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Refinery Inspection by Autonomous mobile robot based on WIFI communication

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ABSTRACT
This prototype focuses on the system which is useful for Oil and gas refineries that can be a dangerous environment for many reasons, including toxic gases, heats and catastrophic failures. In order to avoid the dangerous accidents occurring in industries and oil refineries, a mobile robotic platform is developed and implemented. Here we focus on the use of Wi-Fi for communication between user and robot and for localizing the robot. Many efficient algorithms are developed and tested to minimize the total number of Wi-Fi access points (APs) and their locations in any given environment while taking into consideration the throughput requirements and the need to ensure every location in the region can reach at least k APs. When multiple Wi-Fi APs are close together, there is a potential for interference. Graph-coloring heuristic was used to determine AP channel allocation. In addition to this, Wi-Fi fingerprinting based localization is also developed and implemented. All the algorithms implemented are tested in real world scenarios with the robot developed and results are accurate.

INTRODUCTION
Oil and gas refineries can be a dangerous environment for numerous reasons, including heat, toxic gasses, and unexpected catastrophic failures. In order to combat how human operators interact with this environment, a mobile robotic platform is developed. This paper focuses on the use of Wi-Fi for communicating with and localizing the robot. Specifically, algorithms are developed and tested to minimize the total number of Wi-Fi access points (APs) and their locations are given in environment.
Throughput requirements need to ensure every location in the region can reach at least k APs. When multiple Wi-Fi APs are close together, there is a potential for interference .Graph-colouring method is used to determine AP channel allocation. In addition, Wi-Fi fingerprinting based localization is developed. All the algorithms that are implemented are tested in real world with the robot which is developed and results are accurate.There is no existing system that is automated or inspecting of parameters in oil and gas sector. Also all existing machineries are related to manufacturing industry. In proposed system we design one robot and it can monitor some parameters like smoke, temperature and humidity.

LITERATURE SURVEY
Wireless sensor networks in the oil, gas and resources industries: This paper gives a study on the use of Wireless

Sensor Networks in refineries, petrochemicals, underwater development facilities, and oil and gas platforms. The work focuses on the networks that monitor the production method and to prevent or detect health and safety issues or to enhance production process. WSN applications give many opportunities for production organisation where the use of wired counter parts may prove to be prohibitive. They can be used to monitor pipelines, natural gas leakages, corrosion, equipment condition, and real-time reservoir status. Data collected by such devices gives new views into plant operation and innovative solutions that improves the oil, gas and resources industries in improving platform safety, reducing operations, preventing problems, decreasing errors, and reducing operating costs. In this paper, we survey a number of WSN applications in oil, gas and resources industry operations.

Mobile robotics for offshore automation: this prototype gives applications in some areas for mobile service robots in offshore oil and gas production environment. Requirements and restrictions for the use of robots together with a first prototype and its evaluation is done in the field test. The field of offshore oil and gas production is observed in the first part to identify the possible applications for mobile automation. This shows that there is a wide variety of applications for mobile automation. In the second part the offshore environment is observed in respect to the use of mobile robots. The results of these observations are requirements and restrictions for the construction especially due to explosive atmosphere and the hazardous environment. In the last part, a first offshore inspection and manipulation robot prototype is together with the results of a first offshore application test. The evaluation of this first autonomous service robot that has ever been operated in offshore environments has proven the applicability of mobile robots to offshore sea platforms.

EXISTING SYSTEM

All existing machineries are related to manufacturing sector. There is no existing system that is automated or inspecting of parameters in oil and gas sector.

PROPOSED SYSTEM

In proposed system we are going to design one robot and it can be able to monitor and control some parameters like smoke, temperature and humidity.

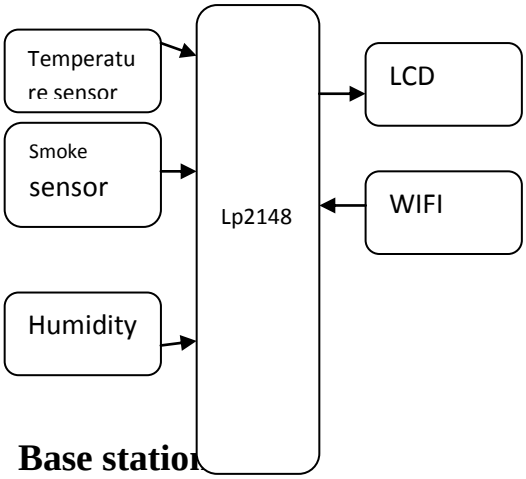
In this proposed system, ARM7 micro controller is used for controlling all the hardware components that are connected to it. Here we use different types of sensors like humidity sensor, rain level sensor, temperature sensor smoke sensor etc. if any fire accidents occurs then immediately fire sensor is activated, with the help of signal conditioning unit, information is sent to micro controller. Then alarm is activated and message is sent to base station 2 using zigbee modem and the information related to fire accident is displayed on LCD. Now base station 2 sends the information remote locations. In the same way, when the sensor is activated then information is sent using GSM modem.

The changes in the industries leads to global temperate rise, flood increasing, salinity intrusion, lack of water can effect negatively by cresting pollution in those areas. In order to research all changes on natural and human

activities, and for finding a solution to human adapt with climate change, we require an automatic and continuously monitoring system for oil and refinery industries. We have used wireless sensor networks to avoid the accidents by making a system and apply this to overcome the threats caused due to changes in the environment by using sensor nodes, in which one node can observe many climatic parameters from a particular industry in real time. We have proposed automatic monitoring system based on the wireless sensor network. The network formed by wireless sensors is a local area network because it uses only one wireless transceiver that supports communication interface.

BLOCK DIAGRAM

Base station 1



Base statio

Smart phone having aapp

HARDWRE DESIGN OF THE SYSTEM

Sensor Network:

Proposed system contains system normal environmental system converted into some smart environmental monitoring system. It can give right decisions for the changes occurring in different areas. In broadcast definition, a sensor is an object whose purpose is to detect changes in the environment and then provides a corresponding output.

TEMPERATURE SENSOR LM35

The LM35 temperature sensor is an integrated circuit sensor that can be used to measure temperature with an electrical output that is proportional to the temperature. The LM35 sensor generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 series are precision integrated-circuit, temperature devices with an output voltage linearly- proportional to the Centigrade temperature. The LM35 device has an advantage over linear Temperature sensors calibrated in Kelvin scale, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scale. The LM35 device does not require any external calibration to provide typical accuracies.

HUMIDITY SENSOR

Humidity is the presence of water in air or atmosphere. The amount of water vapor in air can affect many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Controlling or monitoring humidity is important in many industries & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly

controlled and monitored during wafer processing in semi conducting materials.

SMOKE SENSOR: A smoke sensor is a device that detects smoke, mostly as an indicator of fire. Commercial, industrial, and mass residential devices uses a signal to a fire alarm system, while household detectors, are known as smoke alarms. Smoke detectors are generally housed in a disk-shaped plastic enclosure about 150 millimeters (6 in) in diameter and 25 millimeters (1 in) thick, but the shape can vary by manufacturer.. Most smoke sensors work by optical detection (photoelectric) or by physical process (ionization), while others use both detection methods.

MICROCONTROLLER

The NXP (founded by Philips) LPC2148 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with Thumb extensions 512KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP), 32KB RAM, Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, USB 2.0 Full Speed Device Controller, Two UARTs, Two I2C serial interfaces, Two SPI serial interfaces Two 32-bit timers, Watchdog Timer, PWM unit, Real Time Clock with optional battery backup, Brown out detect circuit General purpose I/O pins.

WIFI COMMUNICATION

Wi-Fi is a technology which uses radio waves to provide network connectivity. Wi-Fi connection is provided by using a wireless adapter to create hotspots.

Areas which are in the region of a wireless router are connected to the network. Then it allows user to access internet services. Once it is connected, Wi-Fi provides connectivity to your devices by utilizing frequencies between 2.4GHZ to 5GHZ, based on data in the network.

Two types of data are communicated between robot and the control station. Control information has the higher priority because it is used to inform the robot how to act and react.

This is used to say whether it is direct movement commands through teleportation or more general commands like informing the robot of a new destination for inspection and detection.

AP Placement: While determining the position of APs in a given area, it requires minimum throughput that can support both control information and sensor information. These both should be maintained in order to have connection or communication at each and every location in the environment. This says that it requires the mobile robot to be in communication range of at least one AP. While a dense network disappeared from any area achieves this, but it is costly. So that the single-coverage Wi-Fi AP placement problem is established to determine the minimum number of APs and their locations such that each and every location in the environment can reach at least one AP. Throughput needs are specified by the application. The single-coverage Wi-Fi placement problem is NP hard and belongs to a large class of problems called as "Coverage Problems". We have implemented an algorithm which shows flow. Environment information, containing of the dimensions of a given area and a list of object locations, and a minimum throughput requirement are passed into the algorithm.2D grid-system map is then

generated that consists of object and non-object nodes, where an object node is defined as a node whose location correlates to an occupied space such as a wall. Each non-object node is considered a candidate location for AP placement.

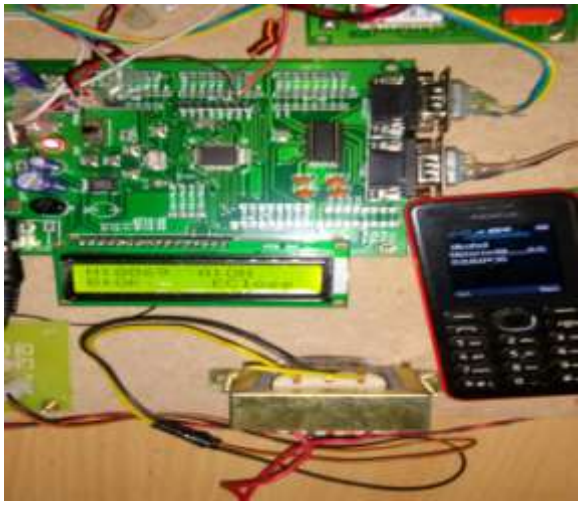
PROPOSED ALGORITHM

Algorithm for the proposed system is divided in two parts as

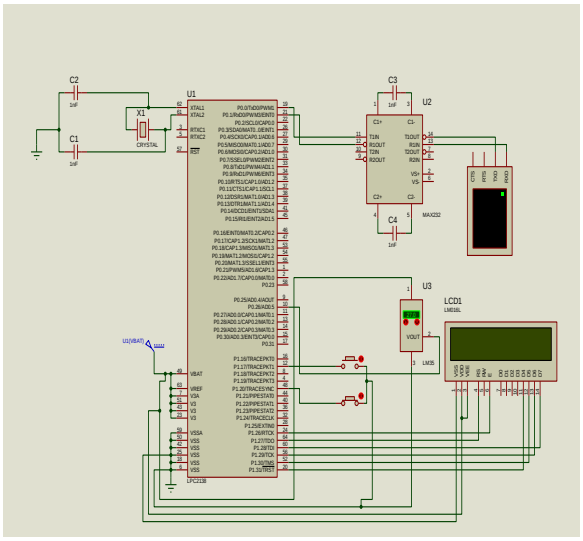
Algorithm for system contains sensors, ARM7:

1. Initialize SPI (Serial Peripheral Interface).
2. Initialize LCD.
3. Initialize GSM, GPS.
4. Initialize all sensors.
5. Display sensors current status.
6. If any sensor status changes then message is displayed on LCD.
7. Then message is sent to the industry Operators about the release of dangerous gases, alerting system on.
8. Then industry operators will choose particular actions to avoid diseases caused by toxic gases.

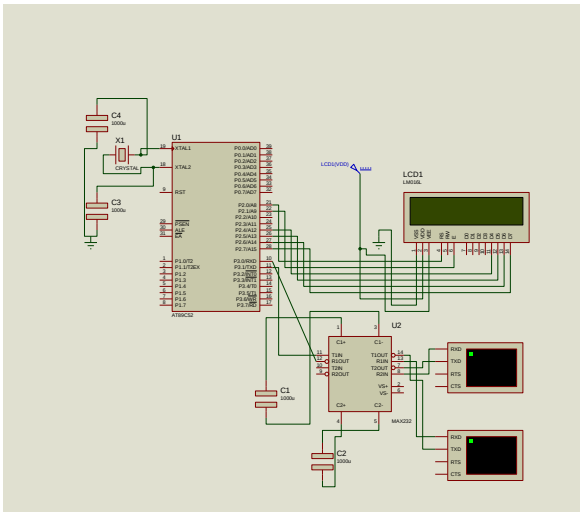
RESULTS



BASE STATION 1



BASE STATION 2



CONCLUTION

In this paper we design a robotic system which autonomously navigate in oil and gas refinery, it must be able to communicate with the control room and also localize itself. In this work we define the different kinds of communication required to develop autonomous robot. We study Wi-Fi signal propagation characteristics and apply that to determine Wi-Fi AP placement. We also assign channels to interfering APs. Wi-Fi fingerprinting based localization was

implemented that achieves a accuracy when used alone and achieves desired accuracy (less than 1m) when combined with INS and fiducially marker based approach.

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