Android and Microcontroller Based Camtree Controller System

Muhammad Arif Hidayatullah and Ferry Wahyu Wibowo
Department of Informatics Engineering, STMIK AMIKOM Yogyakarta,
55283 Yogyakarta, Indonesia

Abstract: The Internet of Things (IOT) has encouraged the development of the automation and remote devices. The usage of a microcontroller in the control fields is still having portion in some projects or hobbies. The microcontroller itself is a Integrated Circuit (IC) that consists of a microprocessor, Read-Only Memory (ROM), Random Access Memory (RAM) and other input/output pins. In this study, the microcontroller used as a brain to process controlling of a camtree. The camtree could be controlled its movements remotely using combination of a microcontroller and an android smartphone through a serial data communication of a bluetooth. The tools and devices employed to build this camtree controller system are an ATmega8 microcontroller minimum system, a bluetooth module, a Direct Current (DC) motors, a servo motors, a BASCOM-AVR application and a basic4android. In testing of servo and DC motors showed that all of motors has been run very well as expected.

Key words: Android, bluetooth, camtree, controller, microcontroller

INTRODUCTION

The technology advancing in the computer and communication fields has made some ideas to improve in the life style. Many appliances and industry tools have employed automatically system and they could remote using controller system such as remote controllers, cellular phones, Personal Computers (PCs), etc. The ideas of internet of things could be a good aspects in the field of multimedia and electronics. The usage of microcontroller in the controlling aspect is still having portion in some projects.

The microcontroller is a component of electronics containing interconnection systems of microprocessor, Random Access Memory (RAM), Read-only Memory (ROM), input or output interfaces and some other peripherals. Using microcontroller, the idea of simple technology could be made. The implementation of a microcontroller for controlling a camtree when taking a picture is an easy way for photographers. The camtree is a camera controller and movement systems functioned as a camera pot to take a picture or video horizontally or vertically in making a film, advertisement or video web series. Many camtrees used today are still manually moved using hand and must contact directly. In this study shows that the camtree could be controlled its movement remotely implemented using an android application and a microcontroller. This controlling is done automatically to ease in taking a picture or video. By implementing a smartphone especially to functioning on application facility of a Bluetooth, so an android application and bluetooth could be a medias to control the camtree remotely based on a microcontroller (Mowad et al., 2014; Pahuja and Kumar, 2014; Hule et al., 2015). There are two goals those are shown in this study, i.e., how to make a device controlled by an android application and how to program an android as controller. The boundaries of this study are implementing of ATmega8 microcontroller minimum system, the hardware could control a camera position and movement and communication between device and android smartphone is done using Bluetooth (Anusha et al., 2015). So, this study conducts the camtree handled easily and more stable in taking a picture or video.

Related works: The tools employed in this study are an ATmega 8 microcontroller minimum system, a bluetooth module, a Direct Current (DC) motor, a servo motor, a BASCOM-AVR application and a basic4android.

AVR atmega 8 microcontroller: A microcontroller is a mini controller system packaged into a single Integrated Circuit (IC) and known as a single chip microcomputer. Furthermore, the microcontroller is a computer system that has one or more very specific tasks, different from the Personal Computer (PC) that has a variety of functions. The microcontroller consists of hardware and software and there is also a memory, Central Processing Unit (CPU), etc. For the mini current needs, the microcontroller be one choice as a control tool that is flexible and easy to
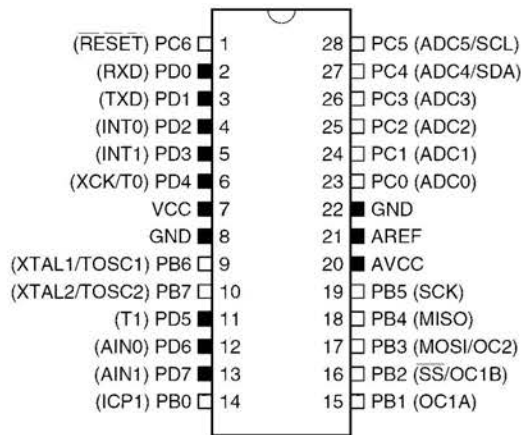
Corresponding Author: Muhammad Arif Hidayatullah, Department of Informatics Engineering, STMIK AMIKOM Yogyakarta, 55283 Yogyakarta, Indonesia

Fig. 1: ATmega 8 Microcontroller pin configuration

Fig. 2: The USART Block on ATmega 8 Microcontroller

carry anywhere and can be re-programmed. In the expansion, the microcontroller has taken an important role in the electronics systems, especially in hobby and consumer electronics applications. The pin configuration of ATMega 8 microcontroller is shown in Fig.1. The Atmega 8 microcontroller has 28 pins, each pin has its different functions, wether as a ports or other functions.

A serial communication: On The ATmega 8 microcontroller, there are two Universal Synchronous/Asynchronous Receiver/Transmitter (USART) ports are used as a serial communication contained on PD0 and PD1 pins. In pin PD0 used as RXD or receiver pin which serves as a receiver of information and pin PD1 to TXD or transmitter used as the sender information. The serial communication on the microcontroller is needed so that the microcontroller can communicate with other peripherals or modules such as a bluetooth, a Wireless Fidelity (Wi-Fi), a wavecom modem, a Personal Computer (PC), even with another microcontroller in order to hold the microcontroller can be functioned and controlled remotely and can be monitored from other places. The USART consists of three blocks namely clock generator, transmitter and receiver. The USART block is shown in Fig. 2.

A bluetooth: A Bluetooth is a communication device that serves as a liaison between the device to other devices or between devices to hardware and other communication devices. The bluetooth is used to facilitate human in connecting the device's file sharing of video, images, audio and others. The bluetooth usage is easier for sending and swaping a files because it doesn't need to use a cable connecting to other devices. The Blu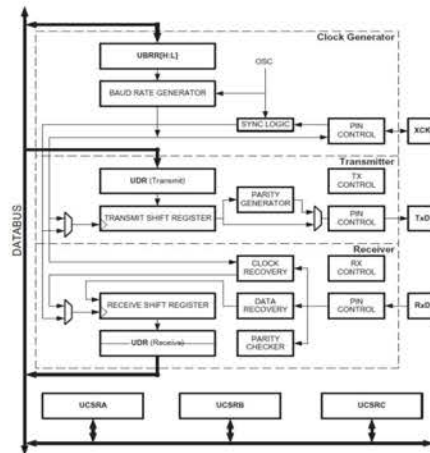etooth used in this study is a bluetooth type of HC-05. This device is functioned as a receiver of commands sent through a smartphone. This device hosted to the ATmega 8 microcontroller via Transmitter Pin (TX) and Receiver Pin (RX). The device will receive an information in the form of characters written on the android application and the ATmega 8 microcontroller will declare and translate the characters those are transmitted as a commands.

A servo motor: A servo motor is a type of motor that is widely used as a driving force to the robot arm. There are two types of the servo motors are used, the 180° standard servo motor and the continuous servo motor. The 180° standard servo motor is a rotating servo type based on the angle given by the pulse. This servo motor type can rotate in two directions, namely the Clock Wise (CW) and the Counter Clock Wise (CCW) with the greatest angle limit is 180°. While the continuous servo motor is a rotating servo type without angle boundary, meaning that this servo rotates continuously without limited in certain angles. This servo type is also capable of rotating in two directions as CW and CCW. In this study, a servo motor functioned as propulsion and control of a camera position.

A DC motor: A Direct Current (DC) motor is an actuator which can rotate in two directions, namely Clock Wise (CW) and Counter Clock Wise (CCW). The DC motor can work on a wide range of voltages, started from 3-24 V. In the implementation, a DC motor needs a motor driver serving as a regulator of motor rotation direction and speed of a motor rotation. In this study a DC motor applied as the driving of the camtree controlled by driver motor and device part of the camtree rail and interconnected with gear (Istiyanto and Wibowo, 2007).

A BASCOM-AVR: A BASCOM-AVR is a free software that functions as a text editor to write a command lines and compiles the code into source file in the form of hexa. The BASCOM-AVR is a Windows-based compiler basic program for AVR microcontrollers that uses a kind of high-level programming language that is developed and issued by MCS electronics, so that it can be easily understood or translated. In the BASCOM-AVR programming, there are a few advantages to build a software program of ATmega 8 microcontroller such as a simulation program that is very useful to test the simulation results of the program that have been built, before the program code is uploaded to the microcontroller IC.
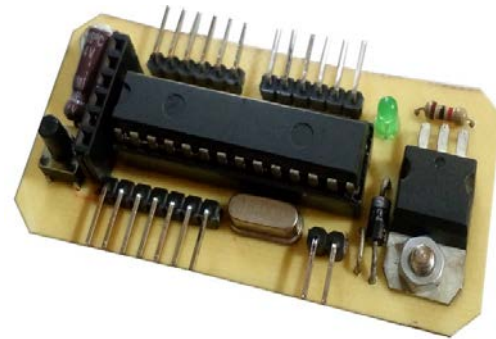
A basic 4 Android: A Basic4Android is an application used to create android based applications within file extension of .apk. This application also uses a Basic language that can be understood and translated easily compared with other programming languages. The Basic4Android is also very light in the usage wether in terms of memory or CPU. To connect to the emulator application is also very easy. Some compatible connection to this emulator application are Genimotion android Emulator android Virtual Manager and others.
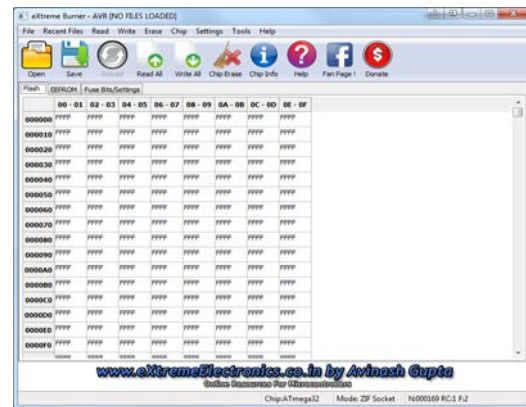
MATERIALS AND METHODS

Tools and materials: The design of a camtree controller system based on ATmega 8 microcontroller and an android application on smartphone is a software and a hardware. The hardware used includes an ATmega 8 microcontroller minimum system whereas the software has been needed as a support system for programming the microcontroller and smartphone. The microcontroller is functioned as the main controller of the entire system or could be referred as the system brain. The circuit is equipped with a power regulator and ports that are used as other support Input or Output (I/O) modules.The microcontroller minimum system has been designed as Fig. 3.

For programming the ATmega 8 microcontroller minimum system from PC, it uses a USB downloader. The program application to upload the file that has been compiled by the BASCOM-AVR to the microcontroller via the USB downloader is eXtreme Burner-AVR application. This application is shown in Fig. 4.

The power supply for the ATmega 8 microcontroller minimum system deploys a power bank. The power bank has a fully charged power of 5 V and it is suitable for the microcon troller minimum system and motor driver. The power bank is also a battery recharger and it's usually

Fig. 3: ATmega 8 microcontroller minimum system

Fig. 4: The eXtreme burner-AVR

Fig. 5: AVD manager

used when the power is reduced. The application used to simulate the application that has been built by the tool of Basic 4 android to control a camtree is AVD manager. This application would perform the end result of the camtree controller application. The AVD manager application is shown in Fig. 5.

System design: In the design and manufacture of a camtree controller system is expected to produce a system that can be used properly. Therefore, it is necessary to
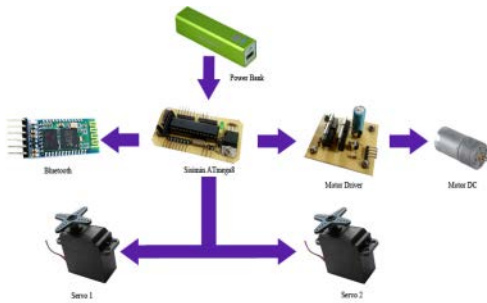
Fig. 6: Block diagram of the camtree controller system

Fig. 7: A camtree body

design the system well. The block diagram of the system design is shown in Fig. 6. When a data are sent from the android smartphone, it will be received by the microcontroller via bluetooth. The microcontroller will process the data and it will result an information. These information are a decision in the form of a command to adjust the position or velocity of a servo motor set again by a motor driver.

RESULTS AND DISCUSSION

The parts of the camtree controller system used in this design are an electronics, mechanics, programming and application parts. The electronics part is a part that is unbelievably prone to defects and errors in assembling and making it. The minimum system board has been used as an interfacing a computer using an additional board namely ISP downloader. This device would connect the minimum system board with a computer, so it can make hex file (.hex) into the ATmega 8 microcontroller. The motor driver is an electronic circuit to control a rotation direction and speed of the motor. The motor driver will receive the value of Pulse Width Module (PWM) from the ATmega 8 microcontroller to determine the direction and speed of rotation of the motor.

The mechanical parts of the camtree controller system are a camtree body, a camtree rail and a camtree programming. The camtree body was made from acrylic with a thickness of 3mm using type of white acrylic which was designed using Corel Draw. The camtree body is used as laying of the microcontroller minimum system, bluetooth, motor driver, servo, battery and DC motor. The camtree sizes are 15.5×12.8×14.5 cm and combined using acrylic glue (Fig. 7).

A camtree rail is used as the basis for the movement camtree made of aluminum measuring 340×230 mm and combined using nails to strength and balance of the construction. The camtree rail is shown in Fig.8. The crystal used for the ATmega 8 microcontroller is 16 MHz

Fig. 8: The camtree rail

and baudrate used in the serial communication is 9600 bps. So that, the microcontroller can receive a command information from the smartphone's bluetooth using a same baud rate between both the microcontroller and the baud rate of HC-05 bluetooth module.

For creating the controller application on the android operating system using visual basic programming language via software application of Basic 4 Android. After compiling and building the application, the app has been made. The camtree controller application is shown in Fig. 9.

For application simulation on the android smartphone using AVD manager application that is shown in Fig.10. In the implementation of the mechanical precision of the camera functions as an activator. There is no shortage in the mechanic parts. All designs could function properly. Thus a wheels of the camtree controller system using gear made of acrylic material with a diameter of 25 mm. The wheels connected to a DC motor as a driving force with a current voltage of 5 V and it is capable moving forward as expected. Whereas the servo motors used for camtree controller system are a servo motor of Hitec HS-645MG with a torque of 7.7-9.6 kg and servo motor of FITEC FS5109M with a torque of 9-10 kg. Both in pairs and in

Fig. 9: The camtree controller application

Fig. 10: An emulator for the camtree controller application

rafts using acrylic. When given a maximal pulse to the servo motors, the rotation of the servo motors toward to 180°, reversely when given a minimum pulse to the servo toward to 0°. Thus when the servo motors has been applied into the body of the camtree controller system, the servo motors move as expected.

CONCLUSION

The camtree controller system based on Android and Microcontroller has been done. The Atmega 8 microcontroller was functioned as a main controller in the data process. This controller application using an android smartphone could control and the distance of remote between smartphone and the device could connect up to range of 30 meters. A setting for direction, rotating of a camtree to shoot the picture or video is easier and simple.

ACKNOWLEDGEMENT

REFERENCES

Anusha, S., M. Madhavi and R. Hemalatha, 2015. Home automation using ATmega328 microcontroller and android application. Int. Res. J. Eng. Technol., 2: 865-868.

Hule, A., R. Bandage, P. Shah and R. Mahajan, 2015. Android based application for wireless control of wheelchair. Int. J. Res. Eng. Technol., 4: 406-408.

Istiyanto, J.E. and F.W. Wibowo, 2007. A DC motor control based-on cellular phone. Proceedings of 2nd Jogia International Physics Conference, September 6-8, 2007, Yogyakarta, pp: EI072-EI075.

Mowad, M.A.E.L., A. Fathy and A. Hafez, 2014. Smart home automated control system using android application and microcontroller. Int. J. Sci. Eng. Res., 5: 935-939.

Pahuja, R. and N. Kumar, 2014. Android mobile phone controlled bluetooth robot using 8051 microcontroller. Int. J. Sci. Eng. Res., 2: 14-17.