Android control and monitoring for smart campus with the internet of thing

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Abstract. Informatics engineering study program at Banyuwangi State Polytechnic has 8 laboratories with lots of electronic equipment in it. That is computers, air conditioners, lights, projectors, sound systems and network equipment. That equipment is used for practicum and other activities every day. The problem that often occurs is that the user forgets to turn off the equipment, which has an impact on the swelling of electricity bills that must be paid by the Banyuwangi State Polytechnic every month. The same as other equipment outside the Laboratory which often forgets to turn off and wants to be turned on when entering the room has an impact on the amount of electricity bill that must be paid. In general control of electrical equipment is still working manually so it is less effective. This prototype was made to make it easier for users to control electronic equipment remotely using the internet in real time. This prototype is equipped with an Android application to facilitate monitoring of electronic equipment in Banyuwangi State Polytechnic. This prototype is equipped with a current sensor so that it can see the amount of current consumed by electronic equipment, but it can also calculate the cost used by the electrical equipment. Users can also turn off and turn on electronic equipment periodically or manually remotely using the Android application. The detection of current sensors in prototypes has an error below 0.01% compared to manual measurements using avo meters

1. Introduction

Technology developments are increasingly rapid until now making companies that provide various programs to help develop Internet-based products. Internet of Things (IoT) is a term that has recently been widely found but few understand the meaning of this term. The Internet of Things can generally be interpreted as objects around us that can communicate with each other through the internet. The Internet of Things has the concept of extending the benefits that are connected in an internet connection continuously. For example electronic devices, food ingredients and including living things and much more. The sensor can be implanted which is always active and widely connected, both with local networks and with global networks.
So far, the development of electronic device control is still relatively slow compared to the growth of the internet in Indonesia. The problem so far controlling remote devices is expensive and the complexity of the control scheme. (Dhit:2010). Using a server that requires extra maintenance, expensive, additional costs to support. Likewise, access to public IP is expensive and increasingly limited. This is a common problem with remote-based controls. The trend of increasing internet usage also occurs in Indonesia. Based on IDC in 2012, Indonesia became the country with the highest internet user growth, which was 30.9 percent, The fourth highest country in Asia, internet

growth after China, India and Japan. This growth is supported by the growth of internet usage through mobile devices. The easier and cheaper mobile devices are one reason for the development of mobile internet. As reported by Kompas.com on October 28 that internet users in Indonesia in 2011 had reached 55 million people, up from the previous year at 42 million. Of these 29 million of them are mobile internet users. However, significant internet growth each year is not balanced by the availability of infrastructure so that the speed of each user is limited. According to MarkPlus Insight, the number of Internet users in Indonesia in 2011 had reached 55 million people, an increase from the previous year at 42 million. But based on Akamai's research, the average Indonesian speed per user is also very low, ranging from 0.8 Megabits per second.

The need to control electrical equipment such as turning on household electrical appliances such as Air Conditioner is more efficient if it can be controlled properly. So far, people use infrared-based remote control to control things remotely, but for infrared-based control is limited by distance. In order to control electrical equipment covering a wide and easy area, one solution is to use an Android smartphone as a remote control.

The Android operating system is a software that has developed rapidly at this time. Therefore, many software developers make Android a new innovation in the field of software or operating systems on Android smartphones. Java programming language is a programming language used for making applications on Android, or commonly referred to as Java code application. This application is used as a media from users to turn off and turn on household electrical appliances.

By using Android, users can control household electrical appliances automatically. Household electronic equipment is also able to be controlled remotely using a mobile application that integrates wifi modules and supports Java programming as an interface and can be used by more than one electrical device. The cellphone used is a cellphone that uses an Android operating system. Therefore, in this research, developed electronic device controls using android phones via the internet

2. Research Method

System design is done by object-oriented engineering method approach. To be able to suit the needs of users. System design includes software design, hardware design and user interface design.

The software design is realized using the Unified Modeling Language (UML) notation, including static and dynamic designs. The software built consists of web-based software and Android-based software. Web-based software, used to manage electrical equipment in agencies, companies, campuses, hotels and others. While the Android application and website can be used by individual users or officers or in charge of the Laboratory. Although at the level of applying this system both applications (android and web) can be used by all users as needed

In this smart Campus system, a current sensor will be installed on each device to monitor the equipment is on or not. Then, for the needs of the on / off control, the relay control device will be paired that can break the voltage entering each equipment. The hardware will be connected wirelessly with the internet network using a microcontroller. So it can be controlled remotely and real time. Every hardware device will be attached to an electrical socket and will continuously send the status to an IoT server / broker using the mqtt protocol

The user interface design is created by mockup every form of user interaction with web applications and mobile applications. This interface design is made friendly and secure to make it easier for users to interact with the device. Where the device will present information about the status of electrical equipment in each room, the power consumption of each electrical equipment and the on / off control facilities. on the Android application, users can also see the amount of fees that must be paid

3. Result and Achieved Ouputs

Figure 1. Electric/power socket prototype

the prototype shown in Figure 1 is a power socket equipped with a microcontroller. Inside is also equipped with a current sensor to monitor the current passing in the socket. Relay to connect and disconnect power lines. besides, the microcontroller is equipped with a wifi module. This module is used to communicate with the user's mobile device

the current sensor will detect the current passing through the electrical socket. the results of reading the current will be sent to the user's mobile device. This current data will be processed on android to find out the power consumption used today, as well as being able to find out the electricity costs to be paid

Figure 2. Figure 2 shows the login page. This page serves to authenticate the user, whether the user has registered or not

Figure 3. Figure 3 shows the mockup home after the user successfully logged in. this page shows the total electricity cost per day, the list of devices and the status of the electrical device. The status of electrical equipment that can be seen is the condition of the device is on or off, and is using a timer or not

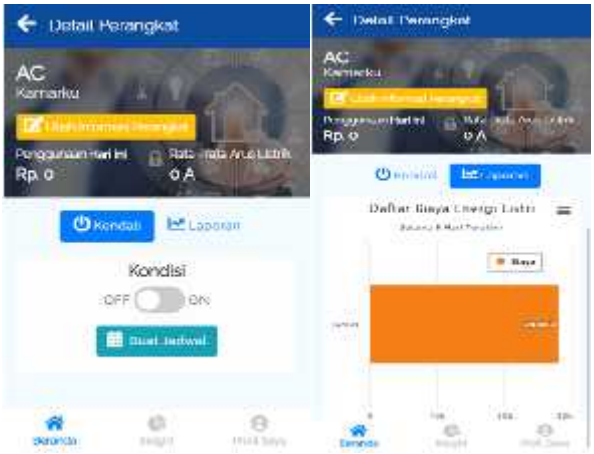

Figure 4. Device details (Detail Perangkat)

Figure 4 shows the device detail mockup, on this page users can control the on or off of electronic devices. Users can also schedule when the device is on and when the device turns off automatically. on the report tab, users can see the amount of costs needed on one device only

Figure 5. in this mockup insight users can see the percentage graph of the use of electronic devices that are often used every month. on this page also shows the costs in rupiah that need to be paid every month

In this research also tested the accuracy of the current sensor placed on an electrical outlet. in addition to being used for monitoring, this sensor is also used as an electrical safety. When there is a significant and sudden increase in the current value, this event is categorized as a short circuit and the electrical connection is disconnected.

Table 1. comparison of current sensors with ampere meters

Device type	Current when the device is on (A)		Current when the device is off (A)	
	Current sensor	Ampere meter	Current sensor	Ampere meter
Air conditioner	6,2	6,42	0,01	0,01
CPU 1	0,74	0,77	0,01	0,01
10 watt lamp	0,59	0,59	0,01	0,01
30 watt lamp	0,61	0,61	0,01	0,01
Fan at level 1	0,46	0,46	0,01	0,01
Fan at level 2	0,48	0,48	0,01	0,01
Fan at level 3	0,53	0,53	0,01	0,01

from table 1 above shows how accurate the current sensor is installed in an electrical socket. Almost all data read by the current sensor has 0% error. on air conditioner devices there is an error of 0.3%, while in the CPU there is an error of

4. Conclusion And Recommendation

4.1 Conclusion

Based on the results of the implementation of this study in Politeknik Negeri Banyuwangi, the conclusion comes as:

1. The use of this prototype makes it easier for users to control electrical equipment from anywhere at any time
2. Users can monitor electrical equipment in real time
3. Can save electricity usage so that it can reduce the costs that must be paid each month
4. The current sensor used is very accurate in reading the current passing through the electrical socket. This is evidenced by an error of almost 0% in each sensor reading.
5. Even if the electrical device is off or stand-by, the electrical equipment will still consume power continuously

Based on the research result and conclusion, researchers recommend to other researchers who will cite this research:

1. The use of devices with a very large number to determine the reliability of the system used
2. Use a mobile device with a different operating system.
3. This system can be used for various fields, health, agriculture, plantations, and others that still use electrical equipment

5. Acknowledgement

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