

**ANDROID APPLICATION TO HELP READING ENGLISH WORDS USING
MOBILE VISION AND TEXT TO SPEECH FACILITY AT SDN GAYAM 01
SUKOHARJO**



**Submitted as Partial Fulfillment of the Requirements for Getting Bachelor Degree of
Informatics Departement Faculty of Communication and Informatics**

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UNIVERSITAS MUHAMMADIYAH SURAKARTA**

2019

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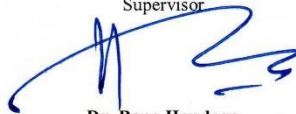
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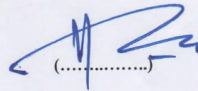
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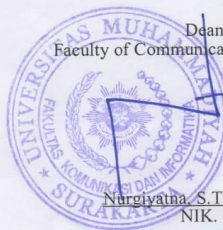



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ANDROID APPLICATION TO HELP READING ENGLISH WORDS USING MOBILE VISION AND TEXT TO SPEECH FACILITY AT SDN GAYAM 01 SUKOHARJO

Abstract
Reading is an activity carried out by humans to obtain information or pleasure especially for elementary students, reading is a very important activity to gain knowledge and build their life skill for their future especially in English communication. SDN Gayam 01 Sukoharjo is an elementary school located in Sukoharjo regency with the number of students reaching 450 people, in everyday learning some of the students still find it difficult to take part in learning such as reading English. This study aims to create an Android application to help SDN Gayam 01 Sukoharjo's students and teachers who have difficulty reading English letters, using the mobile vision from Google Mobile and TextToSpeech facility to hear the pronunciation directly from American. The student and teacher expected to read English letter correctly, programming language using Java. This application has passed black box testing and user acceptance test with satisfying test.

Keywords: Android, Mobile Vision, TextToSpeech

Abstrak
Membaca merupakan kegiatan yang dilakukan oleh manusia untuk mendapat pengetahuan atau kepuasan tersendiri. Untuk murid Sekolah Dasar, membaca adalah kegiatan yang sangat penting untuk mendapat pengetahuan dan membangun keterampilan berkehidupan di masa yang akan datang khususnya dalam berkomunikasi bahasa Inggris. SDN Gayam 01 Sukoharjo merupakan sekolah dasar yang berada di Kabupaten Sukoharjo dengan jumlah murid mencapai 450 orang. Dalam pembelajaran sehari-hari beberapa murid masih merasa kesulitan dalam mengikuti pembelajaran seperti membaca kata atau kalimat berbahasa Inggris. Berdasarkan masalah diatas, penelitian ini bertujuan untuk membuat aplikasi Android untuk membantu murid dan guru SDN Gayam 01 Sukoharjo yang kesulitan dalam membaca kata bahasa Inggris, menggunakan mobile vision dari Google Mobile dan fasilitas TextToSpeech untuk mendengar pengucapan langsung dari warga Amerika. Diharapkan guru dan murid dapat membaca dengan benar, bahasa pemrograman yang digunakan yaitu Java. Aplikasi ini telah melalui blackbox testing dan tes penerimaan pengguna dengan menghasilkan nilai yang memuaskan

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1. INTRODUCTION

Introducing English language is important to introduce to the student to prepare them for facing globalization era that makes the distance of each country disappear with internet and make English language will be needed in various fields.

Government has published decree in Surat Keputusan Menteri Pendidikan dan Kebudayaan No.060/U/1993 about the possibility of an English program being taught earlier as a local content and can be started from fourth grade of elementary school.

Therefore, the introduction of English language cannot be underestimated. By introducing English language to primary school student, before take another step to higher education the students know early about English language and the students can improve their competitiveness among global community

English language become most used language in the world and an international language. We could see it as an international language by the Anglophone existence spread in five continent. (Hardjono, 2001)

In teaching English language, sometimes the teachers feeling difficulties at spelling English words. Therefore, the students will learn and read the hard spelling words whether it is correct or not. Smartphone that has become a part of human life today can used as a learning tool to improve English language reading skill for students and the teachers needed. Based on data collected by Net Children Go Mobile survey with 3500 respondent in seven Europeans country (Belgium, Denmark, Ireland, Italy, Portugal, Romania and the United Kingdom) about 46% children within range 9–16 years old has a smartphone (Mascheroni & Ólafsson, 2016)

Smartphone is a cellphone with some electronic component such as screen, memory, microprocessor, and built-in modem. Smartphone combine PC functionality, handset and produce luxurious gadget, with camera, messages, video, music player, game, email access, and GPS feature(Williams, Hutchinson, & Sawyer, 2001)

Technology development aspect has good and bad effect to human lifestyle change especially for primary school students. One of the bad effect from technology development for student are smartphone addiction, which can affect their social life and education heading towards to negative effect especially in physic matters. On the other hands, the usage of smartphone also have positive effect at their education if it is used wisely like for educational application to help student in learning activity

Children in elementary schools should begin to familiarize with technology as a part of their learning process. Teachers should consider for using technology as support in the curriculum to make children use technology properly and its benefit from exposure to more advanced applications that they will use when they become older (Murphy, DePasquale, & McNamara, 2003).

The English teacher of SDN Gayam 01 Sukoharjo still using conventional way to teach English language education to the student, the teacher still using book and direct greetings, which usually still focus on theory in the book and neglect in practice.

Some of student also feel unsatisfied with the current teaching method because the teacher must skip some material in the book and sometimes let the student's question, that is one of the reason which lead 50% of students attend lessons outside school to pursue material that they should learn at primary school.

TextToSpeech synthesizer is a computer-based system that able to read text loudly, whether it is scanned and submitted to an Optical Character Recognition (OCR) system or directly inputted in the computer (Thierry, 1999).

OCR is a computer system that works by converting data of printed text or hardcopy to an editable softcopy file (Soomro, Hakro, Ismaili, & Shoro, 2018).

Similar study was conducted by (Styadi, 2018) by developing an android application to give an efficient learning in helping users to learn about reading, listening and writing in English for general public use by using voice input and TextToSpeech feature, the application user target are intended for the general public and makes the application are less suitable for children that caused by the lack of diversity in the color in its design

This study aim to help students of SDN Gayam 01 Sukoharjo to improve their reading skill by developing an application called Pronunhelper. The expected outcome the student could read English words better which automatically could improve their spelling abilities.

2. METHOD

This application will be made for SDN Gayam 01 Sukoharjo and called as Pronunhelper and run in Android platform, Pronunhelper will be added with OCR and TextToSpeech feature. The feature needed are based on consideration of writer's interview with the students of SDN Gayam 01 Sukoharjo.

The question for students about "Could you read English correctly?" the answer are vary, one of them said that he cannot read correctly if the words are connected or complex. Then writer try to confirm it by asking them to read a simple sentence: "Do you like animals?" and "What kind of fruits do you like?" The skill of students who attend lessons outside school and who does not, are having similarity and they still having problem with reading English text.

Therefore, writer concluding that an application with TextToSpeech feature are needed to help student in reading and pronounce English words by inputting the word or select text from OCR's extraction.

OCR also needed to facilitate the student to make them able to listen the text's pronunciation extracted from their book or text on their environment.

Pronunhelper will run on android platform to make student easier to access the application considering that nowadays almost every student have smartphone, below is a use case diagram of Pronunhelper application shown in Figure 1:

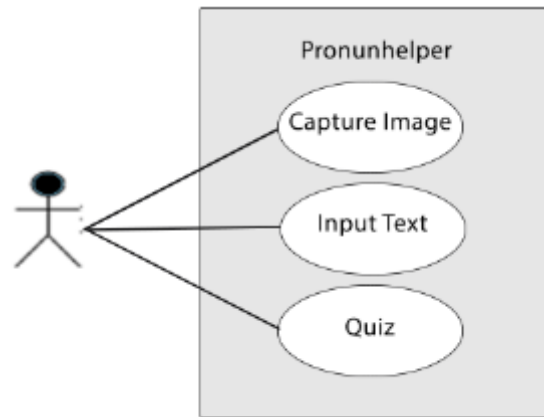
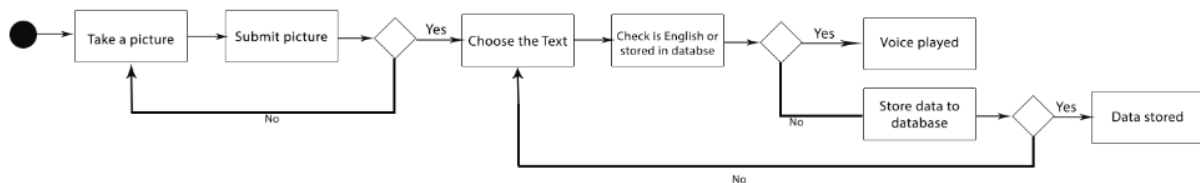


Figure 1. Use case diagram of Pronunhelper application

The user are the fifth and sixth grade student of SDN Gayam 01 Sukoharjo, user has two features that can be accessed in the application which cover:

- a) Capture image are capturing image-using camera provided in application, the image will be processed to extract the text then the user can select a text from the list to be played its pronunciation.
- b) Input text by user to be played using TextToSpeech with only Latin letters can be entered, there are no language limitation as long as it use Latin letters then after user submit it, the pronunciation will be played directly.
- c) Quiz are provided to train the user about their skill of English pronunciation by playing the pronunciation of English words then the user need to write the words played therefore, the user are not only know how to read a word but also know to write the word spoken.

Based on use case above in Figure 1, there are three-activity diagram available for Pronunhelper shown in Figure 2:



(a)

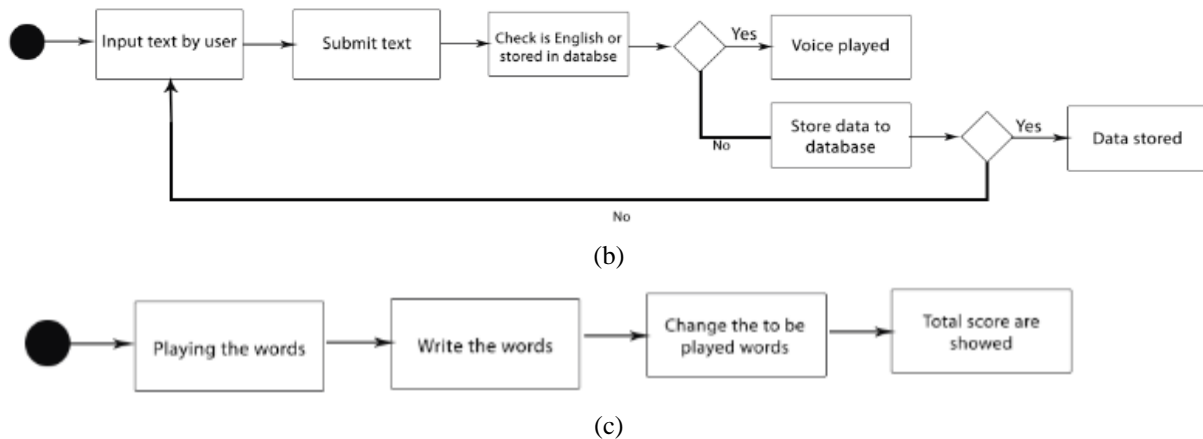


Figure 2. Capture image (a), Input text (b), Quiz (c)

Figure 3a presenting when user choose capture image, the user need to take a picture contain a text from application's camera and submit the picture to extract the text resulting a list of extracted words then user can choose a words from list to be played with TextToSpeech after checked to determine whether that the text are English or have inputted to whitelist database to make the text not checked, this feature are needed to prevent miss language detection. If the user want another picture to be captured or want to retake the picture, the user will moved to application's camera to retake the picture. User only can extract the text using application's camera and the captured image cannot be saved into device or cloud, the extracted text can be played if the text inputted are English or if user disable the language checking feature.

Figure 3b presenting when user choose input text instead of capture image, user need to input a text then submit it to be played with TextToSpeech, only Latin letters and English are accepted to play the words using TextToSpeech in Pronunhelper.

Figure 3c representing when user choosing quiz, user will moved to guidelines layout and after confirm it, user need to write the words played after user click play button then user can continue to next words and shown a score based on the correct answer.

Design of Pronunhelper are divided into four layout to cover all feature of Pronunhelper, the design is made as simple as possible but interesting to make user can use the application easily, below is the display of main features of Pronunhelper feature shown in figure 3 and figure 4 below.



Figure 3. Text-To-Speech layout design

Text-To-Speech layout contain an *Edittext* for user to input their own text and a button to play the words pronunciation using android TextToSpeech.

Considering children like to play with their surroundings, to increase their satisfaction and enjoyment when using this application, there are two *SeekBar* on Text-To-Speech layout to set the pitch and speed rate so users could play with pitch and speed rate while listening to the words.

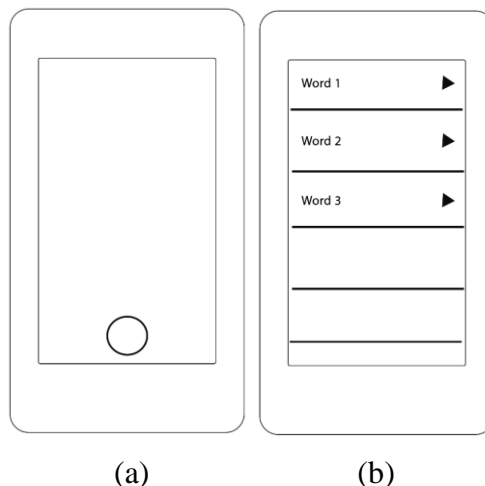


Figure 4. Camera layout (a), Result layout (b)

Camera layout contain one button on it to capture the image, the capturing result will be showed by overriding camera layout and the button icon and function will be changed to process the image to be converted. After the process button pressed, students will be moved to result layout with conversion result on it and play button to play its pronunciation.

Pronunhelper will be developed based on the requirement analysis and the design that has been created by using some tools. Android Studio as an official IDE from google are chosen IDE to build Pronunhelper considering that this IDE are built for android development.

The development are start from converting all information collected such as design, use case and activity diagram shown above to be used as a guidelines about how to create Pronunhelper and fulfilling the need of SDN Gayam 01 Sukoharjo, the design of Pronunhelper need to make the user interested and feel comfortable by making the interface colorful and interactive. Based on this case, Pronunhelper using various color for design and divide the color to be used only on certain layout. Therefore, the user might see different color when opening a layout. In order to make Pronunhelper interactive, Pronunhelper provide a feedback in the form of sound for button in menu. The button in Pronunhelper also using a ripple effect and animation by making the button seems floating when user pressed the button, both of this approach might increase the UX of Pronunhelper and increase user convenience, below is the image code of the animation shown in figure 5.

```

1  <?xml version="1.0" encoding="utf-8"?>
2  <selector xmlns:android="http://schemas.android.com/apk/res/android">
3      <item android:state_enabled="true" android:state_pressed="true">
4          <objectAnimator
5              android:duration="@android:integer/config_shortAnimTime"
6              android:propertyName="translationZ"
7              android:valueTo="12dp"
8              android:valueType="floatType"/>
9      </item>
10
11     <item>
12         <objectAnimator android:duration="@android:integer/config_shortAnimTime"
13             android:propertyName="translationZ"
14             android:valueTo="0dp"
15             android:valueType="floatType"/>
16     </item>
17 </selector>

```

Figure 5. Animation code

In order to make the button behavior changed when user pressed it, the *selector* are needed to choose which item or behavior will be chosen if a condition fulfilled.

The first *item* declared with attribute condition `android:state_enabled="true"` and `android:state_pressed="true"` to make the *item* only activated when the button enabled and pressed by user and give a button float effect with 12dp (*density pixel*) value.

The second item are not declared with any attribute, therefore this item will become the default activated item and automatically activated when the code used in button when button unenabled and not pressed by user and will be re-activated when user release the button. The button state changed shown in figure 6a and figure 6b.

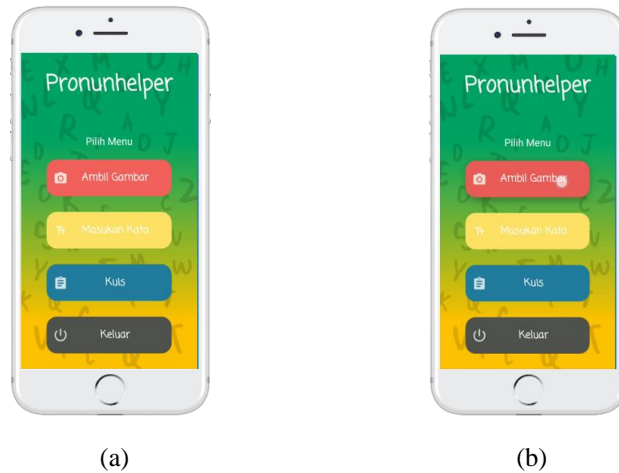


Figure 6. Button normal state (a), Button pressed state (b)

Camera used in Pronunhelper are CameraKit version 0.132, CameraKit is an open source library developed by Wonderkilm to make it easier to develop cameras in application, this library placed in layout code and initialized and configured in java class file. A listener added to CameraKit to receive a respond, when user pressed a button that trigger *capture()* method from CameraKit to take a picture, CameraKit will call *onImage()* inside the listener as shown in figure 7.

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```

Figure 7. CameraKit bitmap conversion

onImage will be called if the capture process was success, this method receive a *CameraKitImage* and converted to *Bitmap* using *Bitmap.createBitmap()*.

OCR in Pronunhelper are using *FirebaseVision* from *Firebase ML Kit* to recognize character from an image captured by user using the application's camera, OCR will receive *Bitmap* image input to be processed from application's camera using OCR from *FirebaseVision*.

A variable type *FirebaseVisionTextRecognizer* is needed, the variable are assigned to *FirebaseVision.getInstance().getOnDeviceTextRecognizer()* then the variable can be used to process the *Bitmap* image to extract the text. A listener called *addOnSuccessListener()* needed to receive a respond when process successful and the method will receive *FirebaseVisionText* that used to get a list of *String*, the list was processed using repetition to get a *String* based on the block or lines of text extracted from image as shown in figure 8.

```

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mRecognizer.processImage(image)
    .addOnSuccessListener((OnSuccessListener) (result) -> {
        mIntent = ResultActivity.getIntent( context: MainActivity.this);
        mCapturedLayout.setVisibility(View.GONE);

        for (FirebaseVisionText.TextBlock block : result.getTextBlocks()) {
            for (FirebaseVisionText.Line line : block.getLines()) {
                String lineText = line.getText();
                mBlockList.add(lineText);
            }
        }

        mIntent.putStringArrayListExtra( name: "block", mBlockList);

        startActivity(mIntent);
    })

```

Figure 8. OCR OnSuccessListener code

TextToSpeech used for Pronunhelper are using built-in TextToSpeech facility that added since API level 4 on android operating system, TextToSpeech initiated by implementing *TextToSpeech.OnInitListener* on the java class and a method called *onInit()* will be overridden. inside *onInit()* if the initiation are success, TextToSpeech are set to have speech rate with value 0.8f with f stand for float considering that 0.8f are an optimal speech rate for user to hear based on writer testing, the language used for TextToSpeech also set to US to make user have experience in listening the American pronunciation. An alternative option also provided if the initiation are failed by using *Toast* to display an error message in the layout with a short time.

A text are inputted to TextToSpeech inside *speak()* method created by writer to use TextToSpeech's *speak()* method with inputting *String* as the parameter and *QUEUE_FLUSH* as the queue mode as shown in figure 9

```

147     @Override
148     public void onInit(int status) {
149         if (status == android.speech.tts.TextToSpeech.SUCCESS) {
150
151             mToSpeech.setSpeechRate(0.8f);
152             mToSpeech.setLanguage(Locale.US);
153         } else {
154             Toast.makeText(context, this, text: "Initiazion failed", Toast.LENGTH_SHORT).show();
155         }
156     }
157 }
158
159 private void speak(String text) {
160     if (mToSpeech.isSpeaking()) {
161         mToSpeech.stop();
162         mToSpeech.speak(text, android.speech.tts.TextToSpeech.QUEUE_FLUSH, params: null);
163     } else {
164         mToSpeech.speak(text, android.speech.tts.TextToSpeech.QUEUE_FLUSH, params: null);
165     }
166 }

```

Figure 9. TextToSpeech initiation and speak code

The database for saving the words that are in exception are using SQLite database that have already installed in Android OS, the communication between user and SQLite are accessed by using *Room* as a persistence library and part of *Android Architecture Component* to decreasing the amount of *boilerplate code* and make simple in database query as shown in figure 10.

```

14     @Insert(onConflict = OnConflictStrategy.REPLACE)
15     void insert(Word word);
16
17     @Query("DELETE FROM word_table")
18     void deleteAll();
19
20     @Delete
21     void deleteWord(Word word);
22
23     @Query("SELECT * from word_table ORDER BY word ASC")
24     LiveData<List<Word>> getAllWords();
25 }

```

Figure 10. SQLite queries using room

Room will give feedback with List datatype that contain the words stored in database when *getAllWords()* from *WordRepository* class are called as shown in figure 11.

```

14     public WordRepository(Application application) {
15         WordRoomDatabase db = WordRoomDatabase.getDatabase(application);
16         mWordDao = db.mWordDao();
17         mAllWords = mWordDao.getAllWords();
18     }
19
20     public LiveData<List<Word>> getAllWords() {
21         return mAllWords;
22     }
23 }

```

Figure 11. SQLite getAllWords code

Pronunhelper are tested by observing to the sound output of TextToSpeech, the observation are involving English lecturer to make sure that the words played by TextToSpeech are suitable to the actual pronunciation. The test are fulfilled by giving TextToSpeech ten different words that seven of them are given by the lecturer, the words tested are shown below in table 1.

Table 1. Words tested for TextToSpeech

Words	Spelling	Status
Chair	Cher	Valid
Book	book	Valid
Pencil	'pensəl	Valid
Table	'tābəl	Valid
People	'pēpəl	Valid
Classroom	'klas,rōom	Valid
Dictionary	'dikSHə,nerē	Valid
Library	'li,brerē	Valid
Shoe	SHōo	Valid
Duster	'dəstər	Valid

OCR also tested by observing the output of text extracted from captured image using application camera, the example result of OCR testing are shown in figure 12.

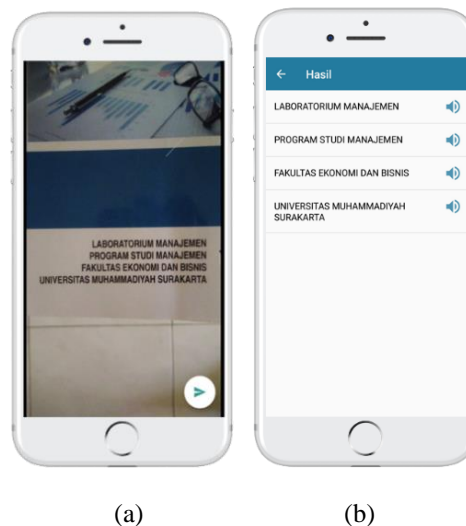


Figure 12. Captured image(a), Extraction result(b)

Figure 12 shows that OCR in Pronunhelper are working and the extracted value are meeting expectation. However, OCR performance are limited by the resolution of camera used and text clearance, the extracted text might not meeting expectation if using a low resolution camera or the text are not clear.

3. RESULT AND DISCUSSION

Questionnaires are given to user to analyze the user acceptance for Pronunhelper application, the questionnaires are representing the function, ease of use and interface. Each question are given maximum 5 point, the testing are including of 9 students from fifth grade and 10 students from sixth grade of SDN Gayam 01 Sukoharjo and 1 English lecturer. The result are shown below in table 2.

Table 2. User acceptance satisfactory

Name	Questions						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Respondent 1	5	3	5	5	5	4	5
Respondent 2	4	4	5	5	4	5	5
Respondent 3	4	4	5	5	5	5	5
Respondent 4	4	5	5	5	4	4	5
Respondent 5	4	5	5	5	5	5	5
Respondent 6	4	4	5	4	5	5	4
Respondent 7	5	3	4	3	4	3	3
Respondent 8	5	4	5	5	4	5	5
Respondent 9	3	3	4	5	4	4	5
Respondent 10	5	5	5	4	5	5	5
Respondent 11	4	4	5	4	4	3	4
Respondent 12	5	5	5	5	4	5	5
Respondent 13	3	5	3	3	5	5	3
Respondent 14	3	5	5	5	5	4	5
Respondent 15	4	4	5	4	4	4	4
Respondent 16	4	4	5	4	4	3	4
Respondent 17	4	4	5	4	4	4	4
Respondent 18	3	3	3	4	4	4	3
Respondent 19	3	3	3	5	4	5	5
Respondent 20	4	5	4	4	4	5	4
Total	80	82	91	88	87	87	88

User acceptance table test value have been converted into numerical value from one to five with condition: (1)*Sangat Setuju (SS)* = 5 point, (2)*Setuju (S)* = 4 point, (3)*Netral (N)* = 3 point, (4)*Tidak Setuju (TS)* = 2 point, (5)*Sangat Tidak Setuju (STS)* = 1 point, and the Q1 until Q7 are meaning to:

- 1). *Apakah tampilan yang ada cukup jelas dan mudah dipahami?*
- 2). *Apakah anda dapat mengakses setiap tampilan aplikasi?*
- 3). *Apakah huruf dapat dengan mudah dibaca?*
- 4). *Apakah aplikasi cukup menarik dan layak digunakan?*
- 5). *Apakah Bahasa yang digunakan mudah dimengerti?*
- 6). *Apakah anda dapat menggunakan aplikasi Pronunhelper dengan mudah?*
- 7). *Apakah anda merasa terbantu dengan adanya Pronunhelper?*

The question above are made by involving headmaster and English teacher of SDN Gayam 01 Sukoharjo to make sure the question are answering the needs for Pronunhelper, the question also using Indonesia language to make student and teacher easier for answering and understanding the question, to easier in reading the table 2, below are provided chart within the total value of each question in figure 13.

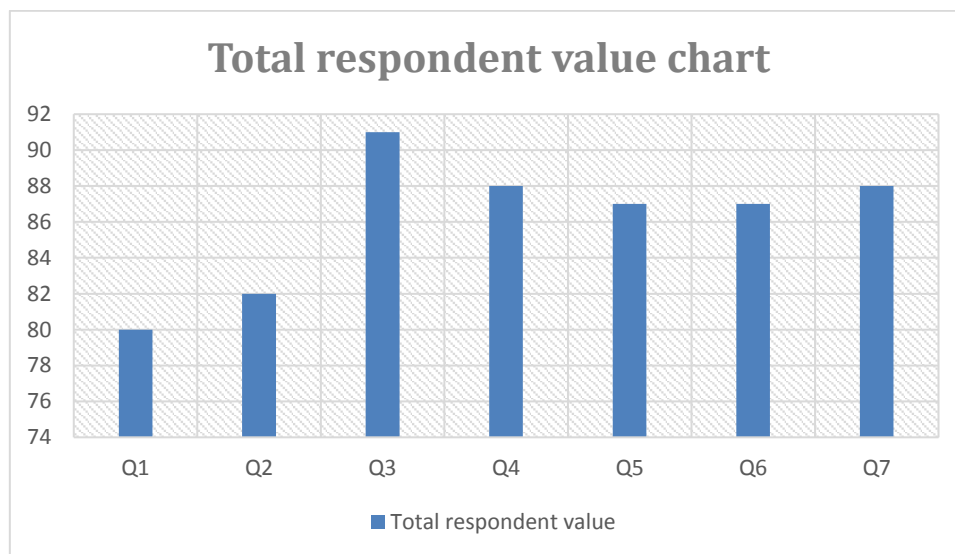


Figure 13. Total respondent value chart

The table above in table 2 shows the user satisfactory of Pronunhelper after the sample user tried to use the application with end result achieving 603 out of 700 or around 86% of satisfactory, with the lowest total point earned by Q1 regarding to ease to understand of the user interface and the highest total point are earned by Q3 regarding to the readability of the text in application.

It is indicate that the development of Pronunhelper need to improve the design to make user easy to understand about the layout and menu provided and not focusing on the interactivity and feature development that causing a lack of implementation of design that easy to understand design for children.

However the value of Q7, which question about whether the user feels helped by Pronunhelper earned 88 out of 100 or around 88% showing that Pronunhelper are capable to help user for reading English an fulfill the aim of this study.

4. CONCLUSION

Based on testing in SDN Gayam 01 Sukoharjo Pronunhelper are running well and the function are works finely proven by Q4 regarding to the usefulness of application that achieved 88 out of 100 point or around 88%, Pronunhelper are able to help the user to understand the pronunciation of English words from text inputted by user or from OCR extraction.

Pronunhelper leaves a room to be improved, there are possible development such as: 1) Increase the display design with using animation picture like animals to make user more interested, 2) Using a well-trained OCR services to improve the accuracy, 3) Using a better TextToSpeech services for better performance.

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