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Under Pipe, Traveling Robot to Detect Gas Line Leakage and Address Navigation to Cloud over IoT

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ABSTRACT

The Internet of things (IOT) is the network of electronic devices, which are related to embedded systems and also other domains through the internet. The infrastructure of the kit is like a moving robot with two motors and it consists of a gas sensor to detect the gas leakages in the pipe. Gas pipes play very important roles for cities, industries and thus in growing economies. So, gas leakages lead to losses as well as are a threat because they can also lead to fire accidents. Placing sensors on each section of pipe is very costly. So here we propose an innovative robot that clings on to the outer surface of the gas pipe and moves with the pipe to check for leakages. The kit consists of MQ2 gas sensor to detect the gas leakages. The robot will be moving continuously along the metal pipe, if there any presence of leakage the GPS sensor module will transmit the location to the cloud.

Keywords: *IOT, MQ2 Sensor, GPS Module, Gas Pipes, Cloud.*

1. INTRODUCTION

The internet of things to uniquely identified objects and their virtual representations in an Internet-like structure. In this project, the main aim is to detect gas line leakage in under pipeline through internet connectivity and monitoring it daily. In the existing system, uses an LPG gas sensor to sense LPG gas when LPG gas leakage occurs. We have used an LPG gas sensor module to detect LPG Gas. When LPG gas leakage occurs, a HIGH pulse will send to the Arduino board. When the Arduino board gets a HIGH pulse from a gas sensor then it displays a message LCD display and activates the buzzer to generate the beep sound. When an LPG gas sensor gives a LOW pulse to Arduino board, then the display shows “no gas leakage” message. 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 the location of the leakage detected over to the IOT login system, here we use IOT to detect and found the location of leakage. Thus we have a fully automated insect-like a robot that moves with the gas pipe and detects gas leakages instantly at a low budget.This kit is a demo project that how is leakage is been detecting. We can also use this in industrial applications for detecting pipeline leakages with large size kit. The IOT plays a major role in this because we are going see the location in cloud storage through the internet. And also the values of temperature of the atmosphere present inside the pipeline.
The remainder of this paper is organized as follows. In Section II, the literature review is presented. In Section III block diagram is presented. The databases used for evaluation and the methodology are detailed in Section IV. The main conclusions are presented in Section VI.

2. LITERATURE SURVEY

Hinaruqsar, Chandana, Nandhini, Dr.TP Surekha, "INTERNET OF THINGS (IOT) BASED REAL TIME GAS LEAKAGE MONITORING AND CONTROLLING"

This proposed paper is aimed at developing that constantly monitors that gas leak with the help of the electronic sensors. This data

is made available real-time through real-time feeds over the internet. This data helps in easily locating the root cause of the emergency condition.

D.VishnuVarathana Reddy, N.Pushpalatha, I.Suneetha "RFID AND SENSORS IMPLEMENTATION IN SMART SECURITY ROBOT NAVIGATION SYSTEM"

This paper proposes an implementation of RFID and sensors in the smart security robot navigation system. Robot movement is generally controlled by a human by using a remote or mobile. The system uses Radio Frequency Identification (RFID) tags as landmarks to estimate the robot position within the topological map.

3. BLOCK DIAGRAM

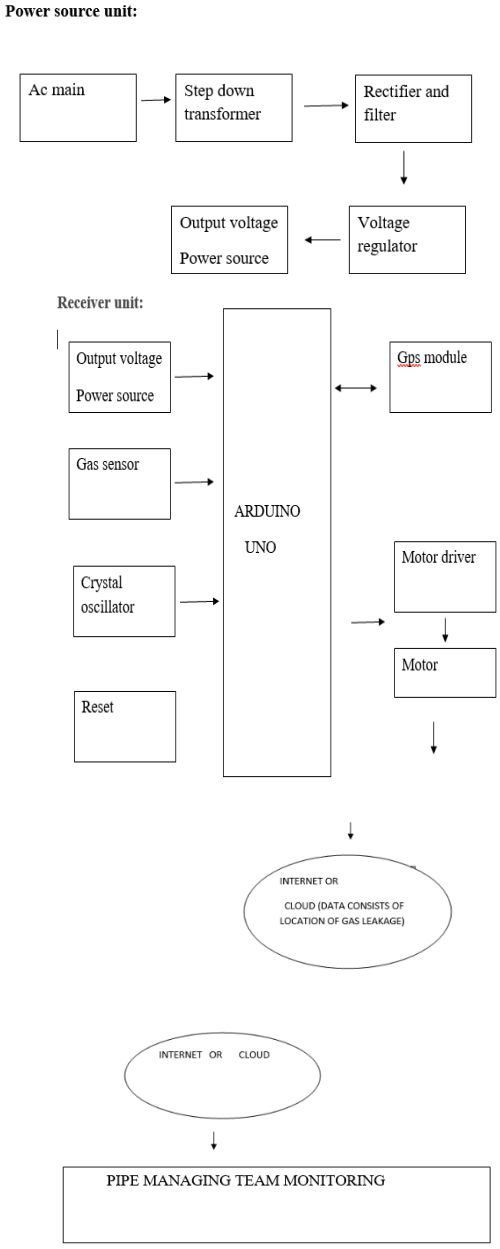

Fig.1 Block Diagram

4. SYSTEM METHODOLOGY

4.1. Power supply

LPC2148 works on 3.3V Power Supply, So LM117 a 1A low dropout regulator designed to provide 3.3V from a 5V supply.

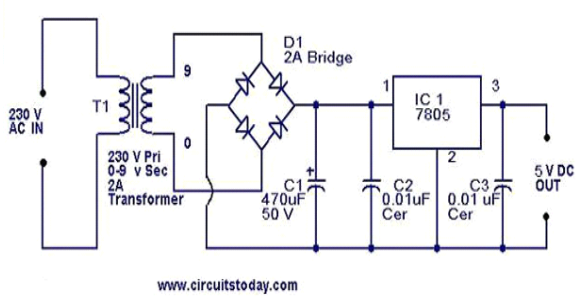

Fig.2 Circuit Diagram

It is ideally suited for systems which contain both 5V and 3.3V logic, with prime power provided from 5v A Power supply unit is assigned as follows,

- Transformer
- Rectifier
- Filter
- Regulator etc,

As shown in the block diagram below.

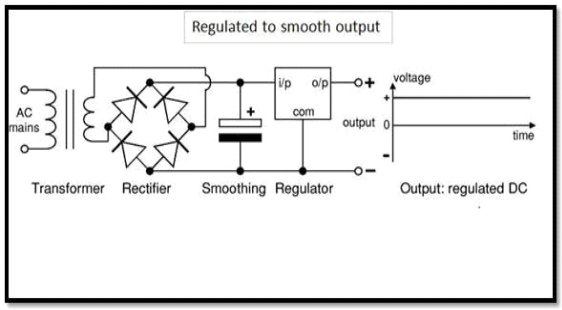

Fig.3 Circuit Diagram

4.1.1. Transformer: A transformer can be defined as a static device which helps in the transformation of electric power in one circuit to electric power of the same frequency in another circuit. The voltage can be raised or lowered in a circuit, but with a proportional increase or decrease in the current ratings. In this system, it is used to step down 230V AC to 9V AC supply and provides isolation between power grids and circuit.

4.1.2. Rectifier: Rectifier is a device which converts alternating current (AC) into direct current (DC).

4.1.3. Filter: The output from the rectifier is pulsating D.C. These pulsations are due to the presence of A.C. component in the rectifier output. The filter circuit removes the A.C. component so that steady D.C. voltage is obtained across the load.

4.1.4. Regulator: Regulator is a device used to regulate the voltage (i.e) if the DC current from the power supply is 12v means, it will decrease the voltage into 5v and passes it to the Arduino board. The output of ordinary power supply is fed to the voltage regulator which produces the final output. The output voltage remains constant and gives continuously power to the board.

4.2. Gas sensor

The gas sensor is a device which is used to sense the presence of gas in the atmosphere. In this, we are using MQ-2 gas sensor. This sensor module is useful for gas leakage detection. It is can also be used for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by the potentiometer.

There are four kinds of gas sensors. There are MQ2, MQ3, MQ5, MQ9. These MQ series of gas sensors consists of the small heater inside and an electrochemical sensor. They are sensitive to a range of gasses and are used indoors at room temperature. The output will be an analog signal and it can be read from an analog input of the Arduino controller.

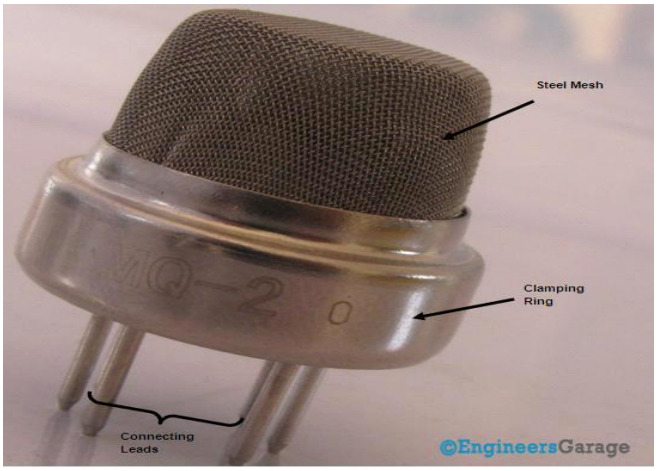

Fig.4 Gas Sensor

Features

- The Power supply needs 5v.
- Analog will be an interface.
- Pin definition: 1 output, 2 GND, 3 VCC.
    - threshold.

4.3. Arduino

It is open source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the C and C++ programming languages.

4.3.1. Arduino Microcontroller

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software [2]. The Arduino microcontroller is essential to the design of the SRC as it provides communication between the voice recognition components and the graphical user interface (GUI). The 8 bit data bus provides communication between the microprocessor and the HM2007.

After Arduino microprocessor reads the 8 bit data bus, the programmed microcontroller will decode and manipulated the 8 bit signals. After processing the 8 bit signals, the Arduino microcontroller sends the ASCII equivalent of the spoken word or phrase through a USB connection to the GUI. The GUI is written in the *Processing* language, which is based on Java. The details of the software used to program the Arduino microcontroller and the GUI will be discussed in later sections.

4.3.2. Software

The Arduino microcontroller is programmed with Arduino proprietary complier. The complier is based on the C programming language. Included with the complier is Arduino propriety libraries which allow the programmer to access to the external pins of the microcontroller. Arduino complier has two reserved functions. These two functions are named setup( ) and loop( ). The function, called setup ( ), is always executed when the Arduino microcontroller is initialized. The loop( ) function is continually evaluated while the Arduino microcontroller is running immediately after the setup( ) function.

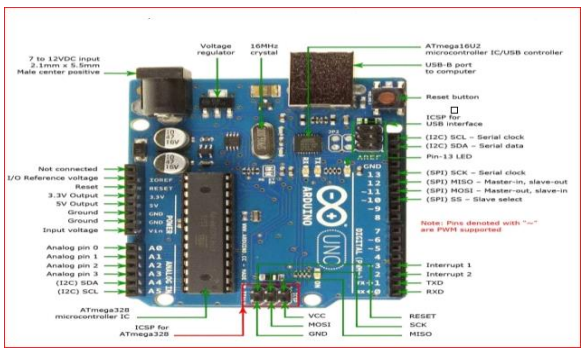

Fig.5 Arduino Board

4.3.3. Basic Algorithm

Within the setup( ) function, the eight pins on the microcontroller are establish as inputs. This allows the eight pins to sense digital logic levels transmitted by the voice recognition components. This setup function also establishes the data rate at which the serial bus will be transmitted or received data. The serial bus is the communication link between the microcontroller and the graphical user interface. Therefore, any data written on to the serial bus by the microcontroller will be read by the graphical user interface and vice versa. The loop( ) function will handle all the decoding of data from the voice recognition components and transmissions of data to the graphical user interface. This function will begin by reading the eight pins on the microcontroller. Since the value held on eight pins correspond to a specific phrase or word stored in the SRAM, the loop( ) function

4.4. GPS module

The SKG13BL is a complete GPS engine module that features super sensitivity, ultra low power, and small form factor. The GPS signal is applied to the antenna input module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

It is based on the high-performance features of the Media Tek MT3337 single-chip architecture, Its –165dBm tracking sensitivity extends positioning coverage into places like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into a portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

4.4.1. Features

- Ultra high sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built-in 12 multi-tone active interference canceller
- Low power consumption: Typical 22mA@3.3V
- ±10ns high accuracy time pulse (1PPS)
- NMEA Output: GGA, GSA, GSV, RMC
- Advanced Features: Always Locate; AIC
- QZSS,SBAS(WAAS,EGNOS,MSAS,GAGAN)
- UART interface: 4800/9600/38400/115200 bps
- Small form factor: 15x13x2.2mm
- RoHS compliant (Lead-free)

4.4.2. Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

Fig.6 GPS Module

4.5. DC motor

A DC motor is a motor which used to convert electrical power into mechanical power. Most often, this type of motor relies on forces that magnetic fields produce. Regardless of the type, DC motors have some kind of internal mechanism, which is electronic or electromechanical. In both cases, the direction of current flow in part of the motor is changed periodically.

Fig.7 DC Motor

A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications. In this project, we are using the 12V DC motor. And this motor will be connected to the motor driver to run the robot.

5. CONCLUSION

This methodology tells that the robot will move continuously in the pipe and if there is any leakage, it will detect and send that location's latitude and longitude position of the certain axis. And also it senses the moisture level, temperature level value of the gas.

6. ACKNOWLEDGMENT

We express our sincere thankfulness to our Project Guide Mr. S.VENKAT for his successful guidance to our project. Without the help, it would be a tough job for us to accomplish this task. We thank our guide for his consistent guidance, encouragement, and motivation throughout our period of work. We also thank our Head of the Department (ECE) Mrs. S.JEYA ANUSUYA for providing us all the necessary facilities and constant motivation.

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