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A Smart Switch to Connect and Disconnect Electrical Devices At Home by Using Internet

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ABSTRACT:

The main aim of this project is to control the electrical appliances from anywhere in the world by using the web server and using the GPRS module. Here in this project we are controlling both the AC and DC loads. At controlling system side we have GPRS module, LPC 2148 microcontroller and load controlling circuits. Whenever this GPRS module receives command from the web page, then it transfers this command to LPC 2148 Microcontroller. The LPC2148 microcontroller will control the respective loads depends upon the command it received. To enable the GPRS connectivity, we are giving the AT commands to the GPRS module from the microcontroller through the programming. We should have the internet balance in the SIM card which is to be inserting in the GPRS SIM900A module.

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. 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 internet connectivity to ARM Controller based embedded systems. This system uses ARM Controller to store the main application source code, web pages and TCP/IP stack which is a vital element of the system software. GPRS module is used to handle the communications and it is interfaced with the ARM Controller using UART 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 Controller which are used to interface with sensors, LCD displays, Motors and relays for monitoring and controlling AC appliances.

OBJECTIVE OF THE PROJECT

The main aim of this project is to protect the home from the outsider's entry and provide the automation is very important now-a-days. This project mainly focusing on these issues. To do this project, we are using the LPC2148 microcontroller.

AIM OF THE PROJECT

The main aim the project is to establish a server for Remote Access Terminal using GPRS Enabled Embedded Server as main communication protocol from powerful microcontroller.

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EXISTING SYSTEM

In the existing method, we were controlled the electrical appliances and other DC loads from the GPRS message. If we send the predefined message from our phone to the GPRS modem SIM card, then the data was received by the controller via UART port and controlled the loads accordingly. If there is signal problem, then this method was not operating the loads properly. Every time, we need to clear the inbox messages. To overcome these problems, we are implementing the proposed system.

PROPOSED SYSTEM

In the proposed system, we are sending the commands from the web page to the GPRS module. The GPRS module will receive that command and send to the controller to operate the corresponding load. By this way the user can control the loads from anywhere in the world.

BLOCK DIAGRAM

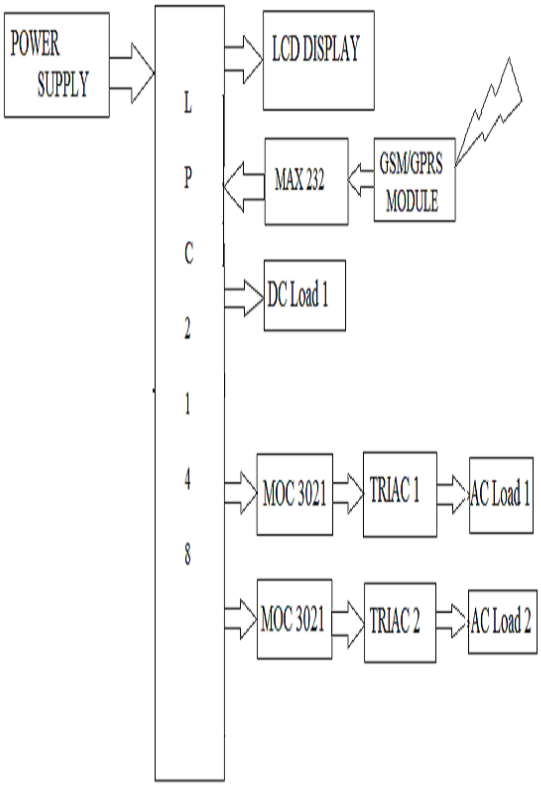

Fig 2.1: Block diagram of proposed system

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-SCPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kb to 512 kb. A128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kb up to 40 kb, make these devices very well suited for communication gateways and protocol converters, 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 external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

POWER SUPPLY

The input to the circuit is applied from the regulated power supply. The A.C input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating D.C voltage. So in order to get a pure D.C voltage, the output voltage from the rectifier is fed to a filter to remove any A.C components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant D.C voltage.

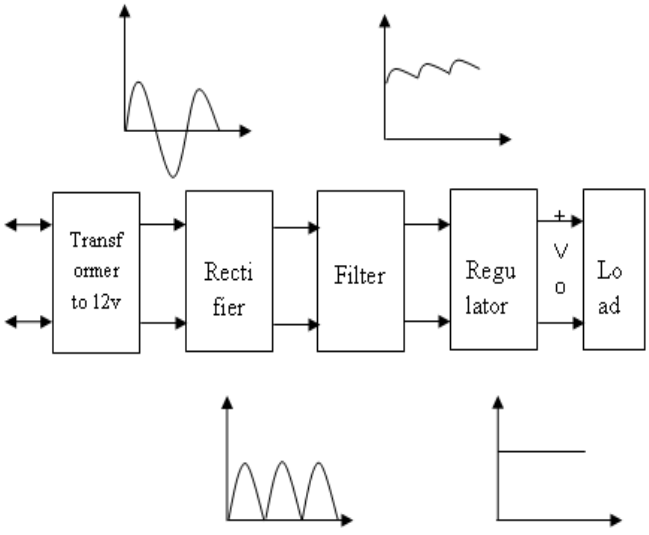

Fig 2.2: Block Diagram of Power Supply

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MAX232

Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards. This IC provides best noise rejection and very reliable against discharges and short circuits. MAX232 IC chips are commonly referred to as line drivers.

Fig 2.4: MAX232 IC

To ensure data transfer between PC and microcontroller, the baud rate and voltage levels of Microcontroller and PC should be the same. The voltage levels of microcontroller are logic1 and logic 0 i.e., logic 1 is +5V and logic 0 is 0V. But for PC, RS232 voltage levels are considered and they are: logic 1 is taken as -3V to -25V and logic 0 as +3V to +25V. So, in order to equal these voltage levels, MAX232 IC is used. Thus this IC converts RS232 voltage levels to microcontroller voltage levels and vice versa.

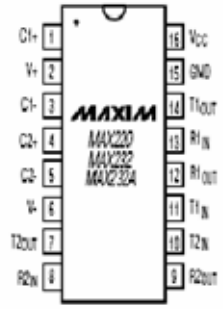

Fig 2.5: MAX232 pin diagram

ARM7 MICROCONTROLLER

ARM is an acronym for advanced RISC machine and is manufactured by Phillips. ARM7 is based on reduced instruction set computing architecture. ARM7 is most successful and widely used controller family in embedded system applications. The advantage of low power consumption and low cost increases the range of applications from portable devices to almost all embedded electronic market. It is preloaded with many in-built features and peripherals making it more efficient and reliable choice for an high end application developer. It also supports both 32-bit and 16-bit instructions via ARM and THUMB instruction set.

LPC 21XX series of microcontroller are based on ARM 7 TDMI – S architecture.LPC stands for Low Power Consumption, because for the reason it have different voltages for operation and not like other controllers where the entire controller (CPU + peripherals of controller operate at +5V Vcc).

The ARM7TDMI-S is a general purpose 32-bit microcontroller, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro-programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and Impressive real-time interrupt response from a small and cost-effective controller core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

Pin Diagram:

ARM7 LPC2148 microcontroller is a 64 pin dual-in package. There are basically 2 ports in LPC2148, Port0 and Port1. Port0 has 32 pins reserved for it. And Port1 has 16 pins. So total it comes to 32+16 = 48 pins. If it were really 2 ports then the number of port pins should have been 32 + 32 = 64.

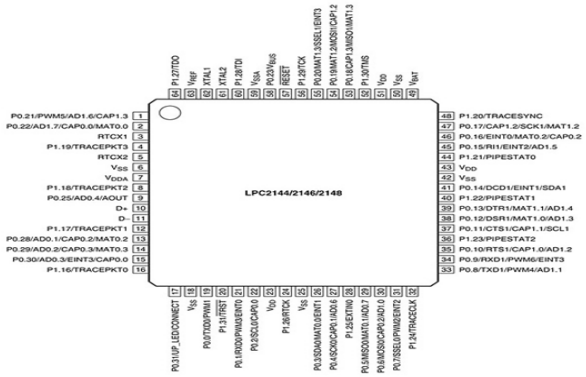

Fig 2.6: Pin Diagram of LPC2148

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Architectural Overview:

The ARM7TDMI-S is a general purpose 32-bit microcontroller, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC).

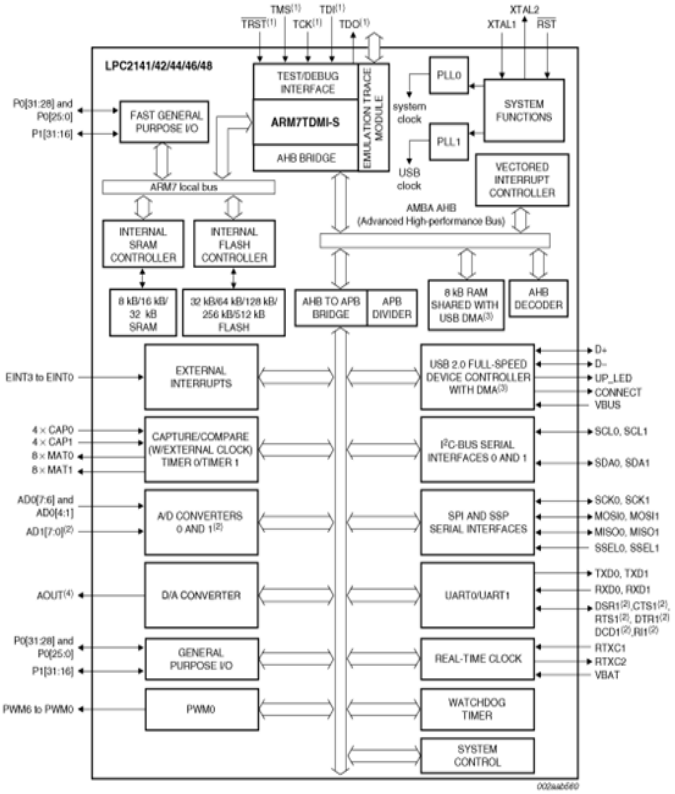


Fig 2.7: Architecture of ARM7 LPC2148

This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective controller core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S controller also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set.

Essentially, the ARM7TDMI-S controller has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit controller using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code.

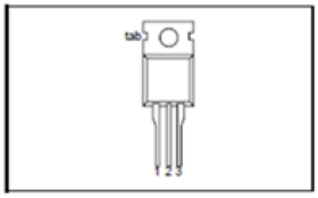
Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM controller connected to a 16-bit memory system. The particular flash implementation in the LPC2148 allows for full speed execution also in ARM mode. It is recommended to program performance critical and short code sections (such as interrupt service routines and DSP algorithms) in ARM mode. The impact on the overall code size will be minimal but the speed can be increased by 30% over Thumb mode.

IMPLEMENTATION

TRIAC - BT136

General Description

Glass passivated, sensitive gate triacs in a plastic envelope, intended for use in general purpose bidirectional switching and phase control applications, where high voltages sensitivity is required in all four quadrants.



PIN	DESCRIPTION
1	main terminal 1
2	main terminal 2
3	gate
tab	main terminal 2

Fig 3.1: TRIAC pin configuration

TRIAC DRIVER MOC3021

The MOC301XM and MOC302XM series are optically isolated triac driver devices. These devices consist of gallium arsenide infrared emitting diodes, optically coupled to silicon bilateral switch and are designed for

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applications requiring isolated TRIAC triggering, low–current isolated ac switching, high electrical isolation (to 7500 VAC peak), high detector standoff voltage, small size, and low cost. This series is designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115/240V AC operations.

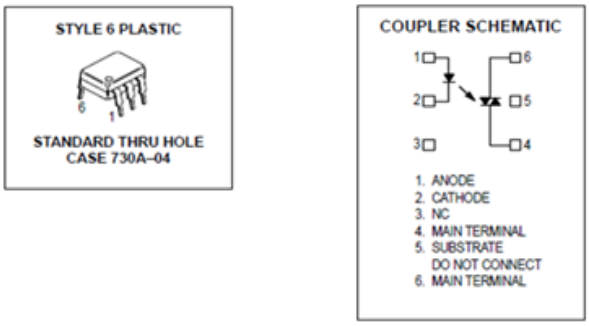

Fig.3.2: MOC3021 pin configuration

Features:

- Low input current required (typically 5mA).
- High isolation voltage-minimum 7500 VAC peak

Applications:

- TRIAC driver
- Industrial controls
- Traffic lights
- Vending machines
- Motor control
- Solid state relay
- Solenoid/valve controls
- Static AC power switch
- Incandescent lamp dimmers
- Lamp ballasts

GPRS MODEM

This GPRS Modem can accept any GPRS network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control.

In GPRS mode you can also connect to any remote FTP server and upload files for data logging. This GPRS modem is a highly flexible plug and play quad band GPRS modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

Package Includes

- GPRS Modem - Assembled & Tested (1 Year Warranty)
- Serial Cable
- GPRS Antenna

Fig 3.3: GPRS modem with inbuilt data interface

Quick Start

1.Insert SIM card: Press the yellow pin to remove the tray from the SIM cardholder. After

2.Properly fixing the SIM card in the tray, insert the tray in the slot provided.

3.Connect Antenna: Screw the RF antenna if not already connected.

4.Connect RS232 Cable to PC/MCU: (Cable provided for RS232 communication).Default baud rate is 115200 with 8-N-1, no hardware handshaking.

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5.Connect the power Supply (12V 1A) to the power input of board. Polarity should be Center +ve and outer –ve DC jack.
6.Network Led indicating various status of GPRS module eg. Power on, network registration & GPRS connectivity.
7.After the Modem registers the network, led will blink in step of 3 seconds. At this stage you can start using Modem for your application.
8.AT commands can be sent to control GPRS Modem.

LIQUID CRYSTAL DISPLAY

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:
1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display messages in two lines with 16 characters each.

It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own.

Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

LCD screen

LCD screen shown in figure 3.13 consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes).

When used during operating, a resistor for current limitation should be used (like with any LE diode).

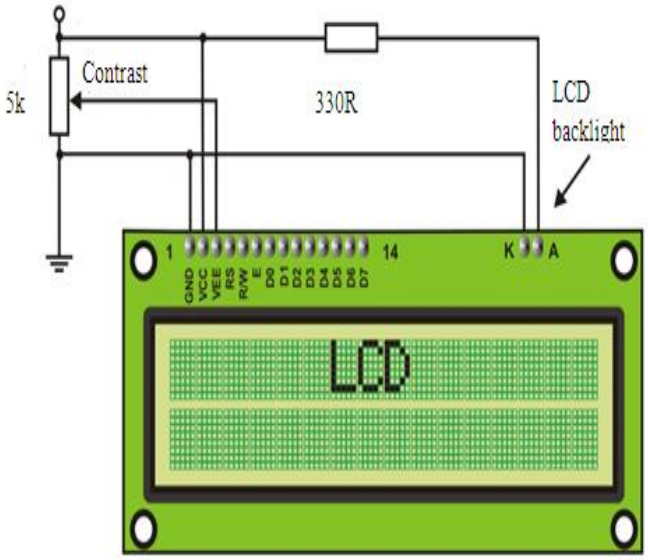

Fig 3.7: LCD connection

RESULTS

The implementation of realization of "A SMART SWITCH TO CONNECT AND DISCONNECT ELECTRICAL DEVICES AT HOME BY USING INTERNET" is done successfully. The communication is properly done without any interference between different modules in the design. Design is done to meet all the specifications and requirements.

PROPOSED SYSTEM RESULTS

The main aim of this project is to control the electrical appliances from anywhere in the world by using the web server and using the GPRS module. Here in this project we are controlling both the AC and DC loads.

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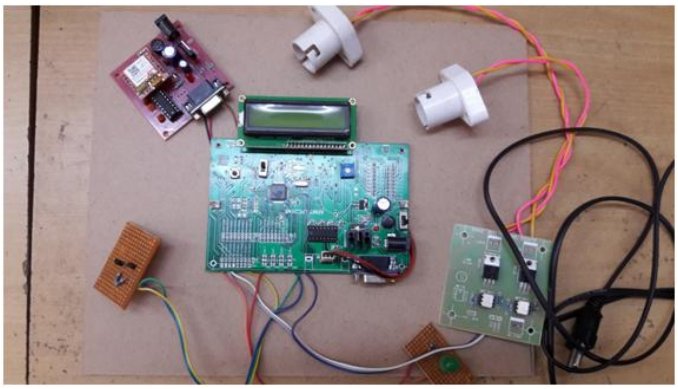

Fig 5.1: Proposed system kit diagram

This method is by using the GPRS module. This GPRS module will work with the AT commands. The GPRS module is connected to the microcontroller via UART port. After initializing the GPRS module then open the predefined links of the web server and send the commands through the links to control the appliances. Then the commands will received by the GPRS module and send to the LPC 2148 microcontroller, and that in turn control the loads.

In this project, we are controlling both the AC and the DC loads. For the AC loads, we need TRIAC and the opto-coupler to isolate both the AC and DC section of the controller.

The code was written in the embedded C language and the code was compiled using the KEIL compiler, which will generate the executable hex file. The hex file was dumped into the LPC2148 microcontroller by using the FLASH MAGIC software.

ADVANTAGES AND APPLICATIONS

ADVANTAGES

- Simplicity of the system.
- Accuracy of the system
- Real time monitoring
- From anywhere we can monitor the system
- Reduction in Manual power & Time saving.
- Low cost easy to implement and low power consumption and controlling is done by using web technology.

APPLICATIONS

- Security applications & Used For lab monitoring system.
- Home applications
- Industrial applications

CONCLUSION AND FUTURE SCOPE

CONCLUSION

A system for remote access terminal using GPRS enabled embedded server is designed in this paper. Using cellular services such as SMS and GPRS to users can control and manage the intelligent appliances using a GPRS network over the internet.

FUTURE SCOPE

In future, we can use the Raspberry Pi 3 microprocessor, instead of the LPC2148 microcontroller. The Raspberry Pi 3 microprocessor has in-built Wi-Fi module and there is no need of GPRS module. Besides that we can also detect the fault loads and inform the user through the web page alert message.

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