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Under Pipe Travelling Robot to Detect Gas Line Leakage and RFID Address Navigation to Cloud Over IoT

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Abstract

Radio frequency identification (RFID) is an umbrella term for a variety of transponder systems, including active (battery powered) and passive (battery-free) tags of widely varying complexity and capabilities. This paper proposes a implementation of RFID and sensors in smart security robot navigation system. Robot movement is generally controlled by human by using a remote or mobile. Robot navigation means the robot's ability to establish its own position and orientation within the frame of reference. In order to navigate the environment, the robot or any other mobility device requires a spatial map representation of the environment and the ability to interpret that representation. The system use Radio Frequency Identification (RFID) tags as landmarks to estimate the robot position within the topological map. A topological map corresponding to the real environment is used to place the RFID tags as landmarks at important places like doors, corners etc., that guides the robot to select the next direction to go. The robot goes along the ways and turn to the left or right direction at each intersection of the hallways.

If any obstacles occurred it moves left otherwise it follows command received from tag. It can also detect metals, if any metal is detected it stops. The wireless video monitoring and recording system present on the robot for monitoring and recording in indoor. In this paper the RFID technology plays major role.

INTRODUCTION

The platform for this work is based on embedded system. An embedded system is a special-purpose system in which the computer is completely encapsulated by the device it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, so the cost savings may be multiplied by millions of items[1-5].The internet of things to uniquely identified objects and their virtual representations in an internet-like structure. In this work the main aim is to detect gas line leakage in under pipeline through internet connectivity and monitoring it daily. An embedded system is a special-purpose computer system designed to perform a dedicated function. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded system comprises of both hardware and software. Embedded system is fast growing technology in various fields like industrial automation, home appliances, automobiles, aeronautics etc. Embedded technology is implemented to perform a specified task and the programming is done using assembly language programming or embedded C.

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There are a number of technologies to monitor, control, and maintain gas, oil, water, and sewer pipelines. Most of these technologies rely on some kind of communication networks to transfer data collected from inside and outside of the pipelines to the control stations. Different network architectures have been used to provide reliable communication in pipeline systems [1], [2], [3] and attempted to support pipeline monitoring.

SYSTEM ANALYSIS

Existing System

The robot navigation methods have been suggested over the past few years. These systems come under one of the following categories: dead-reckoning-based, vision-based, landmark based and behavior-based techniques [6]. The fundamental idea behind dead-reckoning navigation systems is the integration of incremental motion over time. The dead-reckoning navigation method is based on continuous encoder readings that provide the position, orientation, and linear and angular velocities of the robot. This type of navigation is widely used due to its simplicity and ease of maintenance. However, small precision errors and sensor drifts inevitably lead to increasing cumulative errors in the robot's position and orientation, unless an independent reference is periodically used to correct the error. Given these shortcomings, researchers shifted their interest to vision-based navigation to improve the robot position estimation by tracing the visual features in the environment and using them as landmarks [7]. This measurement usually returns bearing to the visual features only, with no a priori knowledge of the landmark positions. Nevertheless, such a technique also has its own disadvantages, which include the lack of information depth, complex image processing algorithms with high computational burden, and its dependence on the working environment. Adopting behavior-based navigation systems can alleviate this problem, as they can incorporate a relatively large number of sensors, making them suitable for navigation in unstructured environments. However, relying on numerous sensors makes the system vulnerable to their drifts and cumulative errors.

B. Proposed System

In the proposed system, the robot keeps moving along the metal pipe it keeps monitoring for any gas leakage, on detection it uses an interface GPS sensor to transmit location of the leakage detected over to the IOT login system, here we use IOT gecko to receive and display the gas leakage alert and location over IOT. Thus we have a fully automated insect like robot that moves with the gas pipe and detects gas leakages instantly at a low budget. The latitude and longitude positions will be send through the internet using GPS sensor to the cloud storage. This very useful when compared to the existing system. There is a benefits in proposed system when compared to existing system.

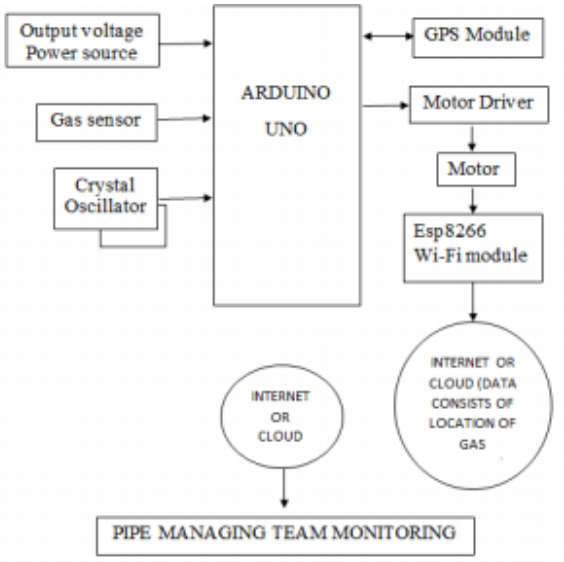

Fig.1: Proposed block diagram

WORKING PRINCIPLE

The robot is consisting of the mechanical part, a computer, a RFID reader and an antenna, and ultrasonic sensors. The mechanical part is a platform with wheels and motors which is controlled by the microcontroller. The RFID interrogator is connected to the computer via RS-232 serial port. The ultrasonic sensors are attached to the sides of the robot and used to measure the distance to walls. Since the area where tags can be detected at intersections is quite large, the robot has to use ultrasonic sensors to determine when to turn without collision to the wall as in Figure 5. And the sensors will keep robot out of collision when the hallway is not straight. The

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computer is in charge of processing the data from the RFID interrogator and ultrasonic sensors via serial ports and sending orders to the microcontroller to impact on the movement of the robot.

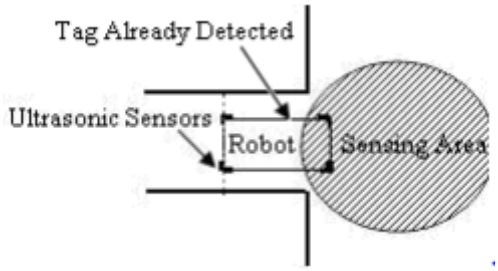

Fig.2: Robot cannot turn

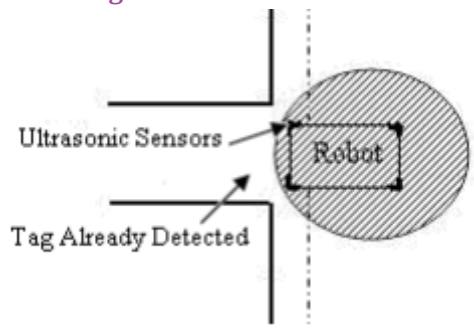

Fig.3: Robot can turn without collision

Figure 3 shows the consistent of the navigation system implemented on the computer, and figure 4 indicates the navigation process. The robot can start from a random place in the building and navigate from the place where the first tag is detected.

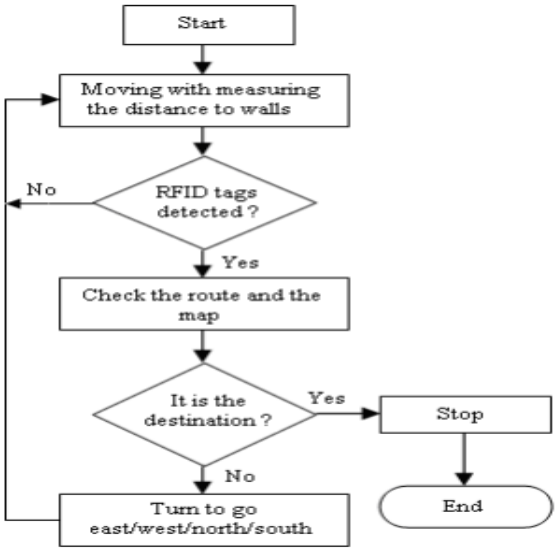

Fig.4: Flow Chart for Navigation Process

The ultrasonic sensor is activated every a few seconds to measure the distance to the wall. If a collision is predicted, the moving direction will be changed.

RESULTS

This method shows that the gas leakage of pipe is been sensed and transfers the location to cloud storage through the internet. So the axis positions, temperature values and moisture values is been noticed and viewed through the software.This process results in gas leakage is sensed and positions are been transmitted to pipe monitoring team. So it reduces the work of human process and easily monitored.

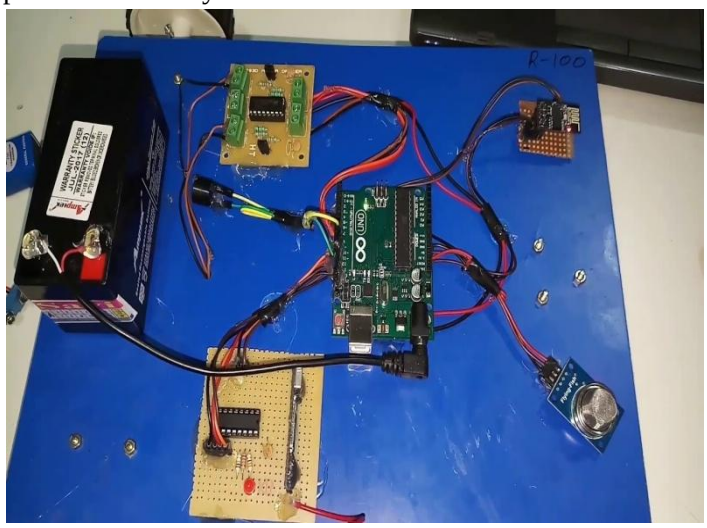

Fig.5: Typical hardware setup

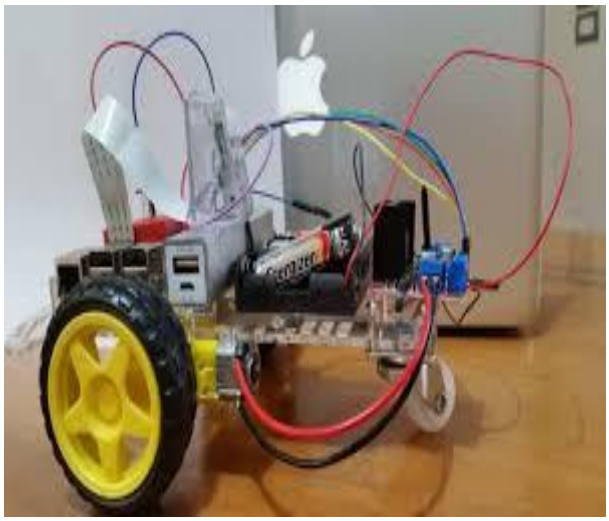

Fig.4: Applying IoTwith Android Things and sensorFlow

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CONCLUSION

The IOT technology makes the robot to move continuously and keep monitoring the pipe. If there is any leakage the kit senses it and sends the location to the pipe monitoring team. Hence the monitoring team will receive the latitude and longitude positions of axis to the cloud storage through the internet. We can improve this kit by fixing a small sized camera which can be useful for viewing the location of gas leakage.

FUTURE ENHANCEMENTS

A novel RFID based robot navigation system is proposed in this paper. This system makes the robot able to navigate around the building and records in indoor environment. The core part of the system is the RFID system and the ultrasonic sensors, which enable the robot to locate itself and move without mistakes. This also uses a topological map of the building plan, which makes the robot to proper route quickly. This paper brings a new product to the world of industry to increase speed and efficiency. This approach is a practical and feasible way to create a smart security robot with navigation function. For future extension of this paper the robot may use different materials to its designing process, based on different functional operations of it. It can May also use more no of IR sensors to avoid obstacles from different sides. And also the robot may increase RFID ranges.

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