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CO-GPS: Energy Efficient GPS Sensing Parameters MonitoringUsing Raspberry PI-3

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ABSTRACT:*This paper proposes an advanced system for process management via a credit card sized single board computer called raspberry pi based multi parameter monitoring hardware system designed using that measures and controls various global parameters. The system comprises of a single master and slave with wireless mode of communication and a raspberry pi system that can either operate on windows or Linux operating system. The parameters that can be tracked are temperature & light intensity. The master board use raspberry Pi, LM35 & LDR Sensors, GPS and GSM modules. We can monitor the data through Personal computer, display device (16x2 LCD) and simultaneously we will SMS alerts when the parameter readings exceed the limit.It transmits the information of the sensor modules to the intermediates station with GSM interface, like the focus of, gas and temperture (MQ2 and LM35) sensor. And most of the collected information will be passed back again to the server (IOT) through WSN (GSM and GPS). Therefore, the ideal aspects of indoor atmosphere might be modified and controlled nicely with proper air quality, like temperture, etc. It will regulate a far more comfortable surroundings of a particular location and then made a more efficient energy saving system. With this particular safety-critical area monitoring program we are going to have much more practical significance as well as application worth in enhancing the greater living environment. Modern protection crucial places monitoring system must offer real-time monitoring of setting for individuals to enhance safety and lifetime.*

KEYWORDS: Wireless Sensor Network, Gas Sensor,Internet of Things, GSM Network, GPS

I. INTRODUCTION

Real time monitoring of power system is essential for its continuous and reliable operation. This advanced system presents a low cost, low power consuming system that can be used for quick and accurate power system parameter monitoring. The designed system will continuously measure the processes and display the power system parameters like voltage, current. Now-a-days the accidents in the industries have increased. Even if any explosionoccurs 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 and then transmitted to the personal computer through ZigBee module. By this the human intervention can be avoided inside the industry and the accidents can be prevented.

Wireless communication is very important concept and it plays an important role in various industries of automation field. Today the application of wireless communication in industrial automation is increasing rapidly. In some applications human beings have been replaced by unmanned devices that will acquire data and relay the data back to the base. A single person can monitor and even interact with the ongoing work from a single base station.Wirelessbased industrial automation is a prime concern in our daystandardized nowadays. Intelligent and low-cost automation of industrial processes are crucial in order to improve process efficiencies, deliver quality products, and ensure timeliness and accuracy of systems. Wireless is predicted to be one of the fastest growing technologies in the area of process automation sector. The embedded web server network consists of advanced processor ARM11-Raspberry Pi. It is having RISC architecture. An embedded web server creates an easy way for monitoring & controlling any device which is at remote place.

For designing the system we require remote pc along with the internet facility at the remote locations. We implement a system which is portable, low cost & having less maintenance by using ZigBee technology. ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios.

The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that require Short-range low-rate wireless data transfer.

In the hazardous working environment, human safety is an important concern. At the sametime if any person is absent in an important place for monitoring, it may also cause serious hazards. At present many systems are implemented in industrial areas but still accidents are occurring.The new method is to design a system and that is place in industries. The system will be equipped withsome sensors like temperature and light for detecting the explosions and the ambient temperature. If any serious situation occurs means an alert given to the nearby workers.

Wireless communication is also an important issue inside the industry. Usage of wired technologies are not worthy as the cables will get damaged after a certain period of time or due to some environmental factors. So the wireless transmission technology is preferred.The industrial monitoring protocol should be designed such that the system must have a reliable end to end data delivery. The data which is collected from sensors should be transmitted without any delay and loss of data. Some of the techniques like ZigBee, Bluetooth, and Wi-Fi and GSM as wellas GPS.

II. RELATED WORK

Inthe designed and implemented a compactwireless sensor network with internet capabilityof environment. System can monitor the status of kitchen and send email and/or an alert SMS via GSM network automatically to userswith detail data. It has the capability to control through internet.With the subject of received email is read by the developed algorithm fed into Raspberry pi andthen the system responds tothe corresponding instruction with high securityapplicable .It has a variety of features such as energy efficient, intelligence, various low cost, portability and high performance.A concept of newtechnology used Raspberry pi based kitchen monitoring system through webpage with ZigBee based technologyas explained in paper [1] Ravi.M.et.al.[2015] As per author explain automation using in wireless communication has made the systems more smart and automatedcommunication architecture .In the Technology used The Local Area Network this also sends an alerting SMS to a predefined mobile number. It may also remote system if a parameter crosses the threshold.

In the proposed system, the patient's physiological conditions are acquired by the wireless sensors nodes attached on the patient body, and are then transmitted to the remote base-station. Base station is designed using a Raspberry Pi. The Raspberry Pi is basically ARM 11 processor with features like serial communication and Ethernet and so on. Allfeatures are explored to c ommunicate with the WSN architectureto perfectly acquire data and update the status to doctor's chamber using LANin resctive order . In the Wireless Sensor Nodes designed using ZigBee is emerging as a significant element of next generation healthcare services. In this paper we proposed a mobile physiological monitoring system, which is able to continuously monitor the patient's heart beat, blood pressure and other criticalparameters in the hospital. Inentire system consists of a router node to acquire the patient's physiological datawith systammic way. The transmitted data from the router node is received by the coordinator node. The coordinator node connected to the server. All the mainnodes designed toupdate the data using LAN.

Ithelps is easy way to monitor the patient at their chamber and helps doctors to take immediate actionson respective conditionin particular research domain.[2]

Keerthi VallapReddy.et.al.[2014]In this paper author has proposeda completely automated license plate recognition systemwith detail diagram. In the aim of researchat designing a system which automatically captures the image of the number plate of a vehicle. These details were verified using Raspberry Pi processor for authentication. The system also alerts the authorities when any unauthorized image of number plate was detected using buzzer alarm system. In the explanation when the authorized vehicle was detected then the system operates the gate using DC motor the relatedwork.As automationis the most frequently spelled term in the field of electronicsconsider with research area .In the require for automation brought many revolutions in the existing technologiesarea.

III. PROPOSED SYSTEM

The implemented system consists of aRaspberry Pi 3 as a main processing unitfor the entire system and all the sensor and devices canbe connected with the microcontroller. The sensors canbe operated by the microcontroller to retrieve the datafrom them and it processes the analysis with the sensordata and updates it to the internet through GSM module connected to it.In the above block diagram, there it isshowing the main elements in the proposed system.To design an embedded system the first an important step is hardware selection. The hardwarecomponents should be chosen carefully to obtain high accuracy with minimum hardware and cost.Fig. 1(a), (b) show the block diagram of an embedded environment monitoring system. The hardwaresystem development is divided in major parts, viz. the gas sensor, signal conditioning circuit,ARM microcontroller on-board system, display system, GSM network and GPS. Provisionis also made to interface the unit to a personal computer through serial port for system programmingof ARM-11 as per requirement.

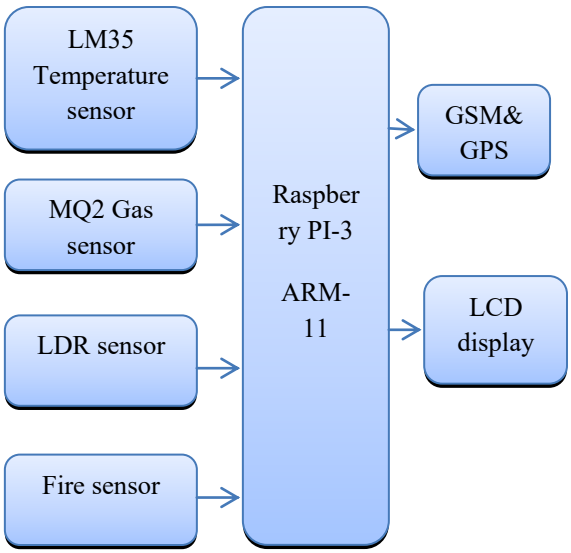
A. Raspberry Pi 3: The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.The main features of Raspberry pi 3 are[4]

Processor: Broadcom BCM2387 chipset.1.2GHz Quad-Core ARM Cortex-A53 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE)

GPU: Dual Core VideoCore IV® Multimedia CoProcessor. Provides Open GL ES 2.0, hardwareacceleratedOpenVG, and 1080p30 H.264 highprofile decode.

Operating System: Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT.

GPIO Connector: 40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines



(a)

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www.bosembedded.com/GPRS/dac19.txt.

(b)

Fig.1(a) Block diagram (b)Server section

Temperature Sensor: LM35 IC which was manufactured by National Semiconductors is used to measure temperature. The temperature sensor has three terminals as shown in figure 1. The V_{cc}pin is given a supply voltage of 5V DC. The ground pin is grounded. The data pin is connected to the chanel-1 of the inbuilt ADC using port pin. The sensor gives electrical output proportional to the temperature (^{0}C). The general equation used to convert output voltage to temperature is

$$T\ (^oC) = V_{out} * (100^o\ C/V_{cc})$$

Light Sensor:LDR is Light Dependent Resistor which is used aslight sensor. It gives output in terms of voltage whichindicates the light intensity of the surroundings. Thecell resistance falls with increasing light intensity. Itsoperating voltage is 320V AC or DC peak. LDR ishaving two terminals as shown in the figure 3. The datapin is interfaced with the trim pot which has variableresistance. The other pin of the LDR is grounded. Theother pin of the trim pot is given to 3.3V power supply.The data pin is given to the inbuilt ADC of themicrocontroller.

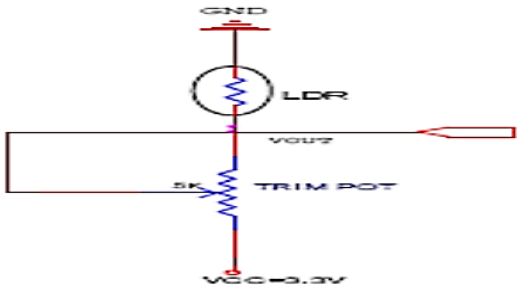

Fig.2. Light Sensor

Gas sensor: Gas sensor is a device that is normally made up of metal oxides that senses the gas molecules. It sendselectrical signals as the output which is proportional to the gas concentration. Selection of a sensor isof prime importance as it decides the overall performance of the pollution monitoring system. Todetect CO gas generally SnO2 gas sensor is used. The SnO2 gas sensor has high sensitivity andselectivity towards CO gas. In the present study, a commercially available SnO2 gas sensor (MQ6) isused.

LCD Interfacing to Microcontroller: A liquid crystal display (LCD) is a thin, flat panelused for electronically displaying information such astext and integers. Its major features are its lightweightconstruction, and portability. Date and time arecontinuously displayed on LCD when the sensor valuesare being stored in EEPROM. Four data lines are usedto send data on to the LCD. When RS=0 and EN pin ismade high to low command is sent to LCD. WhenRS=1 and EN pin is made high to low data is sent toLCD. VEE is used to adjust contrast.

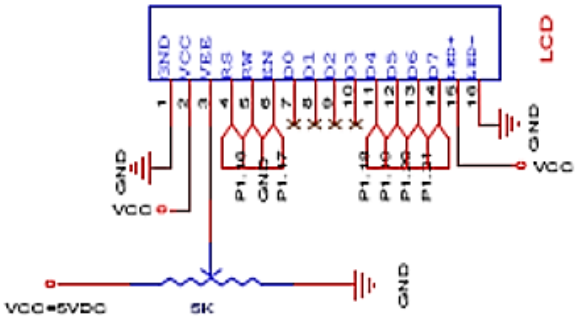

Fig.3. LCD connection to ARM-11

LEDs: The Light Dependent Resistor will monitor thelight intensity of the light intensity of surroundingenvironment. If the light intensity is getting low thenautomatically the LED lights will glow with a requiredintensity. Using the LED bulbs will save the energy inhomes and industries. Here we are controlling theintensity of the LEDs based on the outside light, so thatwe can save more power.

GSM module: It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. The use of GSM to send health information to webpage. This gives patient the ability to leave the hospital but still he has

to stay in some known places to ensure the ability to reach him in emergency cases. Even with this solution the patient can't move freely and be far from his home.

GPS modules: There are a variety of GPS modules available in the market but the one with a built-in patch antenna on top (POT) gives the advantage of data reception even indoors. For GPS module to work outdoors, you may have to find a clear sky to receive data. The module can either be connected with the USB cable or with just four wires connected directly to the GPIO of Raspberry Pi as shown in the table.

Connecting GPS Module with GPIO of Raspberry Pi

GPS module pin	Raspberry Pi pin
3v3 pin	Pin 2
Gnd pin	Pin 6
Txd pin or Data Out pin	Pin 10
Rxd pin or Data In pin	Pin 8

Fig.4 GPS unit

B. SOFTWARE IMPLEMENTATION

A global positioning system (GPS) module is a device used to determine its location on earth in terms of latitude and longitude. Since Raspberry Pi is a complete computer in itself with a stable operating system therefore connecting a GPS device to it is just like connecting it to any other computer. But getting it to work, then pulling out your chosen GPS-related data in python and performing some predefined tasks with the GPS data is something very different and interesting.

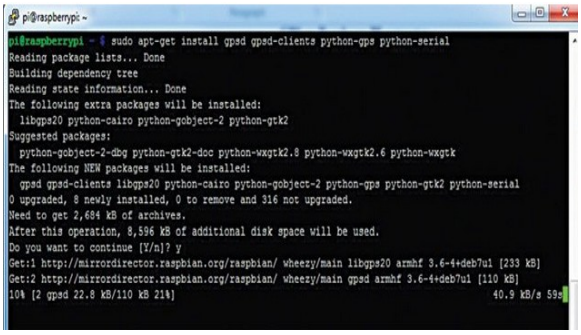

Fig.5. Terminal window of GPS to ARM-11

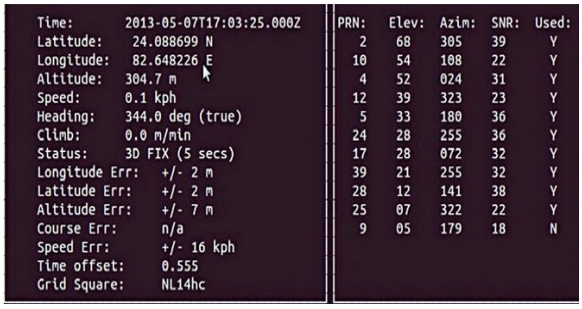

Fig.6. GPS to ARM-11 Location imformation

IV. CONCLUSION

The research and implementation of a systemfor monitoring the environmental parameters usingIoT scenario is accomplished. The system providesa low power solution for establishing a weatherstation. The system is tested in an indoorenvironment and it is successfully updated theweather conditions from sensor data.we evaluate the accuracy and efficiency of the resolution. Associated to more than 30 seconds of heavy signal processing onstandalone GPS receivers, we can achieve three orders of magnitude lower energy consumption per location tagging.

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BIODATA

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