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Implementation of Industrial Data Acquisition, management and Guiding using IoT

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ABSTRACT: *To design multi parameter monitoring system using Microcontroller that measures and controls various global parameters and the system comprises with wireless mode of communication. These process were managed using Raspberry Pi. The parameters that can be tracked are current, voltage, temperature, light intensity and fire and PIR alert. The system comprises of a single master and multiple slaves with wireless mode of communication and a raspberry pi system that can either operate on windows or Linux operating system. Raspberry Pi can sends data to the other system using wireless communication. The various interesting features are field device communication via USB-OTG enabled Android devices.*

IndexTerms: client/server model, Raspberry Pi, ARM11.

I. INTRODUCTION

There are various types of processes which are controlled by different machines in any kind of manufacturing industries. Considering a small industry to a large industry everywhere in production scenario, it is required to keep a track of entire production line up and the daily targets as well as failures for effective production monitoring. In companies which employ mass production daily, the record of daily production is done manually by using a production line counter. And about monitoring of CNC machines, most recording of machine performance, the operation, the number of jobs produced/worked upon are entirely drafted on paper. The reports generated are also manual which are either written on paper or generated on computer by manually entering the data. This data can be like machine running for 8 hours, manufacturing 10 pieces and failing to do 5 pieces. Likewise the report generation if done manually is a time taking job and highly erroneous. This also leads sometimes to data manipulation as well as misinterpretation. In such cases some automation of CNC machine performance becomes very important for effective monitoring of the entire production. This automation should include as many parameters of machine as possible to be continuously recorded mostly on some sort of local storage as well as a remote storage. This remote storage can act as effective monitoring tool for the supervisory persons. If the remote storage is on internet, the data monitoring can even be done sitting almost anywhere in the world.

The proposed work aims at providing solution to above mentioned issue by providing a solution using Raspberry Pi Computer in the most cost effective way. Here the approach used is very simple and can be adapted to any kind of industries by little or no modifications at all. The Raspberry pi with digital opt coupled inputs and active internet connection can read all the values given by the machine easily and log them on the cloud server effectively. The cloud server can be custom created or any freely available open cloud server can also be used. Raspberry Pi computer can be connected to internet using either Ethernet based connection using RJ45 cable connected to local Ethernet switch or it can be connected to internet using USB wifi dongle if WIFI internet connection is available. The board runs on Linux operating system which can support many programming languages like C, C++, Python, Java etc… for our job, we've selected to use python as our programming language.

Internet of Things (IoT) can define as interconnection between people, animal or object that ability to exchange data over network without involving human-to-human or human-tocomputer interaction. IOT offer various kinds of connectivity from devices, systems, and services that work within machineto-machine communications (M2M) and cover with applications, domains and protocols. [1]. Nowadays, there have many implementations of IoT devices, for instances, heart monitoring implants, automobiles built-in sensors, farm animals equip with biochip transponders, field operation

device used by fire-fighters in search and rescue etc. [2]. In current market the implementation of smart thermostat systems and washer/dryer for remote monitoring by using Wi-Fi [3].

According to McKinsey Global Institute, IoT has wider market and potential to create economic impact of $2.7 trillion to $ 6.2 trillion annually by 2025[4]. IoT is not futuristic or aspirational technology trend; instead it already exists in our devices, cloud infrastructure, data, and sensor as well as business intelligence tools. Microsoft Corporation also delivers unique and integrated approach for all enterprises to capitalize on IoT by collecting, storing and processing data. This method was extends from broad product portfolio such as PC, tablets and industry devices on edge of enterprise network to backend system and services develop tool and diverse partner ecosystem [5].

In 2007, there was a bridge collapsed in Minnesota [6], the cause of this tragic accident is steel plates were inadequate to handle to bridge's load. If we are implementing smart cement which equipped with sensor to monitor cracks, stresses and war pages, the tragedy sure can be escaped. Therefore, IoT should be further exploring as object can represent itself digitally or becomes more powerful than it. It known as "ambient intelligence" when there are many object act in unison [7].

II. RELATED WORK

Megat N.M. Mohamed Noor (2013) has conducted work on community based home security using wireless mesh network [15]. In this work, the author builds a prototype for home security system that is based on wireless mesh network. The system is considered cost effective and scalable. It is considered a community based application as it uses open mesh wireless router and raspberry PI device and the deployment is shared among house residential. The raspberry Pi B+ board is interfaced with PIR sensor to detect movement. Moreover, it uses Filezilla server to transfer captured image from Raspberry Pi to host over TCP network. The results show the benefit of implementing this system over home security as it produces a clear human face detection and recognition. The system can also be expanded by deploying additional open mesh wireless router, camera and sensor node. A research on "An agent-based middleware for decentralized dynamic data-gathering in wireless sensor networks" has been done by Haghighi, M. & Cliff, D. (2013) [16].

This article describes the design and development of Sensomax which is written in Java and run on network ranging from limit resource as Sun Spot nodes to resource rich Raspberry Pi board. Sensomax facilitate fully distributed and decentralized bulk programming and update of sensor node to serve multiple simultaneous applications used by users. It enables dynamic run-time changes in application and switch between timedriven, data-driven and event-driven operational model. Sensomax are able to operate and provide response to application request without interrupting outgoing network operation.

Cagnetti, M. et. al. (2013) has conducted work on "A New Remote and Automated Control System for the Vineyard Hail Protection Based on ZigBee Sensors, Raspberry-Pi Electronic Card and WiMAX" [17]. The author proposed systems that perform action to protect vineyard and relay message to remote control. For the overall design, an "umbrella" solution is used in which ZigBee sensor used to send the data to central control unit (Raspberry Pi). However, WiMax are chosen because it overcomes both distance limitation of Wi-Fi and the absence of ADSL. They provide result to prove that the system is user friendly and effective to protect over hail and maintenance cost.

III. PROPOSED FRAMEWORK

Following Fig.1 show the system architecture block diagram including the Raspberry Pi processor based development board, LDR, Temperature, Fire, LDR and PIR sensor and USB camera, GSM modem, LCD and related hardware.

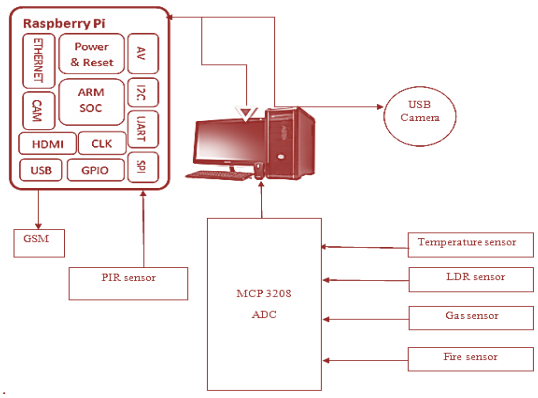

Fig.1 Functional architecture

The designing part includes basically two sections as follow.

1. Hardware Section
2. Software Section

1) Hardware Design:

RASPBERRY PI: The Broadcom SoC used in the Raspberry Pi is equivalent to a chip used in an old smart phone (Android or iPhone). While operating at 700 MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041 GFLOPS On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999. The GPU provides 1 Gpixel/s or 1.5 of graphics processing or 24 GFLOPS of general purpose computing performance. The graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001. The Raspberry Pi chip, operating at 700 MHz by default, will not become hot enough to need a heat sink or special cooling. The SoC is stacked underneath the RAM chip, so only its edge is visible. On the older beta model B boards, 128 MB was allocated by default to the GPU, leaving 128 MB for the CPU. On the first 256 MB release model B (and Model A), three different splits were possible. The default split was 192 MB (CPU RAM), which should be sufficient for standalone 1080p video decoding, or for simple 3D, but probably not for both together. 224 MB was for Linux only, with just a 1080p frame buffer, and was likely to fail for any video or 3D. 128 MB was for heavy 3D, possibly also with video decoding (e.g. XBMC).

b) Temperature Sensor :- LM35

The LM35 series are precision temperature sensors. Its output voltage is directly proportional to the Celsius temperature. Therefore LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user does not need to subtract a large constant voltage from its output to obtain suitable centigrade scaling. It can be used with single power supply or with plus and minus power supplies. It sinks only 60 µA from its supply, it has less selfheating, less than 0.1 °C in still air. The LM35 is rated to operate over a -55 to +150 °C temperature range.

Fig 3. Temperature Sensor LM35

d) Light Sensor:-IR

IR sensor detects IR radiation falling on it. Depending on the application there are many types of IR sensors which can be built. IR Sensors uses a specific light sensor to detect a particular light wavelength in the Infra-Red (IR) spectrum. Here we can install a LED which produces light of same wavelength as per sensor's specifications to observe the intensity of the received light. The light from the LED reflects back from the object and into the Light sensor when that object is close to the sensor. Because of this the intensity of the received light suddenly increases and this can be detected by using threshold.

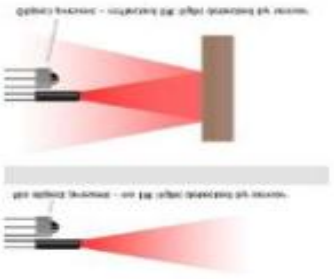

Fig.5 Light Sensor

e) MQ-2 Gas Sensor :

This sensor is used in gas leakage detecting equipment's in family and industry. They are suitable for detecting of CH4, Propane, Hydrogen and Alcohols. It features to fast response with providing stable and long life. It provides high sensitivity to CH4. It's low cost and suitable for different applications.

Webcam USB interface details:

Webcam exposed few i2c and reg read/write interfaces through the control end-point. These were used for writing the initial startup-code, configuring various params like brightness etc. and also reading auto-gain settings. It also presented iso end-points with different buffer size in different alternate config to meeting the bandwidth requirements. For my purpose i used the alternate config 0x07 with end-point buffer size of 1024. There are other end-point with smaller buffer-size like 256 also. Camera streaming is initiated by writing few config setting through i2c interface and once started frames are received on iso endpoints. A single image is broken down into multiple frames of 1024 size and sent through iso end-point. Frames are of different types (FIRST_FRAME, INTER_FRAME, LAST_FRAME, DISCARD_FRAME) and driver on host is responsible for stitching up all the frames together to form a complete image. The image transferred by camera is in a

propitiatory format and needs to be converted before a imaging software can be used to display .

GSM MODEM SECTION: This section consists of a GSM modem. The modem will communicate withmicrocontroller using serial communication. The modem is interfaced to microcontroller using MAX 232, a serial driver.

2). Software design

a) Raspbian OS

Raspbian is a free working framework in based on Debian. It is based on the Raspberry Pi module. A working framework is the arrangement of fundamental programs and utilities that make our Raspberry Pi run. It gives essentially speedier execution to applications that make substantial utilization for floating point arithmetic operations. Every single other application will likewise increase some execution speed because of advanced instruction of the ARM11 CPU in Raspberry Pi.

b) Apache HTTP Server

The Apache HTTP Server which is called as Apache is the world's most famous web server software. It is based on the NCSA HTTP server. Apache has a big role in the initial growth of the World Wide Web. An open community of developers under the auspices of the Apache Software Foundation have developed and maintained Apache. This is most commonly used on a Linux; this software is available for a wide variety of operating systems, including UNIX, FreeBSD, Linux and Solaris.

c) TCP IP Protocol

The same layered structure as used in the TCP/IP protocol suite is used by the software running on the embedded web server. The TCP/IP protocol suite permits PCs of all sizes, running distinctive operating systems to communicate with each other. The TCP/IP protocol suite is a blend of various conventions at different layers as appeared in Figure.Figure demonstrates Layers of TCP/IP protocol suit.

Each layer is independent from each other. The Link Layer generally incorporates the device driver in the operating system and corresponding network interface (card) in the PC. An Ethernet controller driver controls the Ethernet interface and the network layer controls the communication.

IV. RESULTS AND DISCUSSIONS

Temperature, humidity, gas are three parameters which are used in this proposed system. Digital Sensors are used to interface to get the data and save them in a spreadsheet and use them for monitoring, controlling and automation purpose. is the proposed system for monitoring resources. The system consists of sensors like (Temperature and Fire sensor) and MQ-2 (Gas Sensor) for monitoring environment. The sensors are interfaced with Raspberry Pi 3B through GPIO Pins. GPIO stands for General Purpose Input Output. The pins are used to give interface for various sensors and other resources.

By using the above sensors, system gets some environment parameter like temperature, fire and emission of gases. The readings generated runtime are monitored. The data is also stored in Google memeory card with Timestamp. By the help of Google Gmail, it is possible to make remote access to data generated runtime. As per the readings generated by the system it can be controlled and monitored by the user and can also be used for automation. Making the resource data available to user remotely, it makes user or owner to keep an eye to the system and check the resource status anytime and anywhere.

V. CONCLUSION

Implementation of web server using Raspberry Pi for intelligent monitoring is a new method to monitor an industrial environment which designed here for the real time implementation. This system can have communication Port. It supports online supervision and control Private Network (LAN) as well as Public Network (Internet). The whole system has good portability, good openness and low cost and it is also easy for maintenance and upgradation. It is possible to interface various kinds of Sensors with these modules and make different applications. This system can monitor embedded system operation straight through Internet and achieve network monitoring. This work can further be extended by using high end embedded servers with wireless sensor networks with increase in sensor nodes and parameters.

REFERENCES

[1] J. Höller, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, D. Boyle: From Machine-to-Machine.

[2] Margaret Rouse, (June 2014), Internet of Things (IOT), [ONLINE] Available:

http://whatis.techtarget.com/definition/Internet-of-Things

[3] Lu, J., Sookoor, T., Srinivasan, V., Gao, G., Holben, B., Stankovic, J., ... & Whitehouse, K. (2010, November). The smart thermostat: using occupancy sensors to save energy in homes. In Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems (pp. 211- 224). ACM.

[4] Manyika J. et. al. (2013), disruptive technologies: Advance that will transform life, business and the global economy retrieved from McKinsey & Company [ONLINE] Available: http://www.mckinsey.com/insights/business_technology/disruptive_tec hnologies

[5] Internet of Things (2014), retrieved from Microsoft [ONLINE] Available: http://www.microsoft.com/windowsembedded/enus/internet-of-things.aspx

[6] Libby Sander & Susan Saulny (2 August 2007), Bridge collapse in Minneapolis Kills at least 7, from New York Times [ONLINE] Available: http://www.nytimes.com/2007/08/02/us/02bridge.html?_r=0

[7] Jack M. Germain (9 October 2014), The Importance of Openness to the Internet of Things [ONLINE] Available: http:// www.linuxinsider.com/story/81024.html?rss=1

[8] Anonymous, (n.d), Raspberry Pi [ONLINE] Available: http://my.rs online.com /web /generalDisplay.html?id=raspberrypi

[9] Anonymous, (n.d), What is a raspberry pi [ONLINE] Available: http:// www.raspberrypi.org/help /what-is-a-raspberry-pi/

[10] Anonymous, (n.d), What is samba [ONLINE] Available: https:// www.samba.org /samba/what_is_samba.html

[11] Anonymous, (n.d), Configure Samba [ONLINE] Available: http:// www.ephesoft.com/ wiki/index.php?title=Configure_Samba

[12] Annonymous, (n.d), XBEE [ONLINE] Available:http://www.geeetech.com/wiki/index.php/XBee

[13] John Donovan, (24 May 2012) Security Issue with Wi-Fi, Bluetooth, and ZigBee [ONLINE] Available: http:// www.digikey.com/enUS /articles/techzone/2012/may/security-issues-with-wifi-bluetooth-andzigbee.

[14] David Baker, (15 August 2013). How ZigBee Compares in Wireless Home Automation, [ONLINE] Available: http://www.control4.com/blog /2013 /08 /how-zigbee-compares-inwireless-home-auto

[15] Megat N.M. Mohamed Noor. Community based home security system using wireless mesh network. International Journal of Academic Research Part A; 2013; 5(5), 73-79. DOI: 10.7813/2075-4124.2013/5-5/A.9.

[16] Haghighi, M., & Cliff, D. (2013, May). Sensomax: An agent-based middleware for decentralized dynamic data-gathering in wireless sensor networks. In Collaboration Technologies and Systems (CTS), 2013 International Conference on (pp. 107-114). IEEE.

[17] Cagnetti, M., Leccese, F., & Trinca, D. (2013). A New Remote and Automated Control System for the Vineyard Hail Protection Based on ZigBee Sensors, Raspberry-Pi Electronic Card and WiMAX. J. Agric. Sci. Technol. B, 3, 853-864.

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