ABSTRACT

Having a comfortable home is everyone's dream, to design buildings that have beautiful architecture and comfortable to live. In technological era now, home is not only need to have a beautiful architecture design and comfortable but it also requires a variety of electronic devices that able to detect the condition of the house and turned on the right device to suit the required conditions. For this reason an integrated control device is now needed to be able to control all electronic devices at home easily. This paper tells a design of an integrated smart home control. This device can detect room temperature, light intensity, motion detection so it can determine the actions necessary to regulate the condition of a smart home. This control is also equipped with remote control technology using SMS that allows users the system knows the condition of the house and gave orders for the computer to adjust the integrated control. It also has mobile location tracking system uses GPS technology that can detect the user's location. In this design also used a computer and microcontroller ATMega16 ACR that will get data from room temperature sensors, sensor and motion sensor light intensity as input data. This design then give the command in relays and stepper motors to run the devices you need to set the conditions of the available rooms. Sensor readings can also be accessed through the web that is programmed using ASP.Net. While in the position tracking module, the system can track the phone based on Android operating system.

Keywords: smart home, home automation, technology innovation, integrated control, SMS gateway, home application.

1 INTRODUCTION

The main purpose of this paper is to produce a powerful control application and can be accessed from a variety of technologies that are currently developing. This is an integrated control system and is the combination of microcontroller technology, SMS Gateway, and the web. The system has a temperature sensor, motion detector and light intensity. System also can control 8 relays and two stepper motors.

2 MODEL

Design of an Integrated Smart Home Control is a concept that attempts to show how technology products can be applied to assist residents in doing homework wherever located.[3] A simple example is a person can monitor the condition of the home from the office where work even turn on or turn off home appliances. A smart house, among others, there is home entertainment facilities, health care to the home security.[4] Some of the goals are expected to provide security and comfort of living inhabitants.[5]

2.1 Atmega 16

At present the use of a microcontroller can be found on various equipment, such equipment is available at home, such as digital telephone, microwave, oven, television, washing machines, home security systems, PDAs, etc.. Microcontroller can be used for various applications such as for control, industrial automation, data acquisition, telecommunications and others. The advantage of using a microcontroller that is cheap, can be programmed repeatedly, and can be programmed in accordance with the desire. Currently there are family microcontroller market, namely the Intel 8048 and 8051 (MCS51), Motorola 68HC11, Microchip PIC, Hitachi H8, and Atmel AVR.

2.2 Temperature sensor

LM35 temperature sensor is used to convert the amount of heat that was captured into voltage quantities to the scale of 10mV / degree Celsius. LM35 IC can operate from temperatures of
-40 °C to 100 °C. These sensors have a fairly accurate precision. This sensor is very simple with only three legs fruit. The first leg IC LM35 as Vcc (voltage sources), the second leg as the output and the third leg connected to ground.

### 2.3 Passive Infra Red Sensor

One of the sensors that can be used to detect human movement is a PIR sensor (Passive Infra Red). The sensor works with infra-red based on the phenomenon, while the infrared rays are not visible, but can be detected. Objects which radiate heat, including the bodies of animals and humans, also emit infrared light, with the strongest radiation at a wavelength of 9.4 μm.

### 2.4 Light Dependent Resistor

Light Dependent Resistor (LDR), has a disk of semiconductor that has two electrodes on its surface. At the time of the dark or dim light, the material of the disc produces a free electron with a relatively small amount, in that way, there are some electrons to transport electrical charge. This means that when the lights dimmed LDR becomes a bad conductor, or may be called LDR also has great resistance when dark or light.

### 2.5 Stepper motor

Basically, stepper motors are synchronous motors with electronic magnetic fields rotate around the magnetic anchor. Based on the kinds of windings, there are two types of stepper motors are unipolar and bipolar. In this integrated control system used is a bipolar type. Stepper motor speed is basically determined by the speed of data delivery on commutator. The faster the data given the faster it spins.

### 2.6 SMS Centre

SMS centre (SMSC) served to make the handling of SMS operation of a wireless network. When an SMS message sent from a mobile phone, it will be received by the SMS centre first and then will be forwarded to the destination number.

### 2.7 Android

Android platform is a production of Google's software stack for mobile devices which consist of operating systems, middleware, and key applications. Android applications can be developed through the Standard Development Kit (Android SDK) uses a similar syntax java programming. It will not run Android applications directly on the operating system kernel, but running on Dalvik; a virtual machine specifically designed for use on embedded systems.[6]

### 3. DESIGN AND ANALYSIS

#### 3.1 Implementation

This integrated system has the following system specifications:

1. **Control**
   - ATMega16 as sensors and controllers Computer PC as an overall system controller.
2. **Censorship**
   - Second light sensor (LDR), a temperature sensor (LM35), a motion sensor (PIR).
3. **Output hardware**
   - Two stepper motors, relay board with 8 relays.
4. **Data Communications**
   - Communication between the microcontroller and the PC using a serial computer.
5. **Tracking position**
   - Mobile berOS Android (simulator from the SDK).
6. **Database**
   - SQL Server 2008.
7. **Website**
   - ASP.net (only displays the status of the appliance).
8. **SMS Gateway**
   - SMS and MMS ActiveExpert 5.0.
9. **Display sensor**
   - DundasGauge for. NET Framework.
10. **CCTV**
    - CCTV using a Webcam with AviCap connection.

![Figure 1. Design of an integrated smart house](image-url)
11. Folder
Google Map API

12. The software integrator
VB.Net 2008.

3.2 Data Communication
Communication between the microcontroller and the PC are using a serial computer. Serial communication is a serial data transmission (data is sent one by one in sequence). Serial data communication is done by the UART (Universal Asynchronous Receiver Transmitter). IC UART tailor made to change the parallel data into serial data and receive serial data is then converted back into parallel data.

3.3 Android mobile position tracking
To perform a location determination of mobile devices there are lots of ways, but which is often used is the Cell Identification (Cell-ID) and Global Positioning System (GPS). Utilization of Cell-ID has the advantage that they do not require any enhancement by utilizing a network provider facility that allows a cellular customer to know the position of Base Transceiver Station (BTS) station. But the accuracy of Cell-ID technique is very low at around 1-3 kilometers (km). GPS has a much higher accuracy. Therefore, in the development of software for this final was decided to implement a mobile position method using GPS because of the level of accuracy is much higher compared with Cell-ID.[8]

3.4 Hardware
In the Figure 2, it shows hardware of the integrated control system at home and position tracking. Seen in figure 2 also, one board ATMega16, a relay board, one PIR sensor, an LM35 temperature sensor, two light sensors (LDR), two stepper motors, and two batteries 9 volt. Relay board on the application automatically switches are assumed as a host device such as a refrigerator, TV, and lighting. In addition there is also a webcam which is assumed as CCTV system. For tracking the position required an Android phone. In this final simulation only uses the Android SDK.

3.5 System Software

![Figure 3. Flowchart of Android program](image)

The first step is to request to appear after the program codes which are used as authentication credentials to users who request the position of the Android phone. After the match, then the program will take the position of the GPS and continue an Android phone by sending the position to the number who request via SMS.[9]

![Figure 4. Flowchart of AT Mega 16 program](image)

At the time of the serial connection is executed, the program will initialize the connection from the PC. ATmega16 AVR UCSRA.7 will check
registers, if there is a serial shipment there will be a temporary storage of data on the UDR. Data from the UDR was put into the variable "sign". After checking the serial data, then the program will perform character recognition on variable entry "sign." If data on the variable "sign" = "1", it will turn on relay 1. If data on the variable "sign" = "a", it will turn off relay 1 and if the data on variable "sign" = "m", then the motor will rotate stepper1.

![Figure 5. Sending program flowchart](image1)

![Figure 6. Flowchart of SMS receive](image2)

![Figure 7. Connection display](image3)

![Figure 8. Sensor display input](image4)

![Figure 9. Relay and motor display output](image5)
4. RESULTS AND DISCUSSION

4.1 Android Testing Program

Simulation program is using the emulator from the Android SDK.[10] After the program is run on the emulator, then the user must enter the code before running the function. The code is intended to recognize that the SMS was request tracking position. After the SMS containing the code, then the program will re-send an SMS containing GPS position of the mobile phone. The contents of the message are “location: lat, long;”. [11]
At Figure 15, the image sensor system to send status data format "PIR LDR1 LDR2 Temp." Sample Image 4:17 "28.81 0 3.70 3:58", meaning temperature Celsius 28.81°C, PIR = 0 (There is no movement), LDR1 = 3.70 (1-10 scale), LDR1 = 3:58 (1-10 scale).

4.3 Web ASP.Net

![Figure 16. Web ASP.Net display](image-url)

This ASP.Net web page will see the status of a state function of temperature sensors, PIR, and LDR2 LDR1. This user aims to facilitate users to access the system.[12]

In this design still many shortcomings that must be repaired and updated. For the future, will be made some improvements such as:

1. Display programs are made more attractive, can be combined with the WPF technology. Net Framework.
2. Due to lack of time in this final, later in development there should be additional features in the database service.
3. Additional circuits for sensor signal isolation, so that the results obtained is stable.
4. Additional features on the web to be able to control the system.

5. CONCLUSION

The conclusion of this paper entitled “Design of an Integrated Smart Home Control” is the combination of microcontroller technology, SMS Gateway, and the web has been successfully realized. The system has a temperature sensor, motion detector and light intensity. In its control, the system can control 8 relays and two stepper motors.

As a starter project, this is a first piece to develop better, complicated, and sophisticated smart home. Our trend today is green technology; it is a good challenge to develop a smart home with green technology.

REFERENCE