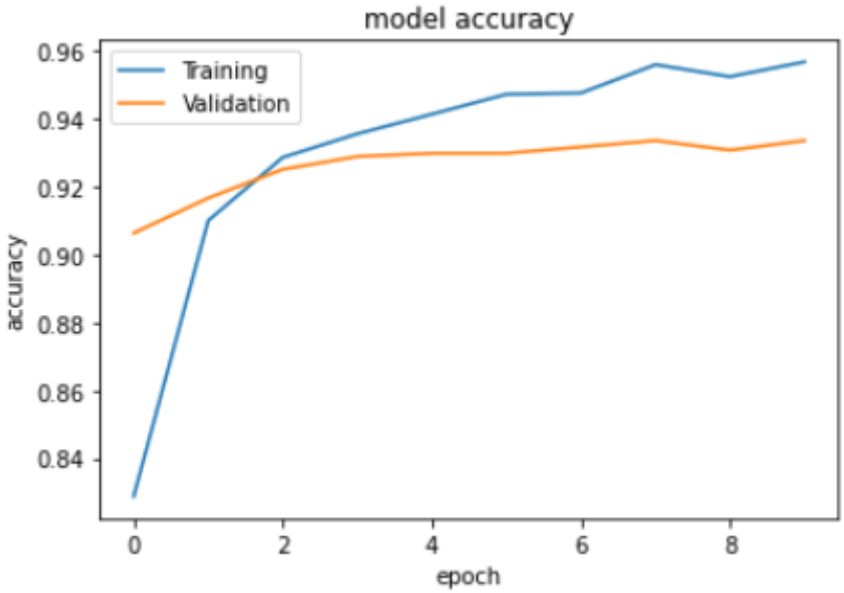


Figure 17. Training and validation accuracy of school bag category

From the analysis, it can be seen that the training and validation accuracy are increasing linearly over time, whereas the validation accuracy also achieved more than 90% in the training process. The difference in accuracy between training and validation are closer aligned which means the model able to generalise on a new dataset.

Figure 18 depicts the result analysis of testing accuracy for each theme. Referring to the figure, the testing accuracy of dataset testing is quite high, with the highest achievement of 96% accuracy. The IMAN Vocab App has the ability to detect the item captured through the images of photo, flash card, real item or even toys.

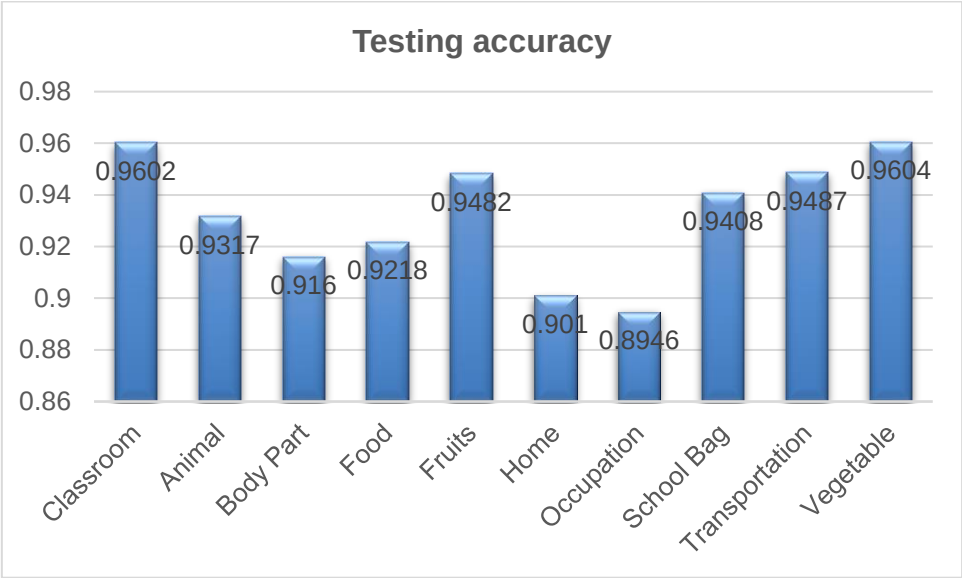


Figure 18. Testing accuracy for each category or theme in IMAN Vocab App

7.2 Analysis of object detection

IMAN Math App was embedded with the AI deep learning object detection model. It was trained only to detect person on the application. This is to avoid any interruption during the learning process. In

addition, it is also programmed to detect only one person. If more than one person is detected, the application will pause for a while until only one person detected. This is to avoid the confusion on which student are doing the task. Figure 19 and Figure 20 demonstrate the analysis done during development stage to make sure that the application is able to detect the person doing the task.

Figure 19. Comparison of detection between person and other object

Figure 19 shows the application is only detecting the presence of a person but not the other object. The box will show only confidence score and location of the person. As can be seen from Figure 19, the detected confidence score is 73.05%.

Figure 20. Comparison when more than 1 person detected

Figure 20 depicts the analysis done when there are two persons detected. The blue one has the higher confidence score of 78.52% while the red box has confidence score of 71.09%. In this situation, the warning is triggered and the application will be paused until only one person detected.

7.3 Children's progress monitoring

Every time the children participate and use the IMAN Apps, the data analysis of the children's progress will be done in the cloud storage. The progress and performance of each child can be easily monitored by the teacher based on the result of data analysis. The grading is autonomous based on the number of correct answers.

In terms of identifying the strengths and areas for improvement for the children, the analysis is done by comparing how many times the children tried the application with the points the child gets for every attempt. Figure 22 depicts the sample of analysis on the strengths and areas for improvement for the children using cloud analytics.

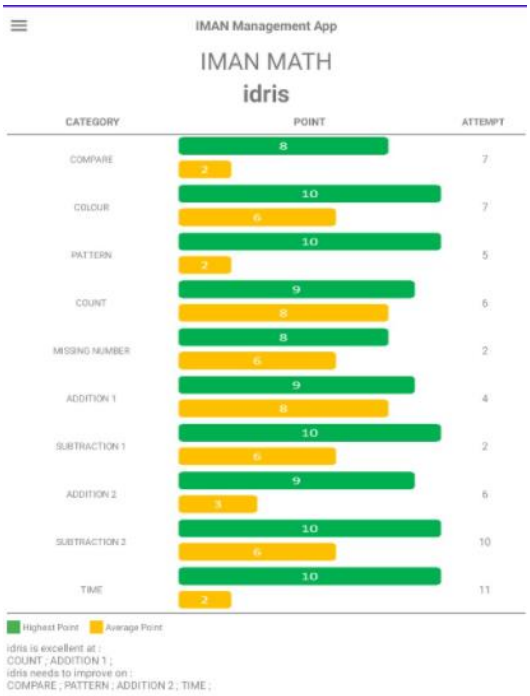


Figure 18. Sample analysis of the strengths and areas for improvement in IMAN Math App

Based on the analysis done in Figure 18, the student excelled in COUNT and ADDITION1 while he needs to improve on COMPARE, PATTERN, ADDITION 2 and TIME.

7.4 Parents' feedback

The parents' feedback from 9 participants had been gathered to see the effectiveness of the IMAN Apps. Table 7 shows the user profile of 9 participants.

Table 7. Participants' profile

User	Gender	Age (years)	IMAN Apps used?
1	Girl	5	Yes, Both
2	Girl	4	Yes, Both
3	Boy	6	Yes, Both
4	Boy	5	Yes, Both
5	Boy	5	Yes, Both
6	Girl	6	Yes, Both
7	Girl	4	Yes, IMAN Math App
8	Boy	6	Yes, Both
9	Girl	5	Yes, Both

Figure 19 shows the results analysis of the IMAN Apps' effectiveness based on the parents' feedback.

Figure 19. Result analysis of IMAN Apps effectiveness

Based on the analysis done from the development to the implementation stages, IMAN Apps are useful especially on recap session in teaching and learning either in kindergarten or at home. Even using the IMAN Apps, the interaction between children and parents or teachers are still happening.

8. Conclusion

In conclusion, the PoC is successfully developed to cater the needs of children education through ‘play’ and ‘learn’ concept in the kindergarten called Learn with IMAN. Learn with IMAN consists of 2 main modules which offers interactive educational application by using AI Deep Learning Image Classification model (IMAN Vocab App) and Object Detection model (IMAN Math App). It is mainly focused on vocabulary and mathematical skill enhancement.

The IoT platform was integrated with Learn with IMAN Apps for students’ progress monitoring by the teacher and the reward system. All the activities done by the students are successfully stored in cloud database and a simple analysis mechanism is embedded to summarise their performance. Reward dispenser module has been added to reward the students after completing the activity. The reward dispenser is a tangible wat to motivate students and reward them for their hard work and achievements.

Feedback has been gathered to study the effectiveness of Learn with IMAN Apps implementation in classroom and home learning. The feedback received from teachers and parents indicate that the IMAN Apps are suitable and useful in teaching and learning session at the kindergarten and also at home.

Learn with IMAN Apps can be extended to primary school students and special kids. The school curriculum syllabus will be embedded and can be customised according to the needs of different age groups. It can also be extended to other organisations such as children’s attractions, amusement parks or any children animation production houses. Overall, this system has the potential to revolutionize how the children learn in early education.

Integrating IoT in education system brought a lot of benefits to the society. It may help to improve the school management through cloud database where enable the real-time data collection for monitoring purposes. Apart from that that, remote education is possible to happen where it offers a chance to stay learn even during pandemic. Learn with IMAN Apps may lead to the development of guidelines and rules on children education application development, advertisement restrictions as well as the protection of personal data. The developed app could be included as one of the IoT use cases in the standardisation works.

Bibliography

[1] Jeanna B.: 2007 *Most Students Bored at School* https://www.livescience.com/1308-students-bored-school.html)

[2] Lancet: 2020, Zarocostas J. – *How to fight an infodemic*

[3] Bulletin of Electrical Engineering and Informatics: 2020, Brahin N. M. A et al. – *Development of vocabulary learning application by using machine learning tecnique*

[4] International Journal of Advanced Computer Science and Applications: 2018, Fadwa A. A et al. – *Human Related-Health Actions Detection using Android Camera based on TensorFlow Object Detection API*

[5] Deep Learning in Mobile Information System: 2020, Daegyu C. et al. – *The Real-Tme Mobile Application for Classifying of Endangered Parrot Species using the CNN Models Based on Transfer Learning*

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