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Industry Optimization using Smart monitoring of various Parameters

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ABSTRACT

This paper proposes an advanced system designed for an industrial unit which has multi parameter monitoring system using a Microcontroller that measures and controls various global parameters and the system is equipped with wireless mode of communication. These processes are managed using Raspberry Pi. The parameters that can be tracked are temperature, light intensity, gas, 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 send data to the other system using wireless communication. Raspberry Pi can send Alert Message (SMS) using GSM modem implemented in the system.

Keywords: Cloud storage, GSM modem, Industrial Internet of Things, Python Programming, Raspberry Pi 3, Sensors.

I.INTRODUCTION

Real time monitoring of any mechanized system is essential for its continuous and reliable operation. This advanced system presents a cost and power efficient system that can be used for quick and accurate parameter monitoring. The designed system will continuously measure the processes and display the power system parameters like gas, temperature, smoke etc. Now-a-days the accidents in the industries have increased. Even if any explosion occurs it can't be easily known to the laborers and it may cause accidents. So in order to avoid this, a system has been designed and this is allowed to monitor the ambient situations inside the industry. Some of the parameters such as explosions, temperature and water level are sensed by using sensors and the received data from sensors transmitted to the microprocessor used in raspberry PI 3 and then transmitted to the mobile device and E-mail through GSM module. By this the human intervention can be avoided inside the industry and the accidents can be prevented.

Feasibility Study

The main considerations in the field of technology are automation, power consumption and cost effectiveness. Automation is intended to reduce man power with the help of intelligent systems, Power saving is the main consideration forever as the source of the power (Thermal, Hydro etc.,) are getting diminished due to various

reasons. The main objective of the project is to automatically monitor the different parameters in any industrial unit in an efficient manner. The project deals with various parameters like motion detection, smoke detection, temperature, fire and light which are adequately detected by sensors in the project. This is very useful in terms of an industry and the laborers who work in them since they are appropriately protected from otherwise life-threatening situations.

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Hardware Description

1.1. Raspberry Pi 3

The Raspberry Pi is a series of small sized (almost the size of a credit card) single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. The Raspberry Pi 3 is the third-generation Raspberry Pi.

Specifications of Raspberry Pi 3:

- 1GB RAM
- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI
- CSI camera port for connecting a Raspberry Pi camera
- DSI display port for connecting a Raspberry Pi touch screen display
- Micro SD port for loading your operating system and storing data

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Fig. 1. Raspberry Pi 3

1.2. GSM SIM800l

The SIM800L module supports quad-band GSM/GPRS network, available for GPRS and SMS message data remote transmission. The SIM800L communicates with microcontroller via UART port, supports command including 3GPP TS 27.007, 27.005 and SIMCOM enhanced AT Commands. It also has built-in level translation, so it can work with microcontroller of higher voltage than 2.8V default. Besides, the board also supports A-GPS technique which is called mobile positioning and gets position by mobile network. This features make it can also be a tracker module.

Specifications of GSM SIM800l:

- Quad-band 850/900/1800/1900MHz
- GPRS multi-slot class12 connectivity: max. 85.6kbps(down-load/up-load)
- GPRS mobile station class B
- Controlled by AT Command (3GPP TS 27.007, 27.005 and SIMCOM enhanced AT Commands)
- Supports Real Time Clock
- Supply voltage range 3.4V ~ 4.4V
- Supports A-GPS
- Supports 3.0V to 5.0V logic level
- Low power consumption, 1mA in sleep mode
- Compact size 23mm x 35mm x 5.6mm
- Micro SIM Card

1.3. Sensors

1.3.1. Flame Detector

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When

used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.

1.3.2. MQ2 Sensor

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detecting (in home and industry). It can detect LPG, i-butane, methane, alcohol, Hydrogen, smoke and so on. Based on its fast response time. measurements can be taken as soon as possible. Also the sensitivity can be adjusted by the potentiometer.

1.3.3. LM35 Sensor

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/^{o}C.

1.3.4. Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact.A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target. The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Some know these processes as "thermosensation".

Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object.

1.3.5. LDR sensor

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The most common type of LDR has a resistance that falls

with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances: Daylight= 5000Ω, Dark= 20000000Ω

II.DESIGN AND IMPLEMENTATION

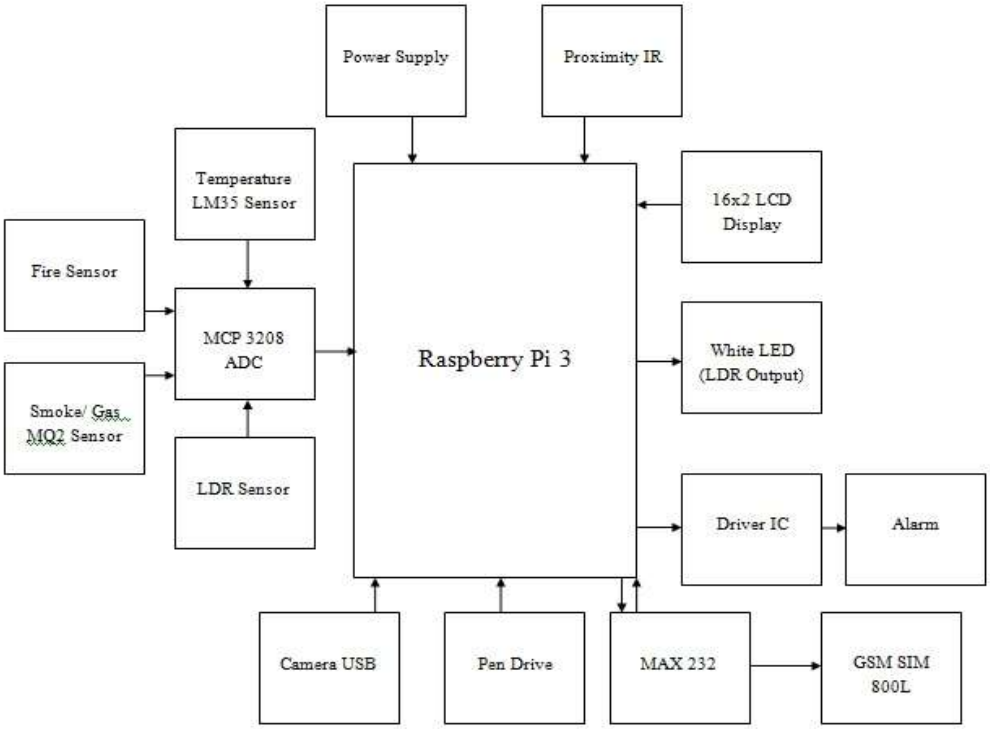

Fig. 2. Block Diagram of the Proposed System

The proposed system is fully equipped with in built peripherals and bridging devices for communicating with raspberry pi or other platform. This module operates in 5 volts. The block diagram shows the interfacing of physical parameters like Temperature, Light intensity, Gas, Flame/Smoke and Motion in this module. Data acquired from each parameter is collected on the cloud server and is displayed in (16x2LCD) which is connected on the module and also sent to mobile equipment as SMS and E-mail alert through GSM.. The relay and alarm are also connected for controlling purpose. The in-built analog to digital(ADC)- MCP3208 converter and digital(DAC)- MAX232 converter is used to measure the voltage and current.

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Fig. 3. Labeled proposed system

III.RESULTS

The proposed system efficiently provides the desired alerts and values of different parameters under consideration. The values of different parameters have been set and programmed accordingly on the Raspberry Pi 3 (using Python Programming) so that the alerts are produced when the values are more than acceptable indicating an undesirable condition. Screenshots of the results obtained are shown below:

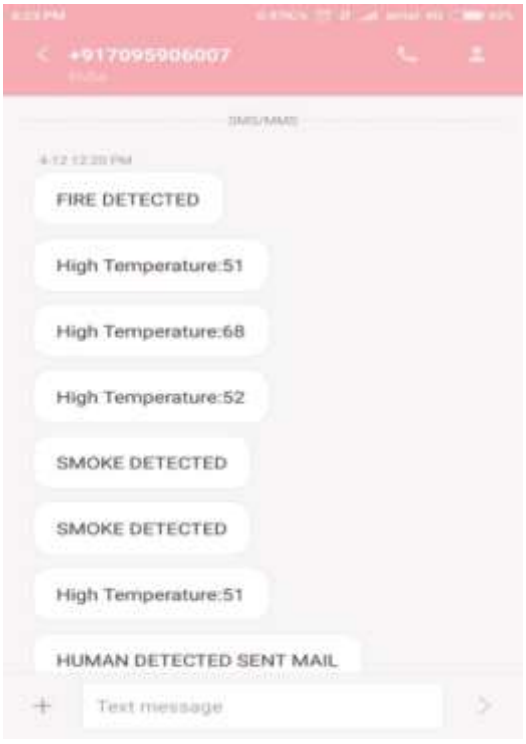

Fig. 4. Figure of SMS alerts

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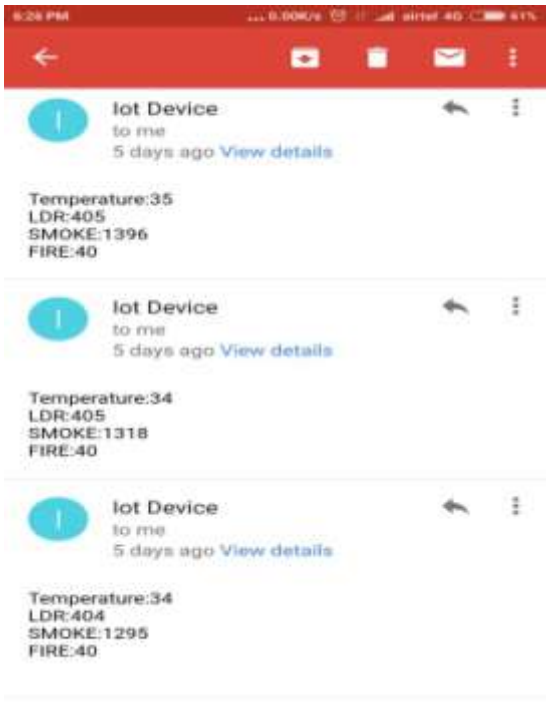

Fig. 5. Figure of Values of Parameters received as E-mail alerts

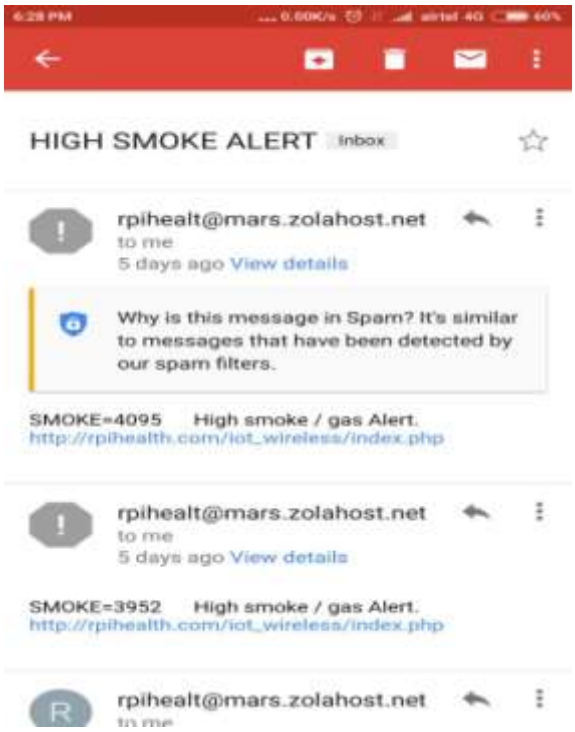

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Fig. 6. Figure showing High Smoke Alert

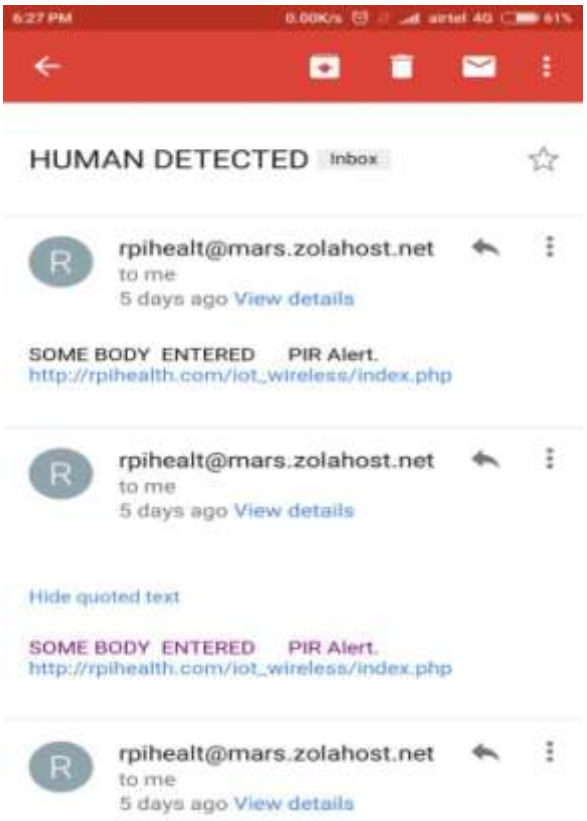

Fig. 7. Figure showing Motion(human) Detection alert

IV.CONCLUSION

The designed system is reliable to use and can be used in any working environment. The sensors which are used are quite sensitive. The suffocation of the labors working inside the mine is avoided. The accidents are prevented which are caused by ambient conditions. This application can be used for all industrial area where human intervention for security can be avoided. In hospitals, shopping malls also this application can be used.

Future Scope

The system can be enhanced for wave form representation of data in an excel sheet using Raspberry pi. The additional slaves can be added for measures various other parameters. Also controlling action can be set for some predefined cases in the master module which enables the automatic operation at certain cases. A dedicated video processor can be used in raspberry pi to display graphical and three dimensional view of the industry.

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