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SMART HOME AUTOMATION USING ANDROID APPLICATION AND ARDUINO MICROCONTROLLER

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ABSTRACT

Smart Home System (SHS) is a dwelling incorporating a communications network that links the electrical appliances and services allowing them to be remotely controlled, monitored or accessed. SHS includes different methods to achieve multiple objectives range from enhancing comfort in daily life to enabling a more self-employed life for elderly and handicapped people. In this paper, the main four areas for SHS which are, home automation and remote control monitoring, environmental monitoring, including humidity, temperature, fault traffic monitoring and management and then the health monitoring have recently been considered. The system design is founded on the Microcontroller MIKRO C software; multiple passive and active sensors and also an internet services which is used in various monitoring and control processes. This newspaper presents the hardware execution of a multiplat-form control system for house automation and combines both hardware and software technologies. The system results shows that it can be categorized as a comfortable, secure, private, monetary and safe system in conjunction with its great flexibility and dependability.

Keyword : - *Home Automation , Bluetooth, Arduino, Sensor,Android.*

1. INTRODUCTION

Smart home is an emerging concept that attracts the synergy of several areas of science and engineering. A lot of research has been going on for more than a decade now in order to increase the power efficiency at the consumer level of the power management systems. Smart Home is the term commonly used to define a residence that integrates technology and services through home networking to enhance power efficiency and improve the quality of living. Smart house is not a new term for science society but is still far more away from people's vision and audition. This is because although recent various works has been done in designing the general overview of the possible remote access approaches for control-ling devices or in cases simulating the smart house itself and designing the main server the design and implementation of an off-the-shelf smart house remote control application has been limited to simply the computer applications and just in cases mobile and web applications development. The "smart house" technology is one realization of home automation ideals using a specific set of technologies. It's a house that has highly advanced automatic systems for lighting, temperature control, security, appliances, and many other functions. Coded signals are sent through the home's wiring to switches and outlets that are programmed to operate appliances and electronic devices in every part of the house. Smart home appears "intelligent" because its computer systems can monitor many aspects of daily living. Smart house can also provide a remote interface to home appliances or the automation system itself, via telephone line, wireless trans-mission or the internet and android application, to provide control and monitoring via a smart phone or web browser. The growing numbers of

elderly population and increasing life expectancy have brought enormous challenges to many aspects of human life, especially in health and healthcare. According to the United Nations online database, currently the percentage of elderly population is 7.6% which is projected to rise as high as 16.2% in 2050. Home automation becomes more advantageous for safety, security. An embedded board physically connected all home automation devices and through integration with a personal computer (PC) based web server, provided remote access to the system .This paper presents smart house controlled by various micro controller systems. The designed system consists of five parts which are connected to both Mickro c and Arduino software .The first sub-system in SHS is a while review on the system .The second sub-system is the security systems that includes a fire alarm system used in announcing the outbreak of a fire and working to extinguish it remotely, and burglar alarm system that signals the occurrence of a burglary. The third sub-system is lighting control system (energy saving) which includes the internal house lighting, and the ceil lighting outside the house. The fourth sub-system is the remote control system for house controlling. The fifth sub-system is the temperature sensing system for air conditioner. SHS has been designed and implemented through two interfaces which are, computer and remote control unit interfacing. Computer device that provided with microcontroller software is the main controller unit for all systems in the house. It receives data from house sensors, process information and updates data for the different systems, and transmit controlling signal to house systems and switching output devices. Microcontroller makes the ability to monitor the important system operations. Users can also control the different systems abilities, and chose the best required system. Also remote control interfacing is available to control some applications in the SHS.

The quality of the internal environment in the individual rooms affects the Smart Home residents' satisfaction, health and their feel of comfort. The quality of internal environment can be treated by controlling selected technical features - HVAC (Heating, Ventilation, and Air Conditioning) with optimal adjustment of the required functions.The measured non-electric values (e.g. CO2, the temperature (T) or relative humidity (rH)) in the individual rooms can provide additional information on behaviour of the automatic system or the residents' behaviour. To detect, recognize or potentially predict behaviour of the building's equipment, it is possible to use corresponding analyses of the measured curves of random values in the building's internal environment. To analyse and classify behaviour of the building's internal environment or even the residents' customs and behaviours leading to efficient energy management in the Smart Home for optimal HVAC control with view to the residents' needs, it is possible to use methods for processing the measured data, such as the Kohonen's method SOM.

2. LITERATURE SURVEY

1] **Developed Of Wi-Fi- Based Switch Control System For Home Applicances Using Android Phone**
Author : Rionel Belen Caldo*, Derrick Castillo, Joseph T. Seranilla
This study aims to develop and design a prototype that can be used, together with an android phone as centralized switch for simple home appliances via Local Area Network or Internet. The prototype can handle up to seven devices at the same time with a master switch. The main body of the prototype contains an Arduino microcontroller connected to a relay driver circuit. An android application is also developed using Basic4Android IDE. The proponents add features such as renaming devices and password security to make a user friendly interface. The proponents used the developmental method and conducted several tests to determine if the prototype satisfied the scope and limitations. The proponents tested the prototype to handle varying number of output devices from two to seven loads and showed that the prototype can really automate the switching of simple home appliances and therefore can further develop for a full home automation system.

2] New Method for Accurate Prediction of CO2 in the Smart Home
Author : Jan Vanus, Radek Martinek, Petr Bilik
This article describes new method for accurate prediction of CO2 in the Smart Home calculated from the temperature and relative humidity in application of the decision tree regression method. The measured data are loaded from the individual BACnet technology sensors by means of the Desigo Insight visualization tool. The individual BACnet technology components are used to control the heating, cooling and ventilation in Smart Home. The measured temperature (T) and humidity (rH) values are then used as input parameters for prediction of CO2 content in the air of selected rooms in the Smart Home by application of decision tree regression. As described in the article, the method can determine the CO2 content with the accuracy of 46.25 ppm. The obtained information can be used for monitoring the residents' life activities, optimizing the technical service system for reduction of the building's operating costs or automation of its responses to changes of the environment or the residents' activities.

3] A design-driven approach for developing new products for Smart Grid households

Author : Uchechi Obinna, Angele Reinders, Peter Joore

The transition of the electricity system to smart grids requires residential end-users to be more involved in managing energy demand and supply. New innovative products and services could help to support end-users to play a more active role in the management of the future electric power system. This paper evaluates the role of Industrial Design Methods (IDMs) in the development of new innovative smart grid related product concepts at the household level. Based on students' design projects, carried out within a master study programme, various IDMs were systematically utilized to develop new innovative products for smart grid households. Our study shows that five IDMs, namely: platform-driven product development, delft innovation model, theory of inventive problem solving, technology roadmapping, and innovative design and styling were mainly applied in the development of the conceptual products. This study shows that a thorough and careful application of various IDMs helped to develop inspiring potential smart grids product concepts that could support end-users at the household level to gain more insight into their energy use, and contribute to balancing energy demand and supply. These concepts include various in-home displays, smart plugs, and smart wall sockets. The resulting product concepts are presented in this paper. We conclude that the systematic use of various IDMs helped to identify and incorporate various technological, societal, market, and end-user aspects necessary for creating innovative smart grid related products that meet end-user and future market expectations.

3. SYSTEM ANALYSIS

3.1 Existing System

Home Automation nowadays can be done in different ways. A variety of solution for connectivity is available such as SMS, Wi-Fi, Radio Frequency or Bluetooth. Among the possible hardware for the main system are microcontrollers including Arduino, computers even a Raspberry Pi or a combination of two. Microcontrollers are cheaper than computers. Choosing the right device depends on the size of project.

3.2 Proposed System

In this paper ,we propose a system, which is very different than the existing system.We are going to implement it with the help of direct Bluetooth(Wireless federation). The main advantage of the system that it can be implement with a wider range not more than 10 to 20 meters. The main four fields for SHS which are, home automation and remote monitoring, environmental monitoring, including humidity, temperature, fault tracking and management and finally the health monitoring have been considered. The system design is based on the Microcontroller MIKRO C software; multiple passive and active sensors and also a wireless internet services which is used in different monitoring and control processes .

4. SYSTEM ARCHITECTURE

The nature of home automation is introduced. It is argued that end users should be able to define how the home system reacts to changing circumstances. Policies are employed as user-defined rules for how this should happen. The architecture of the Homer home automation system is briefly overviewed. The Homer policy system and the Homeric policy language it supports are explained. A technique is described for offline conflict analysis among policies (the analogue of the feature interaction problem). A substantial worked example shows how conflict detection is performed on a range of sample home policies.

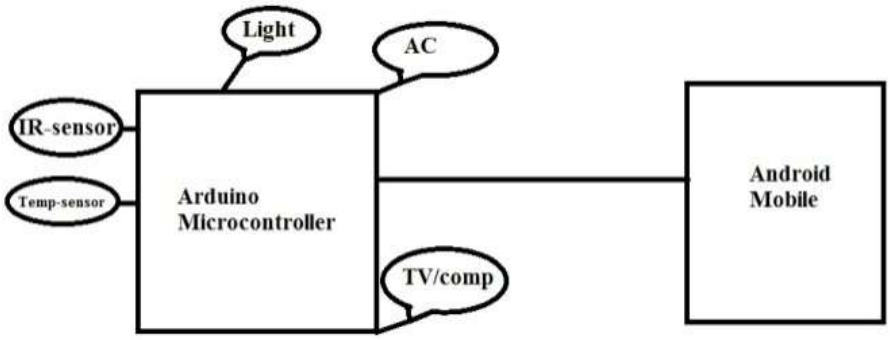

Fig -1: Smart Home Automation Using Android Application and Arduino Microcontroller.

❖ **Algorithm**

1. Start
2. Start all system and android app.
3. We can control all system using android same as remote controller key
4. Once brightness increase light will automatically start
5. Using temperature sensor detect low temperature then heater will start
6. Once temperature is increase AC/FAN automatically starts
7. End

5. HARDWARE AND SOFTWARE SPECIFACTION

a) Microcontroller

Microcontroller can be used as the, brain to control a large variety of products, in order to control large devices. It is necessary to interface or connect them to the microcontroller.. This PIC will differ from other because of the features like channels inbuilt ADC, inbuilt PWM, USART, timer .The microcontroller communicates with the bluetooth module through its TX and RX pins. The serial control command send through the smart phone is received by the bluetooth module and processed by microcontroller. The corresponding port pins are enabled to switch on appliances. Crystal connected between along with two capacitors providing the basic clock frequency to microcontroller.

b) Arduino Board

Arduino is a tool for making computers sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or communicate with software running on your computer .There are many other microcontrollers and microcontroller platforms available for physical computing. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino is also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems.

c) Arduino UNO

Arduino UNO is a microcontroller board it has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

d) Android

A Smart phone is a mobile phone based on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. Android is a software stack for mobile devices that includes an operating system, middle-ware and key applications. Android, by simple definition, is an operating system for many mobile phones. Android is a customizable platform that can look and feel very different on every different handsets. Android gives us tools for creating apps that looks great and take more advantage of the hardware capabilities available on each device. Android is mainly based on Linux operating system which uses java- like languages for running applications. The main purpose of us-ing android is to send the control signals from smart phone through bluetooth.

e) Bluetooth

Bluetooth was selected as our way of communicating mobile with a central system. Bluetooth module receives the data serially in RS232 format from controller and sends it to wireless network. For interfacing it with microcontroller we need to build the circuit because Bluetooth module under-stands data in RS232 standard and controller understands data.

f) Smart home lightting Control system

Smart home lighting control systems is shown in at this section user will be able to control the light in SHS by two different ways by smart phone or by PIR sensor automatically if we talk about using smart phone it will be on/off option or dimmer. Dimmer are devices used to vary the brightness of a light, by decreasing or increasing the RMS voltage. It is possible to vary the intensity of light and speed of fan by using a number of types of dimmers. Modern dimmers are built from silicon controlled rectifier (SCR) instead of variable resistor, because they have higher efficiency. Since silicon controlled rectifier switches between a low resistance "ON" state and a high resistance "OFF" state, it dissipates very little power compared with the controlled load. Dimmer circuit is based on SCR control circuit which is used in lightning control and fan speed control. This section mainly discuss about the hardware construction of mai control board. Arduino UNO is chosen due to its capability to perform the both serial and USB features to establish the bluetooth and USB connection to the android application. Light sensor module is chosen because it is the low cost 2-in-1 modules. For the bluetooth module, low cost bluetooth module is chosen to establish the bluetooth connection between main control board and smart phone. The electrical current is directly connect to the main control board whereby it separates the regulator and relay circuit. The voltage regulator is constructed by common reliable regulator circuit which consists of transformer, rectifier and regulator. 5V and 3.3V DC output is regulated in order to fulfill the voltage needs of the specific components in the main control board.Moreover, the low voltage activating switches will replace the existing switches the ease of installa-tion is taken into account for this system. The system is designed to directly install beside the electrical switches on the wall. The installation of this system eliminates the complex wiring reinstallation and overhead wiring on the wall. The existing switch connection is connected and controlled by the relay circuit inside main control board. Furthermore, multiple control boards can be installed in home. Bluetooth master device in PC/laptop is mostly able connect up to 7 devices. With these simple and low cost components, the main control board can be constructed in pretty small size but still performs the strong functions and features of the system.The application is designed in Android version 2.2 (Froyo) with API level 8. The application is designed in low API level so that the devices with higher version are compatible with it. Figure-6 illustrates the android GUI tested on smart phone.

g) Smart Home Temperature Sensing System for Air Conditioner

At this section we will control the home temperature automat-ically by using a special temperature sensor which is the LM35 sensor is used. It has an output voltage that is proportional to the Celsius temperature. It has low self heating capability, suitable for remote applications, low cost due to wafer level trimming, operates from 4 to 30v, low impedance output in this case. At this project we us this sensor in the kitchen for mentoring & control the room temperature & us a special option which is lcd which user can read the temperature and smoke level in kitchen also to be a visual alarm if this level of temperature or smoke will make w fire or if there is already a fire

in the kitchen also we use the temperature sensor to measure the outside temperature in order to compare it with the given temperature to the system to control the air condition according to user comfertability.

6. CONCLUSIONS

In this paper the design and implemention of a control and monitor system for smart house has been established. Smart house system (SHS) consists of many sub-systems that controlled by Microcontroller software as a main controlling system. Also, SHS was supported by remote control system as a sub- controlling system. The system is also connected to a wireless bluetooth technique to monitor and control the electronic house equipments from anywhere in the world using both Arduino and micro controller.

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