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TOWARDS VIRTUAL LABORATORIES WITH A LOW COST EMBEDDED WEB SERVER USING TCP/IP NETWORKS FOR REMOTE HARDWARE ACCESS AND EXPERIMENTATION

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Abstract:

Real experiments are indispensable in engineering education for developing skills with which to deal physical processes and instrumentation. Laboratory exercises are integrated into many courses in electrical engineering. The traditional way of conducting an experiment is to go to a university laboratory. Students work in teams and receive tutorial help from teachers. There is no doubt that nothing can replace synchronous learning through face-to-face interaction, however, it is not always feasible for students to attend conventional classes. Models for using information technology to enhance the learning experience for students who are asynchronous in time and/or space and which are also suitable for on-campus students have been presented earlier.

Keywords – Indispensable, asynchronous, Integrate.

1. INTRODUCTION

A survey of types of laboratories and remote lab scenarios can be found elsewhere. Remote access laboratories are likely to change educational practices. There are different types of remote access. For example, SCADA (Supervisory Control and Data Acquisition) applications have been around for many years and are used by utility and manufacturing companies to control processes.

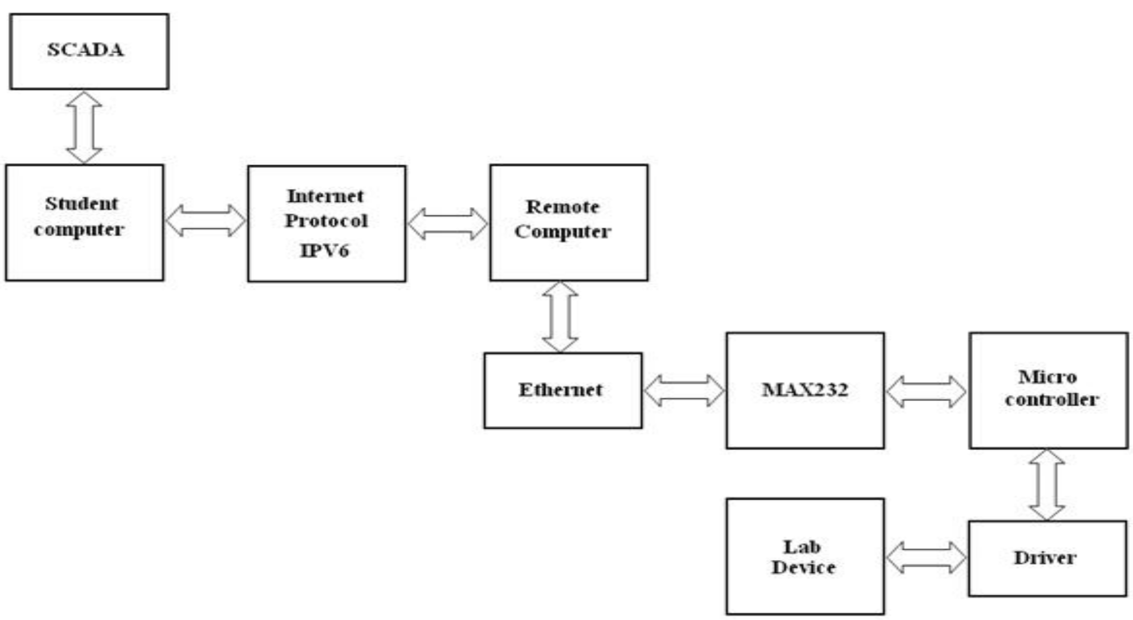

Fig.1.Block diagram

The goal of this type of remote operation is to put the user `in the control room' with full and immediate access to all important system parameters. The test points are fixed, as are the settings of most of the sensors and instruments.It has been long realized that, due to resources being scattered throughout a geographic area, a multitier distributed architecture has to be used to connect resources to allow remote laboratory services. Initial attempts were to create an efficient brokerage between several physical laboratories across a wide geographic region. These systems give the users a variety of experiments across multiple laboratories, and universities manage their local resources optimally. The main obstacle identified was the service-oriented architecture (e.g., SOAP) which is difficult to manage across heterogeneous networks, and socket-based communication is suggested as an alternative. With the advent of HTML5, new capabilities of JavaScript and WebSockets, the problem of inter hardware communication has been eased.

2. EXISTING METHOD

This system discusses a RAL system that enables peer-to-peer (P2P) experimental design and sharing. An extra compilation software step is required to execute the code to communicate with the target MCU. The RAL require three subsystems handling the user interface, instruction interpretation, and instruction execution. These technologies can work in bidirectional full duplex mode and in real time. In most cases, distributed technology and resulting benefits are aimed at the service model, i.e., the universities, RAL developers, and administrations. The overall architecture of the system remains the same client/server where the user can only view and perform a set of instructions and then acquire results. Laboratory as a Service has been proposed, which views laboratories as independent component modules. These are based on Web services which are slow, and more importantly, these rigs are not flexible enough, and no universal approach is provided for students to build them. These are an organized approach for sharing existing remote laboratories among "*institutions*." From a user's point of view, the system architecture remains in the service-oriented model. Web instrumentation is the practice of controlling the actions of an instrument through a network environment. This methodology is popular in RAL systems. This method is slow as it initiates an HTTP-like connection procedure every time a Web service is called and also too complex, involving acute understanding of object-oriented programming, creation of objects, and attaching and mapping of methods.

3. LITERATURE REVIEW

This paper presents a remote laboratory for industrial automation comprising different programmable logic controller (PLC) manufacturers. This facility provides an environment for remote users to learn many automation topics while using different PLCs together with several types of sensors, actuators, and industrial communication networks. The laboratory architecture that makes up the remote automation laboratory (RAL) is based on a Moodle-server master PC (MPC), which also manages the booking system of PLC benches available in the laboratory. There exist a cluster of virtual machines. There is growing research into, and development of, the use of the internet to support remote access by students to physical laboratory infrastructure. These remote laboratories can, under appropriate circumstances, support or even replace traditional (proximal) laboratories, provide additional or improved access at reduced cost, and encourage inter institutional sharing of expensive resources. Effective design of remote laboratories requires attention to the design of both the pedagogy and the technical infrastructure. The design of the current system is a scaled down version of the larger idea. The larger idea consists of a single base station controller that is connectable via the Bluetooth on a mobile phone, in which the user

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will connect and be able to control a wide range of peripherals around their The base station is the only thing the user has to deal with. The base manages the peripherals via the Zigbee protocol, which is a low power, low cost, alternative to Wifi or Bluetooth. Using the Zigbee protocol allows the peripherals to talk in a mesh network, allowing applications and sensors to communicate with each other. For example; if you use your phone to turn the A/C on, the base station can check to see if any windows are open, and communicate.

4. SYSTEM FUNCTION

In this consists of Personal computer, SCADA software, IPV6 internet protocol, Ethernet, IC MAX232, AT89S52 microcontroller ADC or transistor driver and lab device. The Personal computer with SCADA software can be used to access the remote lab experiment from remote computer through internet protocol ipv6. The Lab devices are connects with the internet protocol. The input and output of the experiments can be applied and observed from SCADA. The lab devices are connected with remote computer through signal driver (ADC IC 0804 or transistor driver), AT 89S52 microcontroller, IC MAX232 and Ethernet module. The remote computer IP is selected by user (student) and sends the input

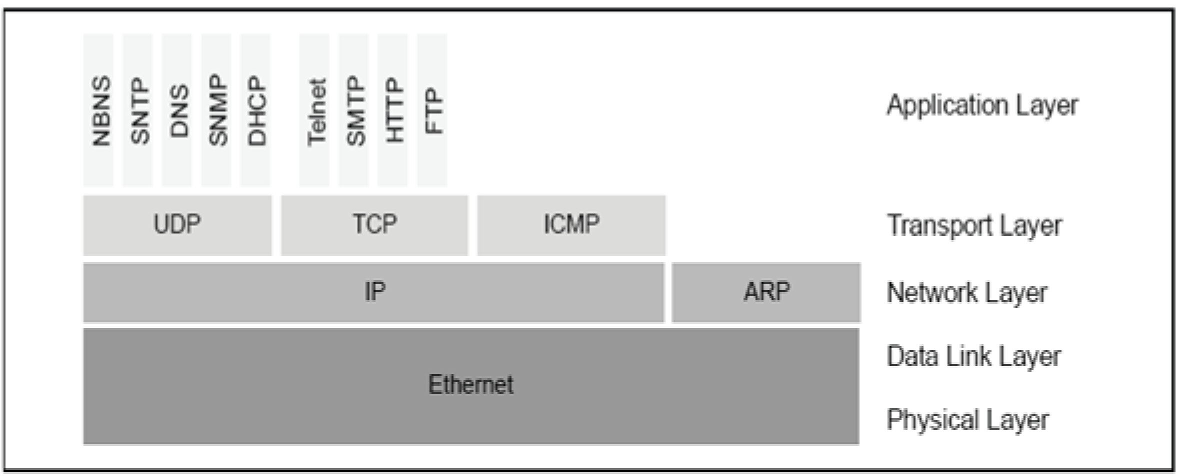

Fig.2.OSI Layer

signal to the lab device through remote system. The remote system receives the command or input signal from the user and it enables Ethernet module. The Ethernet module connects the Microcontroller through IC MAX232 which is used to voltage level converter between controller and Ethernet module. The microcontroller can operate the lab device through signal driver according to the command received by the user system. The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next external interrupt or hardware reset.

5. ANALYSIS

Many of these advantages are offered by other languages also, but sets C apart from others like Pascal, FORTRAN, etc. is the fact that it is a middle level language; it provides direct hardware control without sacrificing benefits of high level languages. Compared to other high level languages, C offers more flexibility because C is relatively small, structured language; it supports low-level bit-wise data manipulation. Compared to assembly language, C Code written is more reliable and scalable, more portable between different platforms (with some changes). Moreover, programs developed in C are much easier to understand, maintain and debug. Also, as they can be developed more quickly, codes written in C offers better productivity.

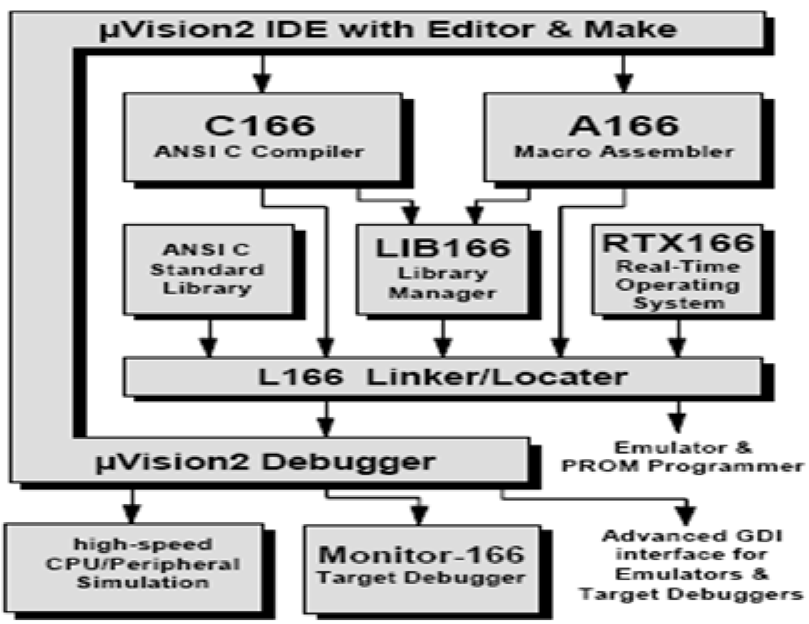

Fig.3.Functional blocks of keil

C is based on the philosophy 'programmers know what they are doing'; only the intentions are to be stated explicitly. It is easier to write good code in C & convert it to an efficient assembly code (using high quality compilers) rather than writing an efficient code in assembly itself. Benefits of assembly language programming over C are negligible when we compare the ease with which C programs are developed by programmers. Dynamic C and B# are some proprietary languages which are also being used in embedded applications. Efficient embedded C programs must be kept small and efficient; they must be optimized for code speed and code size. Good understanding of processor architecture embedded C programming and debugging tools facilitate this.

CONCLUSION

In our contribution, we have flexible IPV6 connectivity at back-end with single layer secure execution Provides features of multipurpose usage with different types of experimental devices. Fully configurable client side application at front-end software layout. Both command mode & GUI mode access is supported. Provides immediate error feedback & password encrypted protection to hardware access.

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