IOT based Industrial Automation using Raspberry Pi

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***Abstract*— Technology is definitely a boon for 90% of the human community, it introduces us to a newer society integrating a global exposure, any minute we are able to access any information around the globe with this highly advanced technology. It has now become an omnipotent tool for humans especially. Looking around the wide spread world we find every little thing being handled with technology and indeed internet. It is used typically for automation ,information retrieving, monitoring at a distance, and various other purposes .We use Internet of things in our project for monitoring and reading the prime parameters as far as an industry is concerned, as we always cannot rely on ourselves to continuously monitor the data we therefore make use of Internet and the technology .These days we reduce our burden so much that even food from restaurants all over can reach us to our place within no time, everything in the world is being automated with technology and we comply with newer technologies as and when we are introduced to. This compliance further makes us discover more technologies for the welfare of the human society , we ourselves at times are engrossed seeing the umpteen number of options that are available around us to make ourselves comfortable living in the society, it defines the sole power of technology.**

The Industrial Internet of things or IoT has gained recognition due to the advancement it has made in communication technology. Industrial IoT is an application of IoT that enables monitoring of industries over the Internet using smart devices and sensors. The two main entity which ensures effectiveness in any field is monitoring. Keeping a view on this aspect, we have designed a low-cost, IOT based industrial monitoring system that monitors the remote manufacturing plants and industries using a web page. In this model a Raspberry Pi which is the main unit is connected with inbuilt Wi-Fi for internet connectivity, a temperature and humidity sensor for sensing the temperature and humidity, a gas sensor which detects the smoke and harmful gases, a fire sensor to detect fire, an air quality sensor to detect quality of air. These components are utilized to build a monitoring system in the work environment to ensure the workers safety. In case of any incident this monitoring system warns the workers by an alarm and sends information to the registered user via telegram. The chief purpose of this research is to sum up the significant role of IoT in monitoring industries. The system also has a inbuilt attendance system that works with the help of RFID.

INTRODUCTION

Modern industries have been introduced to a wide range of manufacturing processes to ease re-configurability and enhance flexibility while retaining the high throughput of the quality of products. Such systems provide real time data acquisition, enabling the monitoring of the actual condition of the manufacturing process. Real-time (data) monitoring is the delivery of continuously updated information streaming at zero or low latency.
IOT technology can generate an added value to logistics. The embedded software architecture offers a reliable solution to eliminate communication latency and provides real-time response to acquired information. Real-time (data) monitoring is the delivery of continuously updated information streaming at zero or low latency.
Monitoring involves collecting data periodically throughout an organization's environment from on-premises hardware and virtualized environments to networking and security levels, into the application stack including those in the cloud and out to software UIs. From this data, we can analyze system performance, flag anomalies and resolve issues.
Real time monitoring ups the ante by providing a continuous low latency stream of relevant and current data from which administrators can immediately identify serious problems. Alerts can be more quickly routed to appropriate staff or even to automated systems. Tracking and sending data then and there is bvery efficiently done. Data can be beneficial in multiple scenarios – to avoid industrial hazards in high profile plants, track yield in power plants, ensure safety in high paced industries, nuclear safety levels etc. Fast paced delivery of this data can save time.

EXISTING SYSTEM

There are separate device available for usage. Many Gas And Fire Detection Systems Are Present In Today's Market as we can see everyday As Separate Devices But Their Operation Is highly Limited in Alerting real time basis In Particular Area where network cannot be relied on. Also for the case of attendance many automated attendance systems are available in the market but they require a basic computer setup to process as well as to store the data

EXISTING METHOD DISADVANTAGES

- Time consuming.
- Occupies a large space
- High operational cost

Needs separate labours for monitoring and maintenance of data

LITERATURE SURVEY

Shivaji Kulkarni and AmoghDarekar[2016 IEEE] describes an idea of LIFI communication. This new technology gives better bandwidth, efficiency and speed. It is transmitting data in both directions (send and receive) using light ranges from 390-700 nm.

Mahesh.S.Kholgade, and et al [2017IEEE] explained the entire system which is using microcontroller to monitor the reading of gas sensor and transmit the message to activate alerting system such as display, buzzer, exhaust fan. This ideology is mainly used for detection of hazardous leakage of liquid petroleum gas by using MQ6 sensor.

Sarguna Priya and et al (IJETT 2014) explained autonomous monitoring of the industrial parameter using different sensors such as temperature sensor, pressure sensor current sensor and level sensor and processed by microcontroller to convey message to the authorized person using CAN BUS.

S.WMohod and Rohit.S.Deshmukh [IJETT 2014] described the system which provides data from various sensors in the sensor module and it is fed to the controlling device of a microcontroller. It is interfaced with a GPRS enabled GSM module to get accessed remotely by users. An arrangement of accessing the main server remotely by mobile users can be achieved through TCP/IP protocol.

Jadhavsunny.P and et al [IOSR-JEEE 2014] explained about the system that monitor and control the parameter through protocols and convey message through networkss, it also has another way to communicate the message to authorised client using GSM communication incase of any failure in web server .

Chien-Lan Liao, and etal [2015 IEEE] explained about blue gallium nitride based LED's which exhibit a 3-dB modulation with bandwidth of 225.4MHZ and output power of light is 1.6mW at 35mA. This modulation bandwidth decreases temperature and increase the drive current so the high bitrates of 4.4GB/s is attained.

FEATURE HIGHLIGHTS OF THE PROPOSED SYSTEM

1.Temperature ,humidity data(values)
2.Real time monitoring
3.Alerts in Telegram API
4.Accurate Data
5.Live Camera
6.Fire Leakage /Gas leakage identification
7.Air quality monitor
8.Automated attendance system using RFID
9.All the data in cloud, easily accessible

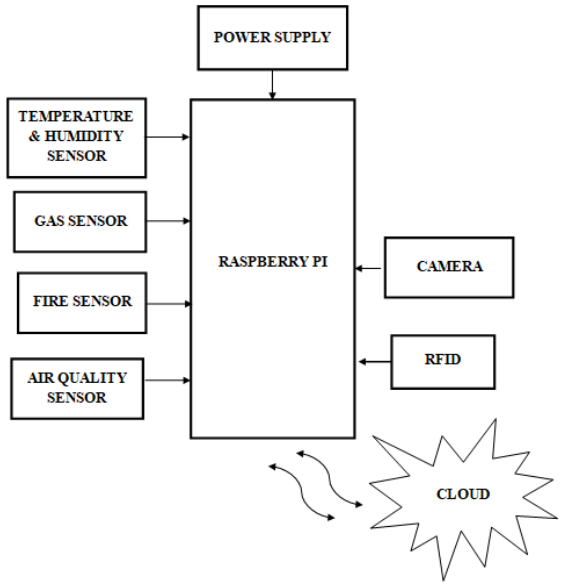
PROPOSED SYSTEM

In this project, a system is designed which will monitor automatically the parameters for industrial applications, the temperature, humidity, gas leakages. Camera is utilized for the purpose of monitoring and preventing undesirable activities or unauthorized persons in the industry. Raspberry Pi is widely used in industries for variety of applications . In the proposed system raspberry pi is utilized as main controller and as well as cloud, python language is utilized to run the prototype or the code. The Raspberry pi communicates then and there with the cloud. When the information is associated with the cloud, it will usually store and can be accessed at any required time and at any distance, doesn't require human monitoring. This system includes automated attendance ,parameters monitoring and alert.

ADVANTAGES

- Data can be accessed from anywhere
- Automated system
- Reduction in labour count
- Reduced operational cost
- Realtime alert

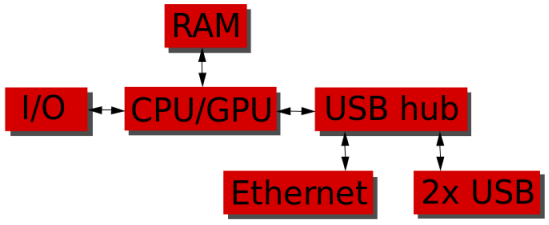
BLOCK DIAGRAM:



COMPONENTS REQUIRED:

- RASPBERRY PI
- DHT 11 TEMPERATURE AND HUMIDITY SENSOR
- FIRE SENSOR
- GAS SENSOR
- RASPBERRY PI CAMERA
- RFID MODULE
- POWER SUPPLY

HARDWARE MODULES



Raspberry Pi

Raspberry Pi is a device integrated like series of credit card sized developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic CSin schools. The very old Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which include an ARM1176JZF-S700 MHz processor device, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgrade to (models B and B+) to 512 MB. The system has Secure Digital (SD) (models A and B) or MicroSD (models A+ and B+) sockets for boot media and persistent storage. In 2014, the Raspberry Pi Foundation launched the Compute Module, which packages a BCM2835 with 512 MB RAM and aneMMC flash chip into a module for use as a part of embedded systems

The sole version for distribution of manufactured raspi devices is solely in China and Taiwan.

Hardware

In the given above block diagram wecould see for model A, B, A+, B+; model A and A+ have the lowest two blocks and the right block missing (note that these three blocks are in a chip that actually it contains a three-port USB hub, with a USB Ethernet adapter connected to one of its ports). In model A and A+ the SoCis connected directly to the USB. On B+ model the chip is contains five point hub, which has a four USB ports fed out, instead of two on model B. Many newer versions of the firmware contains the option to generally choose between five overclock ("turbo") presets that usually when turned on try to get the most performance it gets out of the SoC without impairment of the lifetime of the Pi.

RAM

On the older beta model B boards, 128 MB was allocated in default to the GPU, leaving 128 MB for the CPU. On the veryfirst 256 MB release model B (and model A), three different splits were possible. The default split here was 192 MB (RAM for CPU), which should then 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 framebuffer, and was likely to fail for any video or 3D. 128 MB was for heavy 3D, possibly also with video decoding (e.g. XBMC). On comparing the Nokia 701 uses 128 MB for the Broadcom VideoCore IV. For the new model B with 512 MB RAM initially there were new standard memory split files released(arm256_start.elf, arm384_start.elf, arm496_start.elf) for 256 MB, 384 MB and 496 MB CPU RAM (and 256 MB, 128 MB and 16 MB video RAM). But a week or so later the

RPF released a new version of start.elf that could read a new entry in config.txt (gpu_mem=xx) and could dynamically assign an amount of RAM (from 16 to 256 MB in 8 MB steps) to the GPU, so the older method of memory splits became obsolete, and a single start.elf worked the same for 256 and 512 MB Pis.The second generation has 1 GB of RAM.

Reception and use

Technology writer Glyn Moody described the same project in May 2011 as a "potential BBC Micro 2.0", not by just replacing PC compatible machines but also by supplementing them. In March 2012 Stephen Pritchard echoed the BBC Micro successor sentiment in ITPRO. Alex Hope, the praised co-author of the Next Gen report, was hopeful that computer will engage the children with an excitement of the programming. Co-author Ian Livingstone suggested that the BBC could be involved in building support for the device, possibly by branding it as the BBC Nano. Chris Williams, writing in The Register therefore sees the inclusion of programming languages such as Kids Ruby, Scratch and the BASIC as a "good start" to equip kids with the skills will be needed in the future – although it remains to be seen how effective their use will be. The Centre for Computing History highly supports the Raspberry Pi project, feeling that it could "usher in a new era programming to schools, rather than adding new hardware choices. Simon Rockman, writing in a ZDNet blog, was of the opinion that teens will have "better things to do", despite what basically happened in the 1980s

In October 2012, the Raspberry Pi won T3's Innovation of the Year award, and futurist Mark Pesce the he cited a (borrowed) Raspberry Pi as the inspiration for his ambient device project MooresCloud. In October 2012, British Computer Society reacted to the announcement of the enhancement in specifications by stating, "it's definitely something we'll want to sink our tooth into."

In February 2015, a switched-mode power supply chip, designated U16, of Raspberry Pi 2 model B version 1.1 (the initially released version) was found to be vulnerable to flashes of light, particularly the light from xenon camera flashes and green[and red laser pointers. However, other bright lights, particularly ones that are on continuously, were found to have no effect. The

PI CAMERA

The 5-megapixel sensor with the OV5647 camera module is capable of 1080p video and still digital images that connect directly to your Raspberry Pi. This is the plug-and-play-compatible latest version of the RaspbianOS, making it perfect for time-lapse photography, recording video, also motion detection and for the security applications. Connecting the included ribbon cableto the CSI (Camera Serial Interface) port on our Raspberry Pi, and you are good to go.

• Weight: 3g

• Interface: CSI connector

•Supported OS: Raspbian (latest version recommended)

Fig. Pi Camera

POWER SUPPLY:

There are several ways to convert an AC voltage at a all receptacle into the DC voltage required by a microcontroller. There are also many switching power supply solutions, however, in all applications that involve providing a DC voltage to only the microcontroller device and a few other low-current devices, transformer-based or switch-based power supplies may not be cost effective and efficient. The reason is that the transformers in transformer-based solutions, and the inductor/MOSFET/controller in switch-based solutions, are expensive and take up a considerable amount of space. This is especially true in the case of appliance market, where the cost and size of the components surrounding the power supply may be significantly less than the cost of the power supply alone.

Transformerless power supplies provide a low-expense alternative to transformer-based and

switcher-based power supplies. The two basic types of transformerless power supplies are resistive and capacitive.

Power Supplies (transformerless)

AC power supply theory (Transformerless) is not generally preached at the university level, yet the use of such power supplies is significant and prevalent in consumer goods.

Basic Concept Needed

A transformer less power supply typically integrates:

- Rectification
- Voltage Division
- Regulation
- Filtering
- Inrush Limiting

To put in nutshell, the AC input voltage charge on an output filter capacitor. The AC voltage is therefore rectified in order to ensure that the capacitor is only charged and not discharged by the mains.

Using High Voltage to generate a Low Voltage

A well versed method of generating a low voltage from any high voltage is to use a voltage divider circuit, as shown in Figure 2 From examples, the impedances Z1 and Z2 are typically resistors, and if only negligible current leaves through Vout, then the voltage we can expect at Vout is Vin * Z2 / (Z1 + Z2).

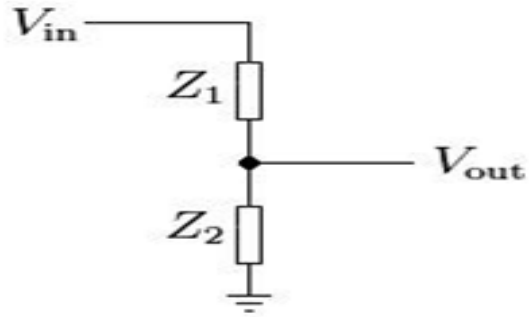
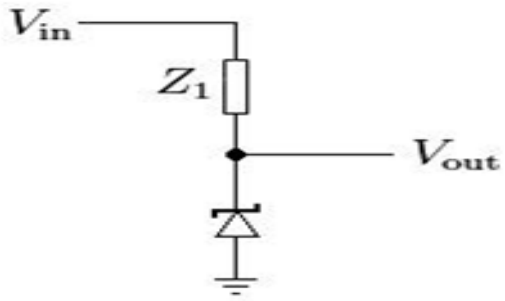


Figure Basic Voltage Divider Circuit

Using resistors for both Z1 and Z2 will generally result in a poor power supply design. Good power supplies support a range of output current from Vout while holding the output voltage constant. In a design which is resistor-based, if there is any of the load current then the voltage drop across Z1 will increase and Vout will correspondingly decrease, which is undesirable. Another issue is that if Vin were to decrease, then Vout will decrease by the same proportion. Given that Vin varies significantly over time (see Figure 1), we know with certainty that Vout will also vary over time as well, which is again undesirable.

To improve the performance of the power supply, we can replace the Z2 resistor with a Zener diode instead, as shown in Figure



Constant Power Loss

The Zener diode introduces a non-obvious drawback common to all transformer less power supplies: constant power consumption regardless of load. The current passing through Z1 can go one of two places: through the Zener diode or through the load connected to Vout. However, the total average current will always match the current through Z1. For a transformer less supply that can source up to 30mA:

- If the load connected to Vout draws very little current (or none at all), then all unused current (up to 30mA) flows through Z2 which dissipates power in the Zener diode.
- If the load connected to Vout draws most of the 30mA, then the power dissipation of the Zener is lower while the power dissipation of the load is higher.

Input Impedance:

Z1 is usually implemented as one of the two options. A simple low cost Z1 is a resistor; a more efficient option is a capacitor. The size here of the Z1 resistor or capacitor and the Zener voltage together to determine how much total output current will be available. Output (Hold-up) Capacitance

A rectified sinusoidal AC input voltage (as shown in Figure 1) it has periods of time where instantaneous Vin has smaller magnitude than the DC output (Zener) voltage. Basically topro up the DC output voltage during these periods, a capacitor is added to

Vout. The capacitor allows Vout to "ride through" the periods of small instantaneous AC voltage.

Blocking Diode Placement

There are two places where blocking of the diode(s) for rectification can be placed: before the Zener diode and after the Zener diode.

In general, placing a blocking diode after the Zener ("post-Zener") will prevent the (admittedly small) reverse current flow from the output capacitor through the Zener. The output capacitor generates reverse current flow through the Zener only during portions of the waveform where Vin is less than the output capacitor voltage. Inclusion of a Post-Zener diode results in a tradeoff that the output voltage will typically be a diode drop (0.7V) less than the Zener voltage.

CONCLUSION

IoT enables a very efficient industrial monitoring system has a wide requirement in various kinds of industries across the world, as they typically raise the safety standards exponentially while at the same time providing a real time monitoring of critical parameters like temperature, humidity, fire state etc. and notifies if any abnormality to concerned officials/ workers. The Implementation therefore is not only in the view of safety but also could be used as a yield booster for all the industry, since it is always monitored the cloud data can be viewed anytime from any place.

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