ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Remote Monitoring and Control System Using Embedded Web Server on Arm 11



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Abstract:

This paper describes a Remote Intelligent Monitoring Center which uses ARM 11 processor as its main controller. The serial cable is connected to one of UART port of ARM board. Whenever a person is entered inside the lab, the person's image can be captured by camera and send it to controller. The controller transmits the data to remote PC through Ethernet by using HTTP. HTTP is a protocol through which users can upload files from their systems to server. Once data is placed at server we can view the data at remote PC (with internet) on web page with unique IP address. We can view continuous streaming of video. If we want to control the devices based on sensor's information we can control through web page from remote location using HTTP protocol. HTTP protocol continuously requests the server for control (turn on or turn off) the devices. In this way we can monitor and control the devices through remote PC.

Key words:

Ethernet, ARM-11, USB Camera, Embedded Web Server, intranet.

I.Introduction:

Monitoring and security are the two major areas of concern in industrial establishments. Monitored parameters include various environmental phenomena like employees work efficiency, security etc. Of all the functionalities present in the system, remote measurement and control of critical parameter plays a very important role. In order to make a remote connectivity feasible following requirements need to be met, like server connectivity with back end database like MYSQL or ORACLE and a web server like application(eg: apache, NGiNX) running on it. Another possible method is by using a web server board.

Security is also a prime area of concern in industrial setup, be it a door type security or security to machinery setup. Here, we propose the design and implementation of low cost remote based web monitoring system with built-in security features. Due to the usage of an embedded intelligent monitoring system which is the Beagle Board from Texas Instruments, portability, low power consumption and low cost have been achieved in the system. The intelligent embedded system is made up of a TI DM3730 -1GHz Cortex A8 core processor. The maximum power consumption of the board is 2 watts. The Beagle Board is a low-power open source hardware single-board computer which measures (82.55 X 82.55) mm, making it very much suitable for a portable system. Later programming is done on this Board to make it act as an embedded web server.Many papers have already been published based on the topics of remote monitoring and security either separately or jointly. But most of them lack implementation. Some lack low level implementation details. In some of them, implementations are done on workstation like embedded server with huge database backup. But in this paper we focus on a system which is open source hardware having small size with implementation details. Section II of this paper deals with industrial setup analysis and the system sketch is given in section III. Section IV gives the system overview and section V deals with tools used and the experiment setup.

II.INDUSTRIAL SETUP ANALYSIS:

In order to implement an error free monitoring system in an industrial setup, here we need to analyze the entire area. In an industry, the parameters to be monitored vary from zone to zone in a locality. Here we take care of all types of industrial setup. Localization of the system in to small zones is done based on the parameter to be monitored. The zone creation isn't that much vital in all the

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cases and can be omitted in some, where localities are small or places where only a single parameter needs to be monitored. The monitoring of zones need to be done continuously, as the values of sensor present in the zone needs to be fed to the intelligent monitoring system in real time scenario, which will later update the portal hoisted by the monitoring system and would alert the concerned personnel with the help of attached gadgets. Security features are built in to the setup in the form of real time surveillance and an entry type feature, the results of which are later posted in to the portal by the intelligent monitoring system. A brief setup of the system is shown.

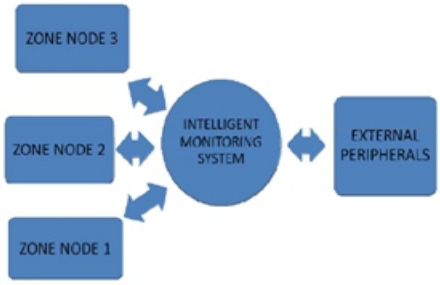

Figure.1 System Overview

A. Creation of Zones:

As already stated, the entire locality can be divided into a number of sub zones on demand. This could be such that on the same setup if we need to focus on temperature gradient as well as on the pressure gradient factor we need to divide the entire locality into sub zones based on requirement, and this division can be done by various means of analysis. Such a setup is shown in the Figure 2, where the industrial establishment is divided in to subzones as power generation area, electrical section, backup room, employee cabin section and ware house (here the zonal split is based on the critical nature of the locality).

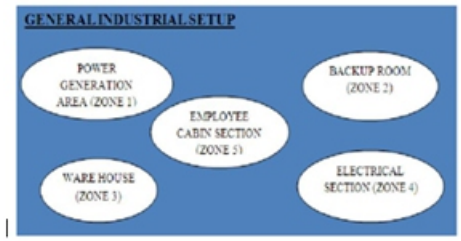

Figure.2.Zone divisions in a General Industrial Establishment

B. Setup Of Arbiter Zone Nodes:

Once the zones have been created, it is then the turn of setting up the monitoring devices at the zonal nodes. In each zone, we maintain special arbiter nodes and each arbiter consists of sensors and a webcam. Sensor selection depends upon the selected zone. Sensors are meant for the monitoring and webcam is meant for security purpose. Each arbiter node is in turn connected to a centre intelligent system which is in turn connected to intranet and external accessories. An example structure of a Zone Node is shown in Figure3.

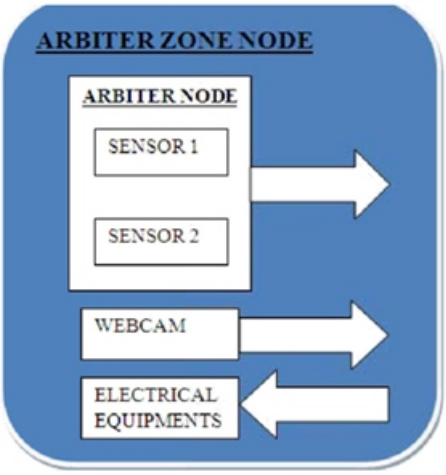

Figure.3 Structure of an Arbiter Zone Node

C. Intelligent Monitoring System:

The data from all the arbiter nodes are fed into the centre intelligent monitoring system. The intelligent monitoring system is made up of an open source hardware called Beagle Board which is a single board computer with TI DM3730 processor, which is a combination of ARM Cortex A8 processor, TMS320C64x+ core and Power VR SGX 2D/3D Graphics Processor. It has 1GHz processing speed with 512Mb RAM and has the capability to boot from SD card loaded with operating systems like Android, Angstrom Linux, Fedora and Ubuntu. The dimension of the board is (82.55 X 82.55) mmThe intelligent monitoring system is preloaded with certain packages so that it is made to act as a flash media as well as a web server. The intelligent monitoring system is connected to external accessories like GPRS/GSM modem, webcam and network accessories for alert, security and connectivity respectively.

D. External Peripheral Setup:

As already mentioned, the GPRS/GSM modem, web cam and network accessories are connected to central system. The GPRS/GSM modem alerts the personnel by sending SMS on request by the intelligent monitoring system.

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The Webcam connected to central monitoring system does the overall surveillance of the locality and thereby provides added security feature to the system. The video captured by the webcam is then hosted on the portal on a real time basis so that it can be viewed from remote locations.

III.SYSTEM ARCHITECTURE:

Figure.4 System Architecture

IV.SYSTEM OVERVIEW:

Here we propose the setup of a remote monitoring system, which would be standalone, low power, low cost as well as less prone to error. Most important step in this setup is to spot out the parameters that need to be monitored on various zones. For that, proper analysis as well as proper selection of the sensors needs to be made. Once the monitoring parameters are fixed in the zones then it is the turn to make arbiters.

The whole system setup can be divided as follows:

•Arbiter zone nodes
•Intelligent monitoring system
•Other external peripherals connected to central monitoring system.

The whole setup is divided into a number of zones based on the environmental factors, and an arbiter node is placed on each zones. Arbiter nodes have sensors as well as the webcam as per requirement. The parameters which are to be monitored are fed to the arbiter by the sensors in the form of voltage signals. The arbiter in turn conveys the information to the monitoring system, which is then fed to the database present in the intelligent monitoring system. The arbiter not only routes the sensor signal to the intelligent monitoring system but also performs routine check on the received sensor output. The OMAP based intelligent monitoring system is the heart of the system.

It feeds the input received from the sensors to web server on real time basis via ODBC connection, as well as continuously monitors for the alarming conditions in the received inputs. If something undesired happens the intelligent monitoring system would alert the administrators by the means of SMS/voice messages through the GPRS/GSM module connected to it, and then it forces the webcam connected to the arbiter to capture image sequence of the alarming incident, which is then fed back to the central system and stored in the video database for further assessment by the concerned authorities. Another important feature of monitoring system proposed here is that it would be able to capture the video images of the locality and display it on the portal in real time basis.Security is another striking feature of our intelligent monitoring system; which would be able to keep a check on the clients using the facilities provided in the locality and the record of the same would be provided on the portal.

V.TOOLS USED AND EXPERIMENTAL SETUP :

Xampp Package is the one preferred for the first phase of database and web development, as it contains an aggregate mixture of PHP-5.0, MY SQL and NGiNX WEB SERVER. Sensors that are mainly used in the setup are LM-35 temperature sensor and LDR. Arbiter consists of ATMEGA 168, which is an AVR with 16kB in system programmable flash memory. AVRDUDE is the ISE compiler used for programming AVR. Interfacing with GPRS Module is done with the help of tool known as GAMMU. A media server is maintained in the system for the live video broadcasting purpose, a utility application known as MJPEG streamer is deployed in the system which helps in live telecasting of the video feed as MJPEG frames there by reducing the broadcast overload of the Beagle Board-XM. For the video recording option in the zonal end we are using the application known as STREAMER. The entire experimental setup and application is based on LINUX based system, LUBUNTU 12.04.

A. System Realization:

A set of temperature and light sensors are connected to the arbiter node. Arbiter node composed of ATMEGA 168 collects the data from the sensors and feeds it to the intelligent monitoring system via serial port connection. A physically realized arbiter node is shown in Figure 5, and its connection to the intelligent monitoring system is shown in the Figure 6.

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The values received from the arbiter nodes are in turn fed to the database present in the intelligent monitoring system. The values are then uploaded to a portal via PHP programming. The program written in the central system carries out four functions as given below:

•Invoke the serial communication via configuring teletypes.
•Port the data to the concerned databases.
•Continuously update the database.
•Connect the database and the web server.

The first three functions are realized using C program and the fourth one using PHP. Figure7 shows the table in the database.Web portal consists of five links, namely home, current value, critical values, entire database and surveillance. The home-link is meant to hold the latest 15 values recorded from the sensors. The current-link shows the current value in the database. The critical value-link shows the details of the sensor values that exceed the safe limit. The entire database-link is meant to access the entire values stored in the database. The surveillance-link is meant to see the live video broadcasting. Figure 8 shows the home page with corresponding links.

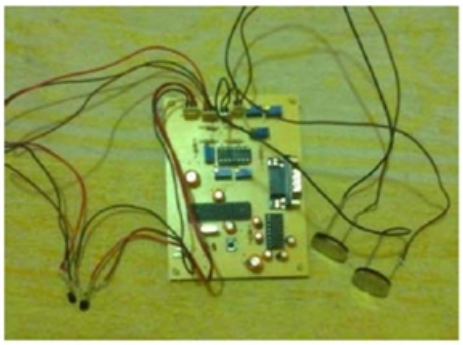


Figure.5 Arbiter node

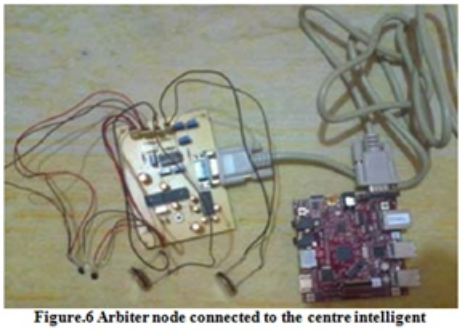
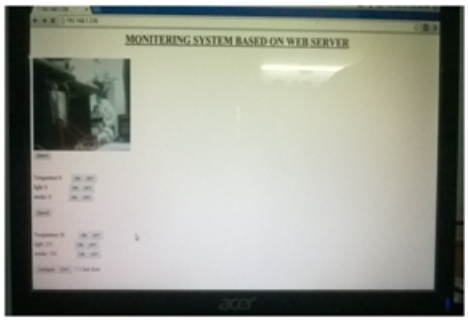


Figure.6 Arbiter node connected to the centre intelligent monitoring system



VI.CONCLUSION:

In this paper, a low cost web based remote monitoring system with built-in security features has been designed and implemented. Portability, low power consumption and low cost have been brought in to the system by the usage of the embedded intelligent monitoring module. This system has taken in to account the setup of a single node and its operation with the intelligent monitoring system. As an enhancement it is possible to incorporate more than one node to the system, and the medium of communication can be made wireless. A zone dividing algorithm can also be backed as a future advancement.

REFERENCES:

[1] R.Shepherd, "Bluetooth Wireless Technology in Home,"Electronics and Communication journal, Vol. 13, Issue. 5, pp. 195-203,October 2001.

[2] Neng-Shiang Liang; Li- Chen Fu; Chao-Lin Wu, "an integrated flexible and internet based control architecture for home automation in intenet era,"Proceedings ICRA 2002,IEEE International Conference on Robotics and Automation, Vol. 2, pp. 11 01-1106, 2002.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
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[3] J. C. Nunes and J. C . M. Delgado ,"An Intenet Application For Home Automation," Electrotechnical Conference, 2000, MELECON 10th Mediterranean Vol.1, pp. 298-301, 2000.

[4] Ali Ziya Alkar, and Um it Buhur, "An Internet Based Wireless Home Automation System For Multifunctional Devices" IEEE transation on embedded system, Vol. 18, June 2011.