Implementation of NXT 2.0 Mindstorm Robot Sensors on Mobile Education for Students

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Abstract*: In the current 4.0 industry era, technological development is very fast and fast. In the world of education the lessons about technology should have been introduced to students since elementary school. Do not have to use complex technology, enough to use robotics technology from the NXT 2.0 LEGO minstorm robot which is lego-based to play and learn algorithms in composing technology. Using this tool can also be controlled by the smartphone application. Using a mobile application that we designed will make it easier for students to use and play this educational media. In this media, each sensor in the robot will be interrelated to the mobile control, we have tested this control with 83.33% detection accuracy. So that it can effectively become an interactive and fun technology-based learning media for students. The purpose of this educational media is to improve the quality of education in Indonesia so that it can be technology-based and enjoyable for students. Because the application of technology to education is very important to hone the power of creative thinking in composing programming algorithms using robots. Students will be very interested and have good enthusiasm in learning robotics based on this mobile application.*

Keywords*: robot LEGO Mindstorm NXT 2.0, Sensor robot, Mobile Application, Interactive Education*

INTRODUCTION

In the industrial era 4.0 the development of information technology is very influential to encourage the progress of various fields. One of the most influential technological advances is the use of digital technology and robotics. As in the use of android technology that is already popular among students. Even students in Indonesia still feel a lot of negative impacts from smartphone usage compared to the positive benefits they take. Therefore it is very important to utilize Android technology in students through educational media. One smartphone that is currently popular is an Android-based smartphone. Reported by Andy Rubin (VP mobile Google) in June 2012 as many as 900,000 Android devices were activated.

The benefits of smartphones for students and the public must be shared and most important especially for the world of students to support learning and learning activities in Indonesia. Actually, if you talk about positive and negative effects, all aspects are sure to have positive and negative impacts. But all that goes back to each of us, how we use it. Especially among lay people or elderly people in rural areas, there are many opinions that the virtual world is identical to things that are negative. To the extent that they parents especially forbid many children to access the internet.

As with the development of smartphone technology, research related to the development of robots is also continuing. One of the most famous robot technologies now is Lego NXT with the NXT-G Mindstorm platform. NXT is a refinement of the Lego RIS (Robotic Invention System) series of robots that have been successful in the market. Lego Mindstorm NXT allows for the construction of robots using several motors and sensors. But the processing power, memory, and communication capabilities of LEGO NXT are far behind what is offered on PDA or laptop devices (Budianto. 2012).

The use of the NXT 2.0 lego mindstorm robot is very interactive when used as a learning medium for students. Because by using this robot, it will be very easy to be able to implement sensors and how a theory works by being proven through NXT 2.0 mindstorm robot technology.

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MINDSTROM NXT 2.0

Mindstorms NXT is an LEGO () educational robot device. The NXT series was officially released in 2006 as the successor to the previous series, namely the successful RIS (Robotics Invention System) on the market. The use of Mindstorms NXT helps facilitate the making of robots. This is because Mindstorms NXT eliminates the need for soldering circuits and eliminates difficulties when installing motorcycles (Jatmiko, 2010.) LEGO Robot Mindstorm NXT 2.0 has a variety of complementary sensors to easily detect automatically, in this robot there is a complete reference just to use a simple program to run it.
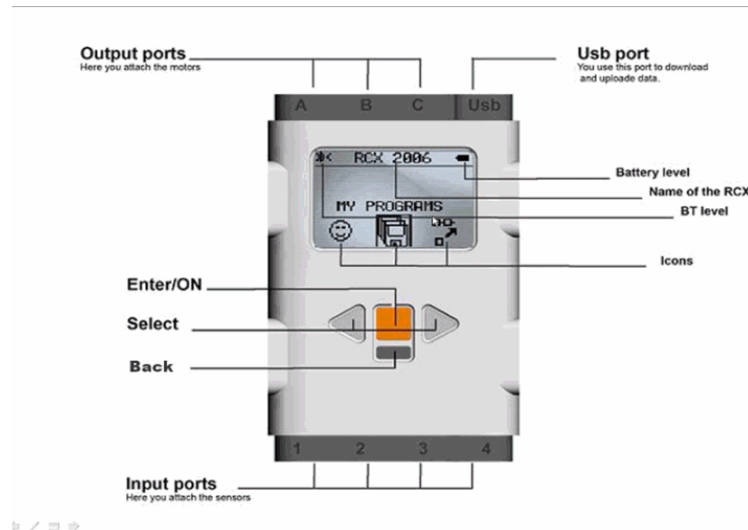

Figure 1: Schema of Robot Mindstorm NXT 2.0

LEGO Mindstorms makes it possible to build embedded systems without any prerequisite knowledge and to solve real problems with constraints such as sensor limitations, low computational power, and memory. LEGO Mindstorms' most important component is the LEGO Brick, which has dedicated software, inputs, and output and has both limitations and advantages. Kim and Jeon describe how freshman engineers learn about embedding systems using the LEGO Mindstorms as a tool.

Ultrasonic sensor

The ultrasonic sensor is the main sensor for navigation and obstacle avoidance. It could be said that the use of ultrasonic waves mimics navigation techniques in bats or submarines. This sensor is shaped like an eye. The right eye is an ultrasonic wave transmitter, and the left eye is an ultrasonic wave receiver. This sensor can be used to measure the distance of a robot with the object to be detected, making it easier for the robot to measure it (Pura, 2014).

Press sensor

Press sensor is a sensor that can detect pressure. The ability of a robot to know that a robot is about an object or colliding with another robot is obtained from the press sensor. The pressure sensor allows not only to detect the presence or absence of pressure but also whether the pressure has been released or not. This pressure sensor can calculate the amount of pressure on the tip of the sensor and can detect the robot when pressing an object.

Light Sensor

The light sensor on LEGO Mindstorms NXT consists of two components, namely: LED (Light Emitting Diode) and phototransistor. This sensor can distinguish light and dark light, read the intensity of light in a room, and can measure the intensity of light on a colored surface. The light sensor is very sensitive in the presence of light and color differences, because every color recorded by the light sensor will affect the detection results.

MOBILE EDUCATION

According to (R. Ibrahim and Nana Syaodih S.2003) teaching media is interpreted as everything that can be used to channel messages or content, stimulate students' thoughts, feelings, attention and abilities, so as to encourage the teaching-learning process. (Sudjana and Rivai. 2007) The benefits of learning media in the learning process of students are:
1. Teaching will attract more students' attention so that they can motivate learning.
2. Teaching materials will be more clearly defined so that students can better understand them and enable students to master the teaching goals better.
3. The teaching method will be more varied, not solely verbal communication through the speaking of words by the teacher, so that students are not bored and the teacher does not run out of energy, if the teacher teaches every lesson.
4. Students do more learning activities, because they not only listen to the teacher's description, but also other activities such as observing, demonstrating and others.

Media when understood broadly is human, material, or events that build conditions that make students able to acquire knowledge, skills, or attitudes. Understanding the media in the teaching and learning process in particular tends to be interpreted as graphic, photographic, or electronic tools to capture, process, and reconstruct visual or verbal information (Arsyad, 2011: 5).

Android-based Education Media is an educational game that is played on a smartphone or tablet that has an Android operating system (Sari, 2012).

Deep Android-Based Learning Media is a form of activity that involves participants in it to be in accordance with the rules that have been set, to achieve goals. There are 3 conditions in the game, namely there must be a player, there are rules that are directed towards the achievement of learning objectives and indicators of achievement of learning outcomes. The element of competition between groups will train students to work together, be confident, and not discouraged (Latuheru, 1988). The game is something that is fun to do and is entertaining. The game becomes interesting because in it there is an element of competition, and hesitation because it does not know beforehand who will win and lose (Sadiman et al., 2008)

An Android-based educational game is a learning media application through interactive games developed on smartphone devices with an Android operating system. This game can be used by students in learning the subject matter. The use of the game is very flexible because it can be used anywhere, anytime, and by anyone. So the use does not rule out the possibility of being used other than students. The use of smartphones as learning media is a new innovation in learning. Smartphones are empowered to use in helping the learning process. Students can learn easily with small devices (smartphones).

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SENSOR IMPLEMENTATION

The LEGO Mindstorm NXT 2.0 robot has a very complete sensor, including light sensors, ultrasonic sensors, press sensors, sound sensors and so on. Besides that there is also a DC motor that can move other connecting components. For example, when used to drive a robot's wheels and legs, the motor can be programmed according to our wishes.

Figure 2: Relationship of sensor control

Programming on this robot, can be done on a computer or directly monitored by a robot, but more freely when programmed using a computer. With the program that we arrange, in the form of program blocks that are interrelated so as to produce a good coherent algorithm.
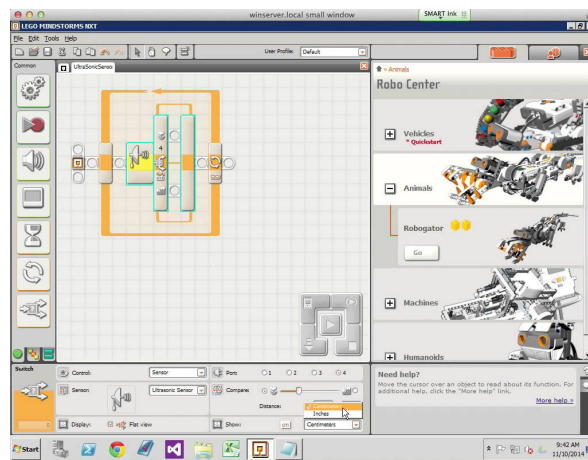

Figure 3: Programming on a robot sensor

CONTROL WITH MOBILE

Interactive learning application using the robot LEGO Minstorm NXT 2.0. In controlling the program can be done using a smartphone with certain applications. In controlling this program is done with artificial applications that have an important role for remote control. This remote control can be done by utilizing bluetooth in robots and mobile.
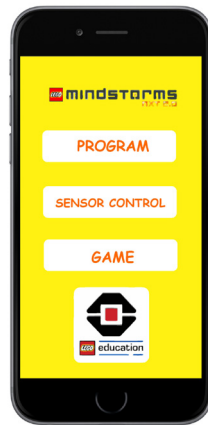
Figure 4: Sensor control with mobile aplication

Testing of the implementation of the LEGO Minstorm NXT 2.0 sensor on the robo is done by testing the distance, light and number of presses. Each test is conducted 10 times from 3 test fields. From these tests it can be produced that the accuracy of the sensor on the LEGO Minstorm NXT 2.0 robot using the mobile application control has a high success rate of 83.33%.

Table 1: Robot Sensor Testing Results

Testing	Ultrasonik	Light	Press	Succes	Percentage
1	10.32	20.02	91.11	2	
2	12.02	21.91	80.20	1	
3	18.30	18.60	81.10	3	
4	19.54	19.24	98.42	3	
5	18.01	21.29	70.04	3	83,33 %
6	10.44	92.08	88.00	2	
7	10.98	21.07	72.76	3	
8	10.12	22.51	53.33	3	
9	19.22	19.42	87.07	2	
10	11.22	21.24	71.03	3	

CONCLUSION

This research is the implementation of robotics technology from the LEGO Minstorm NXT 2.0 robot using a mobile application for effective learning media for students. Students can easily and fun to play while learning with this robot. With this test can be produced that the value of the application to detect the sensor can reach 83.33% success. So it can be concluded that this application can be used in the right learning, interesting and interactive for students.

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