Increasing Student Productivity and Learning Motivation through Training and Implementing MIT App Inventor Software at SMP 7 Muhammadiyah of Yogyakarta

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Abstract. At SMP Muhammadiyah 7 Yogyakarta, Information and Communication Technology (ICT) classes have been implemented for a long time, but the motivation and productivity of ICT students still needs to be improved because the school is still focused on understanding and practicing using ICT media. Therefore, MIT App Inventor software design training to control robot movement (arm-robot) was carried out to increase motivation and learning productivity for students at SMP Muhammadiyah 7 Yogyakarta. This training is carried out face to face directly to students in the classroom. Students are divided into 7 groups, where each group consists of 7 students. Each group had several laptops and was given the MIT App Inventor software design module to access the application, start designing, create a layout, create block coding, integrate the MIT App Inventor program into Android and connect Android as a face-to-face controller to move the Arm-robot. In this training, students succeeded in enthusiastically creating software from the general introduction to design stage, creating layouts and coding blocks to being able to connect and control the arm-robot. Apart from being able to improve ICT skills, this training is also able to boost students' enthusiasm and productivity in learning.

1 Introduction

SMP Muhammadiyah 7 Yogyakarta, Purbayan Kotagede was founded on August 1 1965 and is located in the city of Yogyakarta. Entering the year 2000, the junior high school had 17 classrooms, science laboratories, guidance and counseling rooms, a library, a multipurpose room and computer laboratories for ICT classes. In the computer laboratories, students are facilitated in studying computer science which focuses on the theory and operation of ICT hardware. In the development of educational technology, theory plays a role in increasing the

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effectiveness of learning experiences. Research on learning theory contained in [1] shows that a strong understanding of theory is very important in producing good educational technology development. On the other hand, adding learning media will have an impact on students' learning motivation [2]. Adding computer practice classes to students also has a positive impact on improving the quality of learning [3]. The use of ICT media as a short term learning medium has been proven to be effective in increasing student motivation and learning achievement [4], [5], [6].

On the other hand, learning that is carried out routinely with monotonous material for a long time can trigger students' physical and psychological fatigue [7]. This can be seen from observations in the ICT class at SMP Muhammadiyah 7 Yogyakarta and student responses during the teaching and learning process. This situation is in accordance with the findings in research conducted by Eri Susanti with a focus on identifying factors that influence the decline in student learning achievement at one of the high schools in Purworejo. Internal factors are very dominant in determining student learning outcomes. In this study, psychological indicators and physical fatigue contributed to 65.9% of the decline in student learning achievement [8], [9]. Therefore, it is necessary to carry out learning innovations to maintain students' physical and psychological well-being to increase learning motivation and productivity [10], [11]. Learning innovations using digital technology based on application development are apparently able to improve the quality of student learning outcomes because they increase student interest and motivation to learn [12]. By looking at the empirical evidence presented in existing research, training and application of digital technology with MIT App Inventor Software training to control robots for students will have the potential to increase student motivation and learning.

MIT App Inventor software is a web-based tool for creating Android applications. This application is often also called visual programming because it can create or build programs without needing to understand coding or programming languages first [13].

Fig. 1. MIT App Inventor icon.

MIT App Inventor continues to be developed by MIT's Mobile Learning Lab where the project was originally initiated by Google. MIT App Inventor is applied by instructors or teachers in introducing computer science and application development to students who do not yet have programming language skills [14].

In the training on implementing MIT App Inventor, students were introduced to several steps to create an Android-based application that can control robot movements. First, students are given a basic understanding of the concept of MIT App Inventor, then guided to create an account that is accessible to the application platform. Both students were guided to recognize the menus and steps in making the application. The third step is creating a design or face-to-face display of the program. After forming a layout in the form of robot control buttons, the fourth step is to enter coding blocks that correspond to commands or controls on the robot. The fifth step is to integrate and move the MIT App Inventor application from the web to Android. Finally, the MIT App Inventor application on Android is connected to

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Android's internal Bluetooth, then the Bluetooth is connected to the robot's Bluetooth to control the robot's movements. The following is a block diagram of the system.

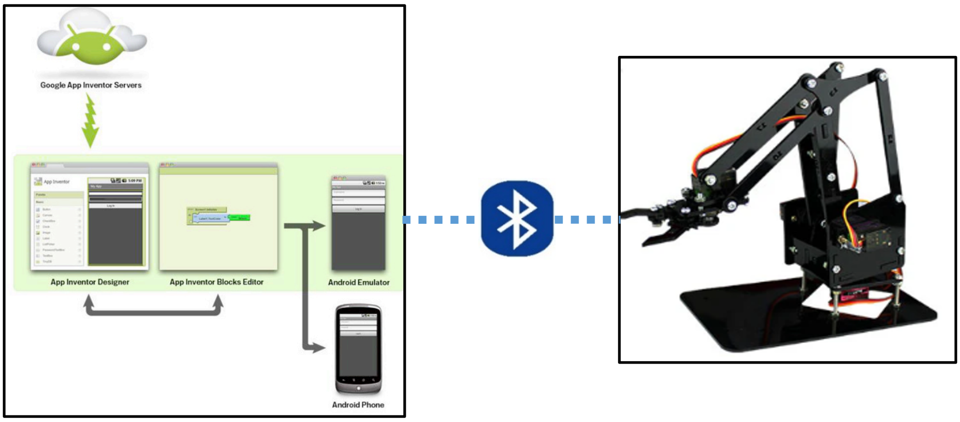

Fig. 2. Robot Control Application System Diagram via Android [15].

Finally, in the training and implementation of the MIT App Inventor application, SMP Muhammdiyah 7 Yogyakarta acted as a partner to facilitate students in the training process and application of the software. Training and application implementation will focus on how students understand application concepts and how computers work. Next, students design applications to control hardware in the form of robots. More importantly, this training and application can trigger students to develop skills and understanding and be motivated to create development applications from ICT classes.

2 Methodology

The training and implementation of App inventor software was carried out in the large class of SMP Muhammadiyah 7 Yogyakarta on April 30 2024, from 13.00 to 16.00 WIB. To train and apply the MIT App Inventor software to 45 junior high school students, the activity was attended by 1 trainer, 7 instructors and 1 documentation team member.
There are several tools and materials needed during the training process. First laptop and Android cellphone. A laptop is used to design a robot controller application via MIT App Inventor, and an Android cellphone is needed to extract the application from the laptop and display the robot controller interface. Second is the internet connection. An internet network is needed to open and operate the MIT App Inventor software. Third, hardware in the form of a robotic hand equipped with Bluetooth. Lastly is the training module. The training module was created by the trainer by providing visual instructions to explain the steps and procedures for making the application.

During implementation, 1 trainer was assisted by 7 instructors to optimize the training process and application implementation. In total there are 6 groups. Each group consists of 6 to 7 students guided by 1 instructor. In training and implementing the application, the trainer creates a program design from the beginning to the end and it is immediately displayed on the screen at the front of the class. During implementation, students are given a guide to the modules in each group. The training and implementation of this application is carried out interactively, where students directly practice making applications using the laptops available in each group. In each group all members work together. If they encounter problems during implementation, students will be guided by the instructor. Furthermore, if the instructor still experiences difficulties, the trainer will immediately provide guidance to the students in the group who are experiencing this.

Finally, to assess the results of the training, observations and initial tests were carried out to determine the results of the training and implementation of the application. Implementation results are obtained from indicators of the achievement of the software creation process, motivational responses and the level of success of students in facing application difficulties.

3 Results and Discussions

3.1 Get Started with MIT App Inventor Applications Online

There are several steps before starting to create an application. First, prepare the computer or laptop used to design the application program. Then the application that has been created is displayed on Android. To do this, an app called the MIT AI2 Companion is installed on an Android cellphone so that applications that have been designed on the laptop can be charged or operated via the Android cellphone. To enter the design application on a laptop, the next step is to open the URL link: http://www.appinventor.mit.edu/. Then log in using Gmail to create an account that has access to MIT App Inventor. If you don't have a Gmail account, you must register for Gmail first. The application account creation display is as shown in Figure 3 below:

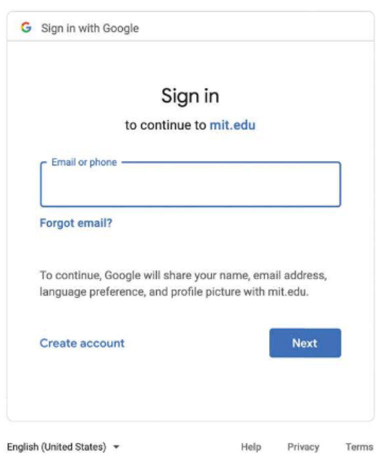

Fig. 3. Creating a Gmail Account for Access to the Application.

When you have logged in, then select the continue menu in Figure 4, left. After that, on the monitor screen in Figure 4 right, select Start a Black Project. Finally, on the new project menu a column for the project name will appear, then the project name can be filled in and the application design screen will appear.

Fig. 4. Application Creation Process for Application Design

3.2 Designing the Arm-Robot Control Application Interface

The IDE window display in Figure 5 is also called Designer. In this window the Designer can design the interface appearance by determining the components used. The components used are buttons, Bluetooth and labels. The Designer viewer consists of Palette, Viewer, Components and Properties as in Figure 5 below:

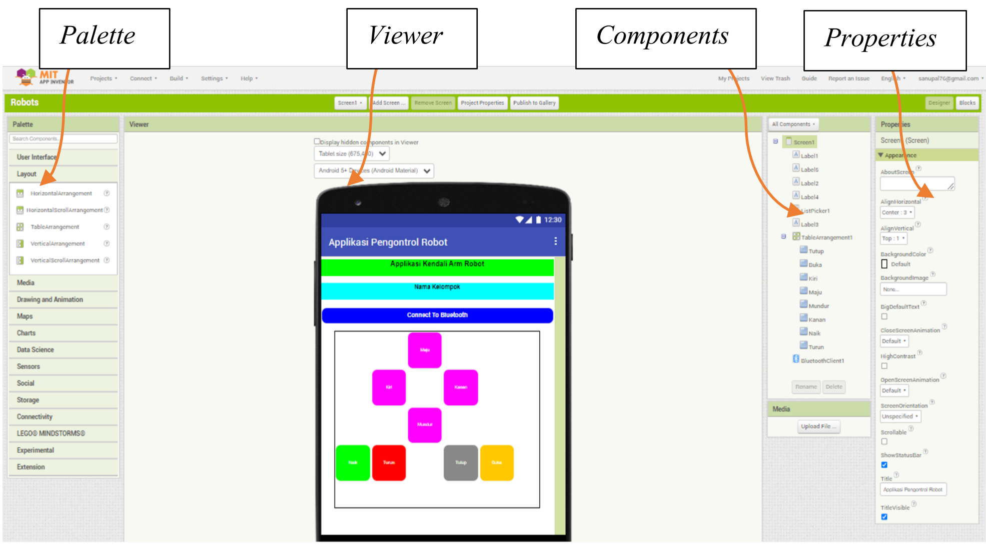

Fig. 5. IDE Window Display.

To design the robot controller screen, display as in Figure 5 above, in the palette panel select the interface menu. Then select and drag several buttons, labels and 1 bluetooth. Next, add listPicker and TabbleArrangement, each of which functions to initiate Bluetooth functionality and table settings. Next, in the Viewer, several buttons, labels, Bluetooth, ListPicker and TableArrangement are drawn onto the screen in proportional positions as in Figure 5 above. After the components are dragged and displayed in the Viewer, then arrange and select each component via Properties. In Properties, the font appearance, background color, position and animation display of all components can be adjusted to suit design needs.

3.3 Creating Coding Blocks in MIT App Inventor Software

After adding and arranging the appearance of all components in the Viewer, then move to the block editor menu as in Figure 6 below.

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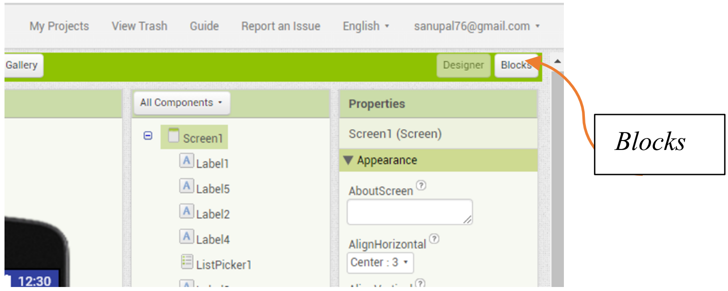

Fig. 6. Block Editor menu.

The viewer menu in the block editor consists of various types of block code and is arranged like a puzzle. These coding blocks act as program blocks in the designed application. In this case there is a fundamental difference between Designer and Block Editor. The Designer controls the form and appearance of the application while the Block Editor controls the characteristics or behavior of the application. To build an application, these two parts must exist and be integrated with each other.

In the editor block there are two main parts, namely the Palette and the Coding Block Viewer. Palette is composed of Built-in blocks and component blocks which function to build application programs. Next, in the coding block viewer a built-in coding block will appear based on the components displayed.

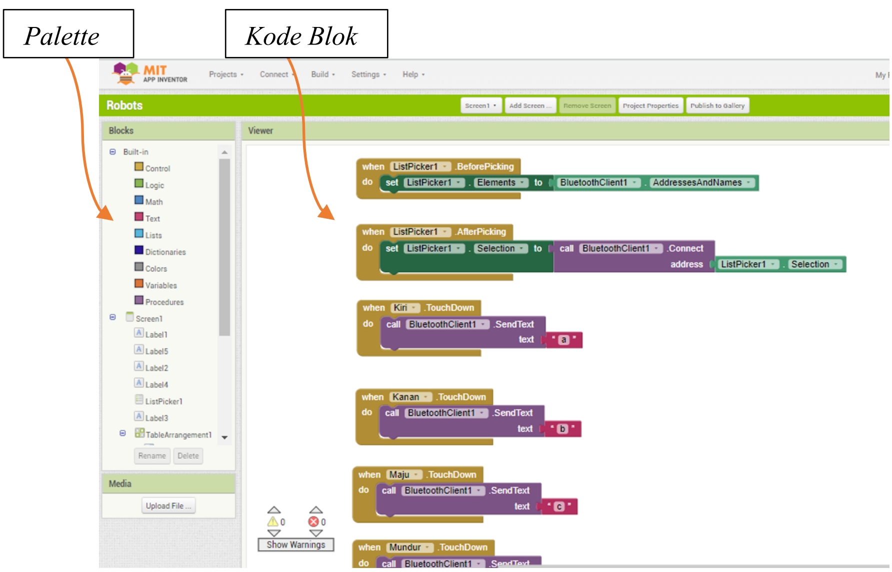

Fig. 7. Block Editor View.

In the Palette block, the robot controller application consists of a Built-in block and a Components block.

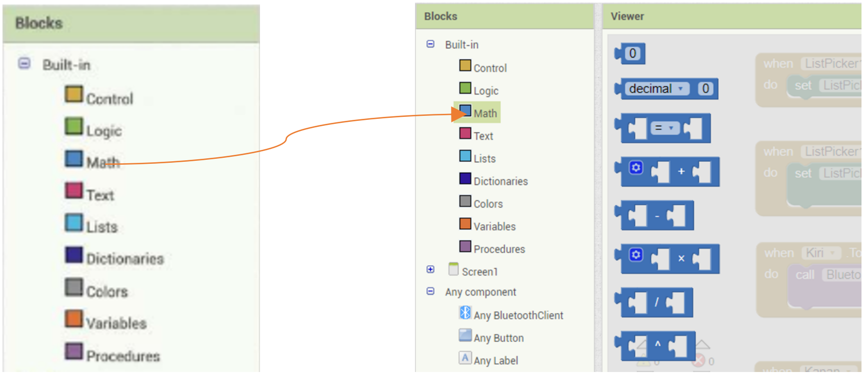

Fig. 8. Built in Block

Built-in blocks like Figure 7 are arranged by category. For example, the Math category is for math instruction block codes, Text is for letter or number character instruction blocks and various other categories. The block code will appear if one of the categories in the Built-in block is selected. Additionally, the component block as in Figure 8 corresponds to the components that have been added to the Designer view. These components will automatically appear in the Component Block. With the selected component blocks and code blocks, behavior, properties and instructions can be controlled. For example, in the Designer view several buttons are installed, one of which is the close button, then the close button will appear in the component block in the Palette block menu. By selecting the close button component, the code block will automatically appear so that the properties, behavior and instructions of the button can be adjusted. This applies to all components, be it buttons, labels, Bluetooth or other components.

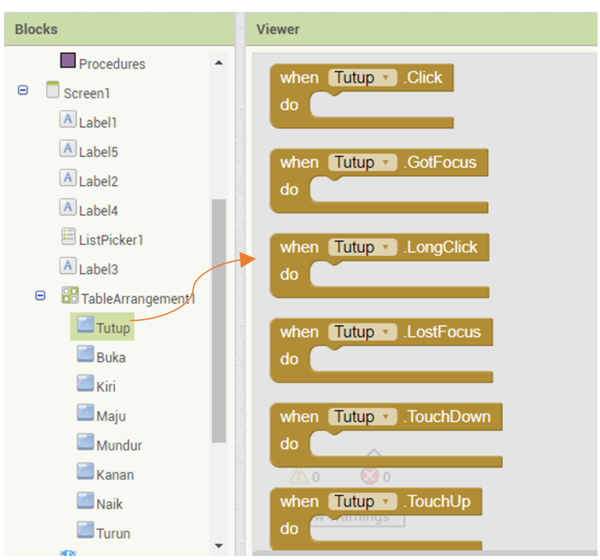

Fig. 9. Block Code.

Lastly is block code programming. In the coding block, the program is set to connect the coding that has been designed in the MIT App Inventor URL to Android Bluetooth and from Android Bluetooth to robot Bluetooth. In Figure 9, the ListPicker BeforePicking is drawn and connected to the element code in Bluetooth, then Android Bluetooth automatically connects to the MIT App Inventor application. ListPicker AfterPicking conditions are installed with selection to provide Android Bluetooth options that will connect to external Bluetooth. If the external Bluetooth is a robot's Bluetooth, then Android Bluetooth with the BluetoothClient block code can connect to the robot's Bluetooth address.

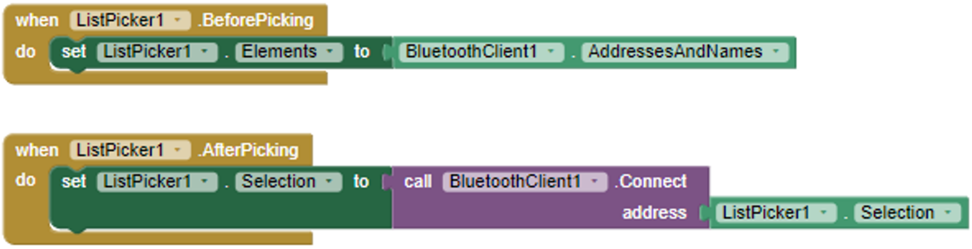

Fig. 10. Bluetooth Initiation and Connection Coding Block

To control the direction of the robot's movement, several buttons are needed to give instructions for the direction of the robot's movement via Android. When one of these buttons is pressed, the left button for example, the Android Bluetooth will give a command to move to the left via the motor connected to the Robot's Bluetooth. To connect the instructions to each button, the block code is given a text code as in Figure 10.

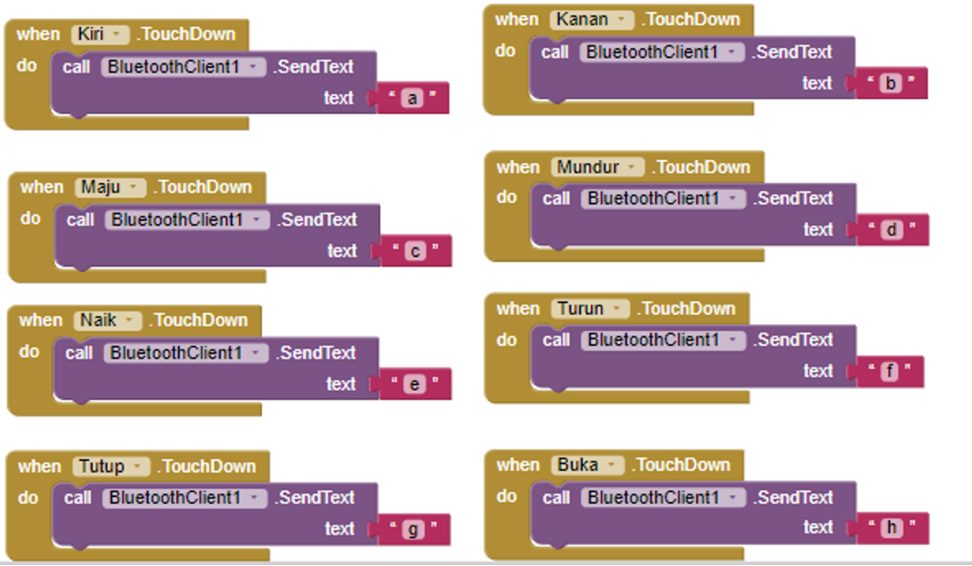

Fig. 11. Robot Movement Control Instruction Button.

3.4 Installing MIT Inventor Software on an Android Phone

After the design of the MIT App Inventor application at the URL is complete, the next step is to connect the application to an Android cellphone to control the robot's movements. For this reason, you need to install MIT App Inventor on your Android cellphone. Installation can be done with Google Playstore on Android phones.

3.5 Connecting MIT App Inventor Software on Android with Arm-Robot Hardware via Bluetooth

The program design can be extracted at the URL where the programming was created. The App Inventor URL Designer layout display when programming will appear the same on an Android cellphone. This step can be done by selecting Al companion in the connect menu in the MIT App Inventor URL window. The robot controller layout display will appear on Android after scanning or entering the code provided by the MIT App Inventor URL as in Figure 11 below:

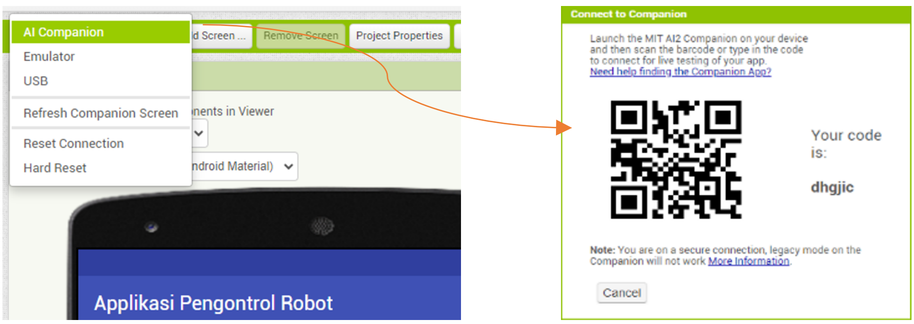

Fig. 12. Program Extraction from the MIT App Inventor URL to an Android cellphone.

The training and application of MIT App Inventor was carried out for half a day, from afternoon to evening, for 42 students of SMP Muhammadiyah 7 Yogyakarta. This training ended with initial observations of the level of enthusiasm and dynamics of the forum during class training. Based on the dynamics of the forum and students' responses, it appears that training and application of MIT App Inventor Software can increase students' motivation to understand more about computer science. During the presentation of the material and the program design process, students were enthusiastic and actively participated in the training. Apart from that, students can follow the material presented well.

4 Conclusion

Training and implementation of MIT App Inventor software at SMP Muhammadiyah 7 Yogyakarta to increase student productivity and motivation went well. In this training, students can create robot control applications via Android easily and enthusiastically. In 3 to 4 hours, students can start and open the MIT App Inventor application online and be able to create a robot controller design interface layout. Additionally, students are productively able to understand how the application program works through the code blocks available in the MIT App Inventor software. Finally, the students were encouraged to integrate the application they had created onto an Android cellphone via Bluetooth installed on the Android and robot. The next recommendation is that students can develop other applications that can be applied to life.

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