

An Ethernet Based Control and Monitoring System Using ARM Processor

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ABSTRACT:

This paper presents a flexible standalone, low cost smart home system, which is based on the Android app communicating with the micro-web server providing more than the switching functionalities. The aim of home automation is to control home devices from a central control point. The communication between the devices is wireless. The protocol between the units in the design is enhanced to be suitable for most of the appliances. The system is designed to be low cost and flexible with the increasing variety of devices to be controlled. Networking is a major component of the processes and control instrumentation systems as the network's architecture solves many of the Industrial automation problems. There is a great deal of benefits in the process of industrial parameters to adopt the Ethernet control system. Hence an attempt has been made to develop an Ethernet based remote monitoring and control of home appliances. In the present work the experimental result

shows that remote monitoring and control system over the Ethernet.

KEYWORDS:

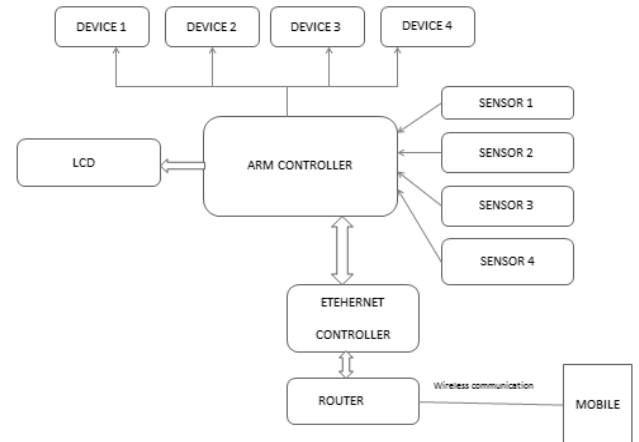
Android smart phone, Smart home, Home Automation, Remote Control, ARM Processor, Ethernet, TCP/IP, Web Server

I. INTRODUCTION

With the continuous growth of mobile devices in its popularity and functionality the demand for advanced mobile applications in people's daily lives is continuously increasing. Utilizing web services is the most open and interoperable way of providing remote service access or enabling applications to communicate with each other. An attractive market for home automation and networking is represented by busy families and individuals with physical limitations. Smart home is a very promising area, which has various benefits such as providing increased comfort, greater

safety and security, a more rational use of energy and other resources thus contributing to a significant savings. This research application domain is very important and will increase in future as it also offers powerful means for helping and supporting special needs of the elderly and people with disabilities [2], for monitoring the environment [3] and for control. The system is designed to be low cost and flexible with the increasing variety of devices to be controlled. In this paper presents the way to provide Ethernet internet connectivity to ARM Processor based embedded systems. This system uses ARM Processor to store the main application source code, web pages and TCP/IP stack which is a vital element of the system software. An Ethernet controller chip, ENC28J60 is used to handle the Ethernet communications and it is interfaced with the ARM Processor using SPI protocol. Configurations like IP address and other details are set using RS232 interface. The site can be viewed on any system with Internet/LAN connection by configuring the specific IP address and by giving User Login ID, password. There are several I/O pins available at the ARM Processor which are used to interface with sensors, LCD displays, Motors and relays for monitoring and controlling AC appliances. Nowadays, Internet has spread worldwide and most of the internet connections use Ethernet as media for data transfer.

II. THE PROPOSED SYSTEM



COMPONENTS OF PROJECT:

- ARM CONTROLLER
- ETHERNET CONTROLLER
- SENSORS
- TRIAC UNIT
- TCP/IP PROTOCOL
- POWER SUPPLY

III. HARDWARE IMPLEMENTATION

A. System Architecture

The proposed Ethernet Based Control And Monitoring System architecture consists of ARM processor, Ethernet Controller-ENC28J68, Sensors, 16x2 LCD display and Mobile.

B. Operation

This section explains the operation and interfacing of each modules present in the Ethernet Based Control And Monitoring system architecture. The whole circuit can be divided into following sections:-

ARM MICROCONTROLLER (LPC 2148):

The LPC2148 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with Real-time emulation and embedded trace support that combines the microcontroller with Embedded high speed flash memory ranging from 32 kB to 512 kB. Due to their tiny size and low power consumption, LPC2148 is ideal for Applications where miniaturization is a key requirement, such as access control and Point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and onchip SRAM of 8 KB up to 40 KB, make these devices very well suited for communication gateways and protocolconverters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10- bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive externalinterrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

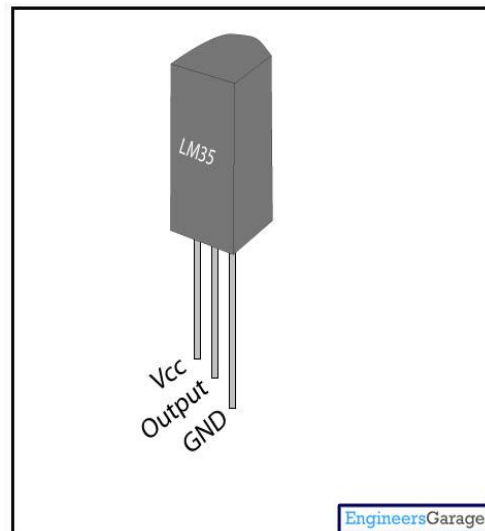
ETHERNET CONTROLLER:

The ENC28J60 is a stand-alone Ethernet controller with an industry standard Serial Peripheral Interface (SPI). It is designed to serve as an Ethernet network interface for any controller equipped with SPI. The ENC28J60 meets all of the IEEE 802.3 specifications. It incorporates a number of packet filtering schemes to limit incoming packets. It also provides an internal DMA module for fast data throughput and hardware assisted checksum calculation, which is used in various network protocols. Communication with the host controller is implemented via an interrupt pin and the

SPI, with clock rates of up to 20 MHZ. Two dedicated pins are used for LED link and network activityIndication.

TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. With **LM35**, temperature can be measured more accurately than with a thermistor. The operating temperature range is from -55°C to 150°C.



PIR SENSOR

The PIR (Passive Infra-Red) Sensor is a piezoelectric device that detects motion by measuringchanges in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin.



LDR SENSOR:

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.



FEATURES:

- Visible light response
- Low cost
- Sintered construction

V. SOFTWARE IMPLEMENTATION

1) Front End Design: HTML is a format that tells a computer how to display a web page. The documents themselves are plain text files with special "tags" or codes that a web browser uses to interpret and display information on the mobile. HTML stands for Hyper Text Markup Language; an HTML file is a text file containing small markup tags. The markup tags tell the Web browser how to display the page. An HTML files must have an htm or html file extension.

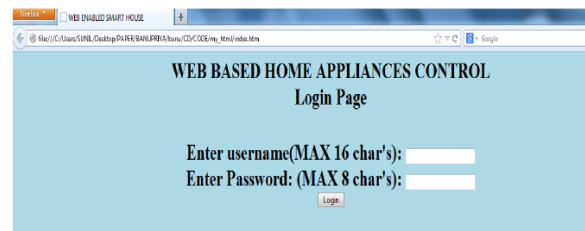


Fig.5 Home Page using HTML

2)TCP/IP Stack:In an Ethernet network, the interface to the network is an Ethernet controller chip and its driver. The Ethernet driver contains program code that manages communications between the controller chip and a higher level in the network protocol stack [1]. For internet communication over Ethernet, a Transmission Control Protocol /Internet Protocol (TCP/IP) software stack is necessary. Keil μ Vision4 provides a driver for the ARM Processor and a TCP/IP stack including an HTTP web server. Web pages need to be stored in external or internal EEPROM. These pages can be accessed using internet browser by accessing the IP address assigned to the system.The stack is modular in design and is written in the 'C' programming language.TCP/IP protocol suite is popular because it has the features used to meet worldwide networking

needs. The important features of TCP/IP protocol are:

- Hardware and software independence
- A large and flexible addressing scheme

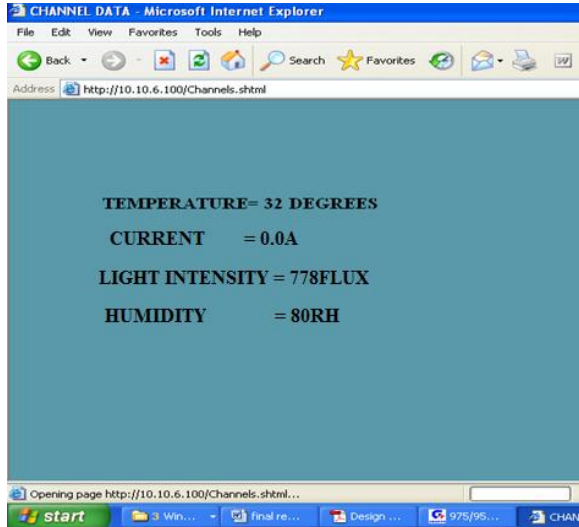


Fig.6 Monitoring the Channel Data

V. EXPERIMENTAL RESULTS:

In this section, the results of the proposed system to control the devices over internet through Ethernet connectivity using ARM controller is presented. Figure 2 shows the login page which we designed using HTML language as a home page, after entering the embedded web server IP address (192.168.1.101). Once the home page is loaded, the user need to provide username and password to facilitate the further access to control home appliances. This ensures the security feature to user access. In the proposed system four devices are considered for demo purpose Light, the speed of the DC fan control and also control any AC appliance through relay. we can control 3 devices just by clicking the menus on the web page, initially all devices Light, the speed of the DC fan will be in off State i.e., '0' state.

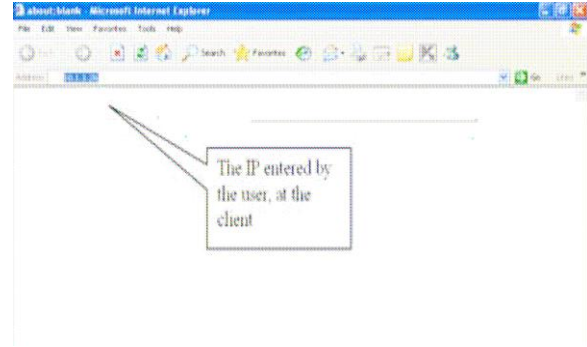


Fig.7 User Entering the IP Address

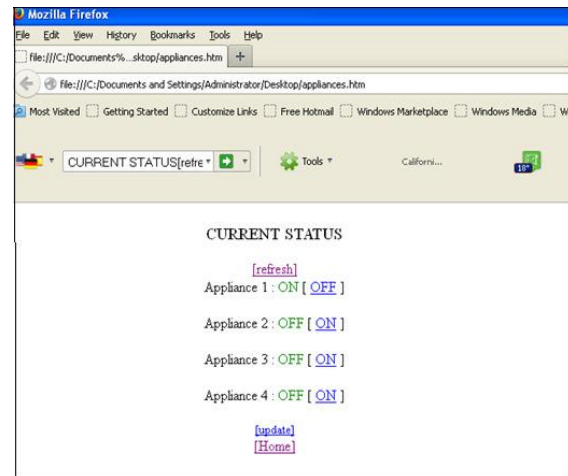


Fig.8 The Status of Appliances on Internet Explorer

VI. CONCLUSION

In this paper we presented concept of home automation which can fit into a home appliances using Ethernet. Ethernet's potential as a network for distributed measurement and control is virtually unlimited. As Ethernet provides inexpensive, relatively high speed network access to individual users and low delay that can support many applications. Ethernet continues to be enhanced with greater performance, higher determinism, and lower cost implementations and real web server is implemented in a device in your own home, which is connected to your mobile. If we compared Ethernet Technology with other technologies like Bluetooth, Zigbee, IR, RF-ID and GSM, it is having low response time, having very high speed, secured and also reliable. In future the separate embedded web server can be designed with Wi-Fi and Ethernet, which is co-existence technology on a single-chip. So the home appliances can also control from Wi-Fi enabled smart device such as smart phones with high graphical interface. There is no limit for future scope in the monitoring and control operation. Industrial automation is no longer limited by the walls of the production facility. More and more automation is being handled via remote communication. This Ethernet Embedded system provides the way to numerous applications to be developed in the area of monitoring and automation.

VII. REFERENCES

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