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Central Intelligent System for Multiple and Multifunctional Devices

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ABSTRACT: The aim of the design is to make simple, flexible and compatible devices to solve the problem of different communication technologies in building and Industrial automation. The protocol communicating with different technologies may make it simple and secure form the other existing technologies. In this paper we present a flexible and compatible device which is purely based on the internet technology. The aim of Central intelligent system (CIS) is to monitor and control the multiple and multifunctional devices from the central control point. Primary motivation of this paper is from the different network technologies

KEYWORDS: CIS, Embedded, Ethernet, automation, protocol

I.INTRODUCTION

There are really many home automation system producers in the world and their product differ from each other in many characteristic, such as functionality, dimensioning, weight, topology of installation, materials power consume, communication protocol and communication mean. Also there is numerous paper and research work published on building and industrial automation area, some of them using separate controlling board, and some of them using Desktop computer as a central unit.

There are some published home automation systems examples [1]. Where the system was based on personal computer dedicated to control master node, also in [5] using Ethernet enable board from modtronix as embedded web server to control the activity of connected devices. In [2][3][4][5][7]used Ethernet microcontroller board as central unit, but not provided any kind of user interface at the central point, user have to access the unit form the another location or from the internet access PC. Finally, manufacturers may be able to earn additional revenues by selling user-interface (UI) upgrades to add new operational features and enhance the functionality of their appliances [4]. Also they had not provided scheduling scheme at central point that may help the user to schedule the activity of their devices.

The paper mainly consists of design and implementation of central intelligent system to give access for multiple and multifunctional devices from the central control point. The unit consists of ARM7 core based processor with NXP 2378 family controller for controlling purpose. It is capable of handling multiple technology input signal and process them according to their presence, it also have the touch screen user interface to help user monitor and schedule the activity of the system. The core objective of paper is to overcome the compatibility issue of different technology by using embedded technology.

The next section will briefly describe the components of central intelligent system.

II. CENTRAL INTELLIGENT SYSTEM

ARM core processor is the heart of the Central Intelligent System (CIS), the unit consist of Ethernet, serial, USB, CAN, POWER LINK CONROL PORT (PLCP), Ethernet Power Control port (EPC), Touchscreen Interface as a hardware overview. To model the complete system Umlet standard UML (Unified modeling language) has been used. The system modeled into three parts as shown in fig. 1. The command devices which are the external user interfaces that will be the PC, mobile phone or PDA's, the web browser running on PC will access the server data using TCP/IP and the mobile phone user can access the data using socket application running on the mobile-

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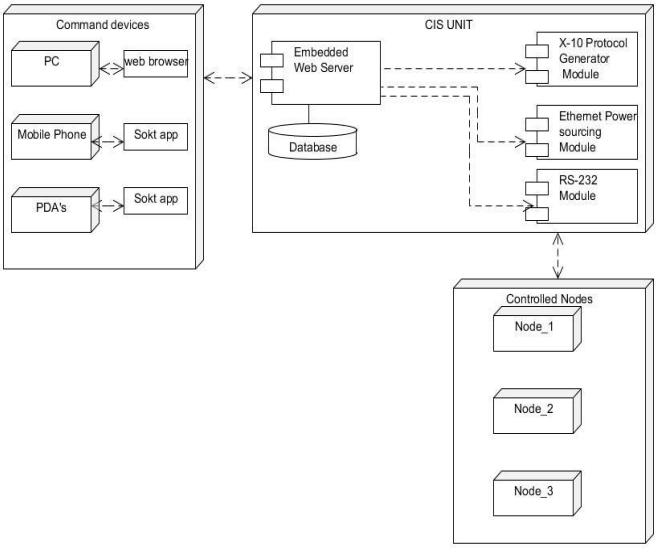

Fig.1. Complete flow of Central Intelligent System

devices. The Central unit consists of embedded webserver which have the flash memory database connectivity on the board itself and have the following software installed in it,

1. HTTP and Graphical User Interface (GUI) Application Program
2. TCP/IP stack Program
3. Common Gateway Interface (CGI) Program and Java Script Pages.
4. Protocol format of the compatible network technologies

Mobile phones have limitation of memory space and also mobile mini browser cannot display the same pages that are designed for the PC web browser[18] for that Wireless Mobile application used to get the information of embedded server and control the devices from the mobile phone, the security layer used for this purpose is SSL/TSL.

The power sourcing equipment (PSE) module is of mid span (MS) type which acts as an Power injector for Powered Devices (PD) which is standardized by IEEE in 2003 as IEEE 802.3af and also the Ethernet port of the embedded web server is acts as a powered RJ45 inlet for the power sourcing equipment as defined in the IEEE 802.3af standard. MAX5922A IC used for the injecting power to the Ethernet cable cat5 (category 5) as [19] described the application note will used as the single port MID_SPAN power injector. MID_SPAN power injector will not open the port until the valid powered devices (PD) is detected by the system. Normally PD is detected by PSE (POWER SOURCING EQUIPMENT) by transmitting and receiving DC voltage between the wire pair and measuring the received current, and PSE will expect to see approximately 25k resistance and 150 nF capacitance between the pairs for the device to considered a valid PD[16].

III. EMBEDDED WEB SERVER

Embedded web server is the kernel of Central Intelligent System, Which is responsible for the overall performance of the system. The central part in the embedded web unit is the ARM 7TDMI based LPC2378 controller, it have an in build Ethernet controller of 10baseT/100baseT for the purpose of Ethernet communication. Related to the embedded web server fig.2 give the brief idea.

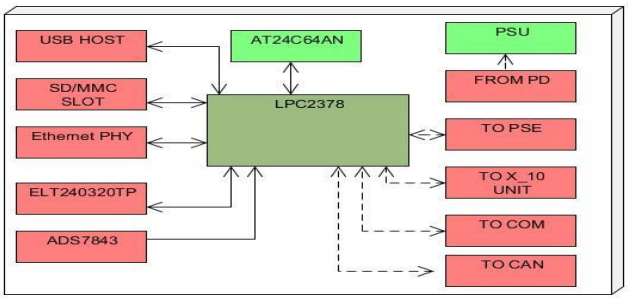

Fig.2. Embedded web server major blocks and their flow

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Power supply unit (PSU) provides power to the system by two ways in that first is from the 9 V transformers and later is from the PD, which is connected to the PSU will circulate the supply to all the peripherals in the system. The PD accepts 12.95 watts (350mA) according to the IEEE 802.3af standard. In the PSU we had used LM1117 from the national which required maximum input voltage in the range 4.75-10V to get output voltage 3.3V for normal operation of the controller. In the next section we will briefly describe the components of embedded web server.

A. POWER SOURCING EQUPMENT (PSE)

It Source the Power to external PD which is part of CIS unit, the power provided by unit is as per the IEEE 802.3af, and in this case the unit acts as the MID SPAN switch to provide power over Ethernet. For that purpose we used MAX5922A IC as power injector, which is used as single port power injector, datasheet of MAX5922A is easily available on the internet, following fig.3.explore the PSE in details.

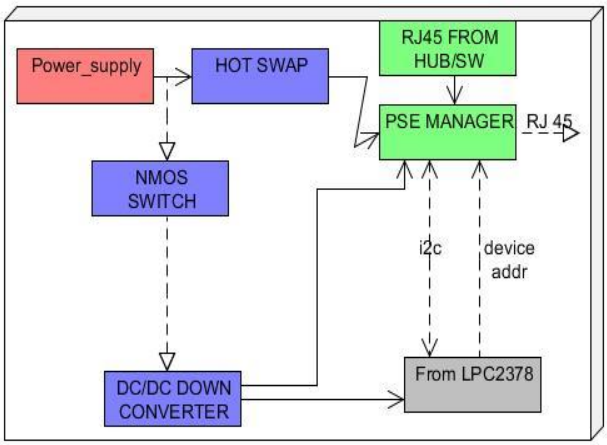

Fig.3. Complete Blocks of PSE module

As described above the Ethernet PSU unit acts as the MID SPAN switch, it connected to non-PoE router or switch through PD. The green color block shows the connection from the non-PoE devices and after that PSE manager inject power as MID SAPN does.

B. POWERD DEVICE MODULE

As it get the power from other PSE enable device on ethernet network, it acts as the PD. If in the ethernet network there is any PSE enable hardware exits, the CIS switch from internal power to PSE power, which is provided by the PSU unit on the ethernet network. Fig.4. Explore the blocks of PD. PDC (Powered Device Controller) manage the power source by PSE over ethernet and DC TO DC converter block it in to suitable voltage range which is required in this case is 3.3V and 5V for USB host devices.

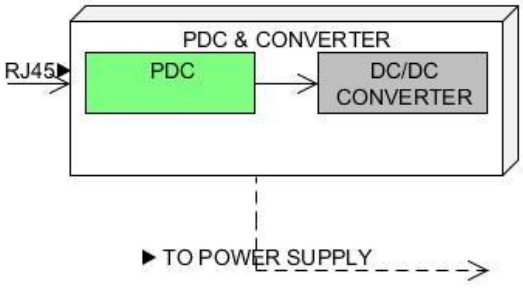

Fig.4. Complete blocks representation of PD.

C. DEVICE CONTROL BLOCK

In the last two sub sections we had described the ethernet blocks in detail, in this section we will describe controlling block of the CIS unit.

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Control section of unit is connected to the LPC 2378 controller GPIO and interrupts buses, to control the devices which are requested from the user or itself by system, in that a simple model is showed in following fig.5.

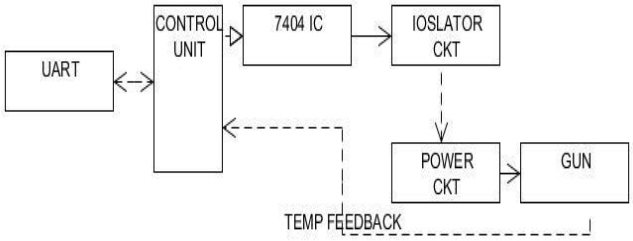

Fig.5. Gun Control through UART of CIS

The device control unit not only dedicated to any particular appliance, it is general purpose I/O section used to configure and control any HOME/OFFICE/INDUSTRIAL device from remote place or from the system. In the fig.5 showed that gun power supply controlled by continue monitoring temperature by feedback link given to the control unit. Optocoupler and triac is used in the isolator and power circuit respectively by varying the firing angle of triac with respect to temperature required at output of gun, we get the desired output. The gun control model tested separately and gave output as per the required material temperature, for the demo purpose we used semiconductor temperature sensor LM35 from national semiconductor which have range between -40 to 150 degree centigrade with 10 mV sensitivity. The next section describes System response state diagram fig. 6.

IV. SYSTEM FLOW

The fig. 6 gives bird eye view of System states when any external or internal event occurred in the system,

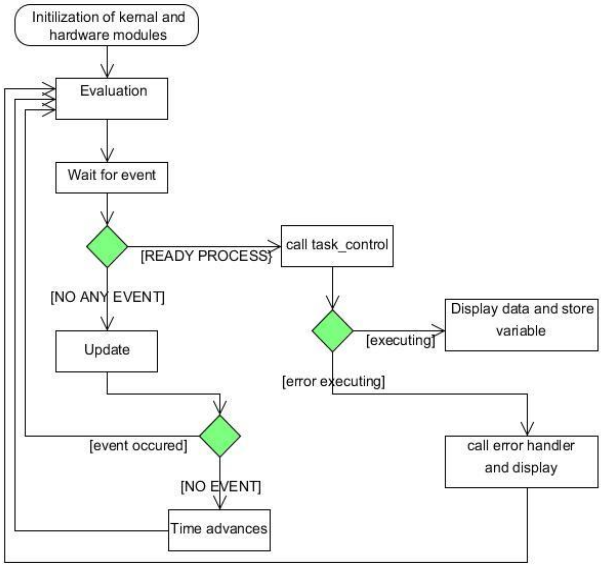

Fig.6. State diagram System control operation.

Starting phase of the state diagram is the initialization phase, in that module initializes all the hardware peripherals and check whether they are working properly or not if they are not working properly the message sent internally to the system that hardware not working properly and the respective flag entry will be disable for the same hardware device. Evaluation phase is the important phase where all the ready process executes sequentially decided by task control box and priority, there are two ways of completion of task depends upon the wait(time) and wait (task), the first is called wait-for-delay and later one is called wait-for-event [20]. The system continuously watching for the occurrence of event externally or internally generated by the system, internal events are generated by the software interrupts programs which execute according to the user or system scheduler. After very task completion respective variables data updated in the device memory for future use.

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V. CONCLUSION

In this paper we introduce the flexible, portable and compatible to existing standards, which will open doors automation of in any field, whether it is oil field of home automation (HAS). The system is secure with the SSL/TSL, system required appropriate authentication when login to any connected environment. As it provides standalone system for automation which not required any kind of external source for operation, it reduces final cost of implementation. In the paper we had not discussed the cost factor; we only focused on the smarter technology to overcome the difficulties in the automation area.

CIS provide the scheduling and auto update facility so user don't have to monitor the status of the device regularly, it provide device database to download from the remote location so user can have free time check the details. Also it consumes very low power (1.15W in case of PD and battery operated) and provide touch screen interface to the user that simplify the user task, that when user in the device environment can directly get the access. An android Real Time OS with android Wireless mobile application version of this model is in progress.

REFERENCES

[1] Ali Ziya Alkar, IEEE and Umit Buhur, "An Internet Based Wireless Home Automation system for Multifunctional devices"
[2] Gaetano Borriello and Roy Want, "Embedded Computation meets the world-Wide-Web".
[3] Imran Ahmed, Hong Wong, and Vikram Kapila (dept. of Mechanical, Aerospace, and Manufacturing Engineering, Brooklyn) " Internet-Based Remote Control using Microcontroller and an Embedded Ethernet Board" – Sept 2003
[4] Peter M. Corcoran and Joe Desboonnet, "Browser- Style Interface to a Home Automation Network"
[5] Helder Adao, Rui Antunes, and Frederico Grilo,"Web-Based Control and Notification for Home Automation Alarm System"
[6] John Holmes, Sept 16, 2007, "Ethernet-enabled Microcontrollers"
[7] Miguel Dominguez, "A Simple Architecture for Embedded Web Servers"
[8] Douglas comer, TCP/IP protocol suit 4th edition
[9] Lean, TCP/IP "Web Servers for Embedded Systems" 2nd edition
[10] Lpc23xx user manual bg "UM 10211"
[11]Craig Zacker, "The complete Reference of Networking" 2nd edition
[12] Trevor Martin "The insider guide of NXP 2300x and 2400x microcontroller", www.hitex.co.uk
[13] MK712, "Touch screen controller data sheet"
[14] Keil Uv4, "tool for ARM based microcontroller", www.keil.com
[15] Armando Roy Delgado, Rich Picking and Vic Grout, "Remote controlled home automation system with different network technologies"
[16] Alvis Chen, Business Development Manager, "PoE switches for Industrial Networking"
[17] "White Paper Power over Ethernet" Version 0.2 e 01.09.2003, Bouvard
[18] Dave Singel´ee, Bart Preneel, COSIC Internal Report, "The Wireless Application Protocol (WAP)"
[19] MAXIM, 5922A "IEEE 802.3af-Compliant Single- Port, Power-Sourcing-Equipment Application"
[20] Ke Yu, Submitted for the degree of Doctor of Philosophy, "Real-Time Operating System Modelling and Simulation Using System C"