Automation in LPG Cylinder Monitoring System

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*Abstract-*The image processing is used to detect, recognize and calculate the number of objects. The proposal of this system is to develop the electronic solution using the image processing technique to reduce human error and also human efforts. In this solution we are going to target problems relevant to LPG like leakage of LPG gas. For counting the number of cylinders in godown, camera will capture the image of cylinders from top side. Using image processing, the number of particular size circles (uppermost circle of cylinder) will detect and from the number of circles, we will get the number of cylinder count. The LPG gas may lead to explosion and suffocation also. Using gas sensor which detects the leakage of LPG and the message of alertness through Arduino will give on the LCD display as well as the buzzer will turn on.

*Keywords-*Raspberry-pi,Arduino,LCD,Raspberry-pi-camera.

I. INTRODUCTION

LPG, first produced in 1910 by Dr. Walter Snelling is a mixture of Commercial Propane and Butane having saturated as well as unsaturated hydrocarbons. We are using LPG gas cylinder in every sector of our life. Since we are busy, we cannot monitor our cylinder continuously.

If LPG starts leaking from the cylinder it can cause huge destruction and various accidents. So, to be safe from such situations we are going to design this project. Our project basically prevents us from such disasters as well as we will implement some extra additional thing so that it will helpful to monitor the LPG.

As we have seen in all godowns they count the cylinders individually. So, sometimes there will be a chance to get wrong count of cylinders. So, to overcome this we will design one system by using image processing so that we will give the correct count of all cylinders and also, we will design gas leakage detector for the security purpose.

Because of the versatile nature of LPG it is used for many needs such as domestic fuel, automobile fuel, heating illumination etc and the demand for LPG is on exponential raise day by day. The leaked gases when ignited may lead to serve explosion. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. Thus, there is a need for a system to detect and also prevent leakage of LPG.

Poisonous gases are one that causes serious environment pollution. Polluted air acts as serious aspects as the soil and water pollution can be detected visually and by taste but polluted air cannot be detected as it can be odourless, tasteless and colourless. The poisonous gases cause serious health impacts so they have to be monitored. The liquefied petroleum gas and natural gas burn to produce clean energy. However, there is a serious threat about their leakage. The gases may lead to suffocation and may lead to explosion. However, there are still some short comings on real time monitoring and on data transmission and accurate location of leakage point when accident happens. Object counting is a very common task performed in different industries. Figuring out how many objects in an image is required in image analysis. Object counting is used to get certain number of elements from images.

These elements act as a source of information for quantitative analysis, motion tracking and qualitative analysis. The conventional method for object counting is manual, time consuming and in non-automatic form. Continuous counting leads to eye fatigue and affects the accuracy of results. However, the process of counting objects is not always straightforward or trivial, even performed manually.

Most counting methods have peculiarities that make them tricky to tackle. Because automatic counting is objective, reliable and reproducible, comparison of cell number between specimens is considerably more accurate with automatic programs than with manual counting. While a user normally gets a different result in each measurement when counting manually, automatic programs obtain consistently a unique value.

Object counting is also needed in some other research fields where objects cannot be segregated by naked eye and the factors 'time' and 'accuracy' matter.

It becomes challenging when different objects are not easily distinguishable, vary in size and surrounded by noisy background. It is important to notice the variety of objects being counted as the accuracy of development algorithm is dependent on the same. Currently, there is lot of research is being made on object counting.

These problems can be solved with the help of the developing embedded systems using wireless sensor network. It can give the correct count of LPG cylinders and display on the screen by image processing. It can give real time detection of potential risk area, collect the data of leak accident and locate leakage point. The system is affordable and can be easily implement in the chemical industries or plans, to avoid threat to human lives.

II. LITERATURE REVIEW

In the year 2011, A. Mahalingam, R. T. Naayagi,1, N. E. Mastorakis, "Design and Implementation of an Economic Gas Leakage Detector", This project developed system to detect the gas leakage and providing immediate alarm or intimation to the user.

Later in 2013, few people developed the design proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by buzzer. This project was developed using microcontroller ARM version 7 processor and simulated using Keil software.

In the year 2014, Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare, designed a system, They provided security issues against thieves, leakage and fire accidents. In those cases their system sends SMS to the emergency number provided to it.

Xiaomin Guo and Feihong Yu introduced a method of automatic cell counting based on microscopic images [2]. Histogram information is used to calculate adjustable lower and upper threshold value. This value is used for segmentation of objects and background. Effect of Floodfill method fills the objects region. It is used to mark or separate regions in an image. A blob is an area of touching pixels with the same logical state. All pixels in an image that belong to a blob are in a foreground state.

All other pixels are in a background state. Blob analysis is used to detect blobs in an image and make selected measurements of those blobs. Blob analysis consists of a series of processing operations and analysis functions that produce information about any 2D shape in an image. If size of a blob is beyond the upper threshold of area, the blob will be segmented by K-means clustering algorithm. By calculating the number of cells contained in each blob obtains the total number of cells in whole image. The result shows that maximum relative error is 1.33%, minimum relative error is 0% and the average relative error is 0.46%.

Carlos A. B. Mello et al. presented two methods for mosquito eggs counting. These methods are based on a different color model [9]. In the first method, RGB image is converted into HSL color model (Hue, saturation, Lightness). From these three components, the hue image is extracted as it contains information about color tone.

Huang thresholding algorithm is applied to the hue image for binarization. A connected components algorithm is used to label the connected regions of the image. Filtering is done using morphological opening operation with structuring element defined in the form of egg. At the last step, it is considered that egg occupies area of 170 pixels.

The number of eggs is calculated by dividing the total amount of white pixels by this average area. The second method is based on converting RGB sub-image to YIQ one. From these components, I band is segmented in two ways: by using laminarization with fix threshold of 200 and by binarization using k-means clustering method. For performing egg counting in this method, it is considered that the average size of mosquito egg is 220 pixels.

III. SYSTEM ARCHITECTURE

1. Objectives of Developed Work:
- To build a low cost "LPG Cylinder Monitoring System".
- To build a system with all the parameters like image processing, gas sensing and circle detection.
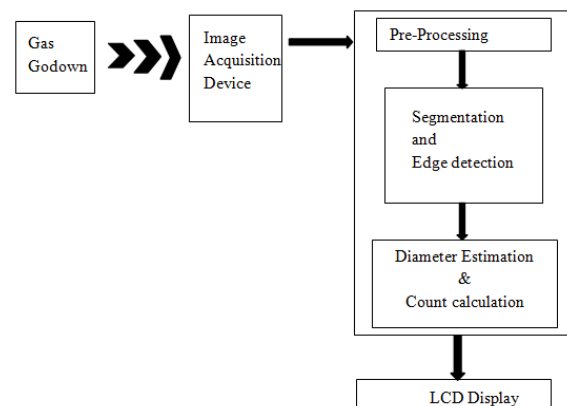- To provide a user friendly system.

2. Block Diagram:

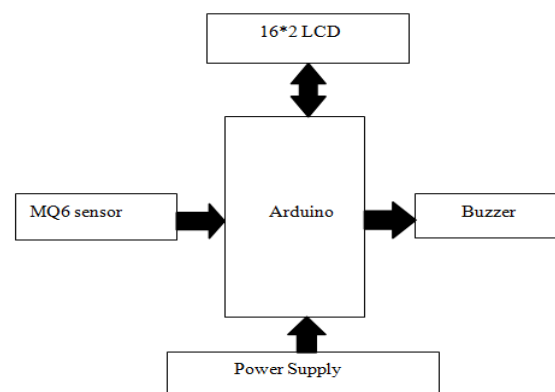Fig 1. Block Diagram of Cylinder Counting Using Image Processing.

Fig 2. Block Diagram of LPG Leakage Detection System.

3. Description of Hardware Components:

3.1 Raspberry pi camera V2:

The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library.

Fig 3.Raspberry Pi.

3.1.1 Hardware Specifications:
- Resolution- 5 Megapixels
- Video modes- 1080p30,720p60
- Sensor- omni–Vision OV5647
- Sensor resolution- 2592*1944 pixels

3.1.2 Applications:
- CCTV security camera
- Motion detection
- Time lapse photography

3.2 Pi 3 Model B+

Fig 4. Raspberry Pi 3 Model B+.

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries. It is widely used in many areas, such as for weather monitoring, because of its low cost, modularity, and open design.It is typically used by computer and electronic hobbyists, due to its adoption of HDMI and USB devices.

3.2.1 Hardware Specifications:
- Microprocessor- Broadcom BCM2837 64bit Quad Core Processor
- Processor Operating Voltage- 3.3V
- Raw Voltage Input- 5V, 2A power source
- Internal RAM- 1Gbytes DDR2

3.2.2 Applications:
- IoT applications
- Robotics
- Industrial/Home automation

3.3 MQ6 Gas Sensor:

Fig 5.MQ6 Gas Sensor.

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals. They may be used in firefighting.

3.3.1 Hardware Specifications:
- High sensitivity to LPG, butane, propane iso-
- Fast response time <10s
- Simple drive circuit
- Heater voltage- 5.0V

3.3.2 Applications:
- Gas leak detection system
- Fire/Safety detection system
- Gas leak alarm
- Gas detector

3.4 Arduino Uno ATmega328P:

Fig 6. Arduino Uno.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog input pins, a 16MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with an AC- to-DC adapter or battery to get started. It is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

3.4.1 Hardware Specifications:
- Operating Voltage- 5V
- Input Voltage- 7V to 12V
- Digital Input/Output pins- 14
- Analog input/output pins- 6
- Flash memory- 32KB
- SRAM- 2 KB
- CLK speed- 16MHz

3.4.2 Applications:
- Usage in Internet of Things
- For making security devices
- For making drones
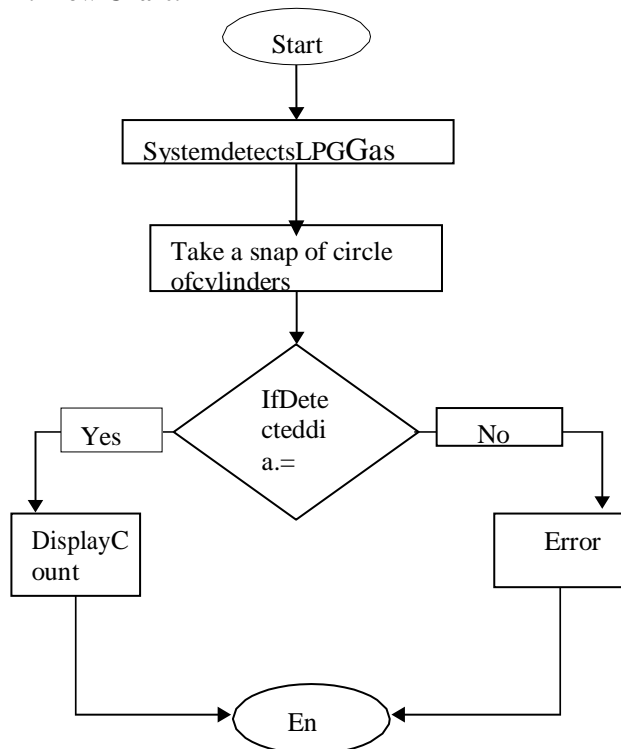- For making Line Follower Robot

4. Flow Chart:

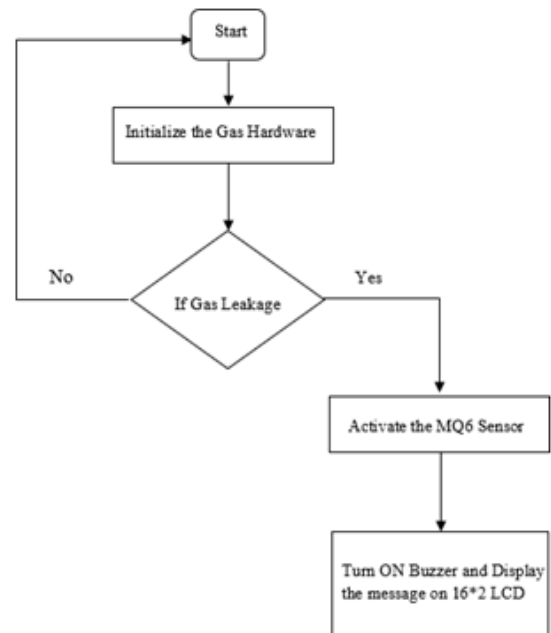Fig 7. Flow Chart of LPG CylinderCounting System.

Fig 8. Flow Chart of LPG Leakage Detection.

The above flow chart shows the working flow of this developed system & the detailed information about these steps is given below in the methodology of this system.

IV. RESULT

- In this project, we have successfully implemented LPG cylinder monitoring system using image processing. This project gives us accurate count of LPG cylinders.
- And also protect from the gas leakage problem.
- Our implemented module is more reliable and flexible in order to control any load. Hence this project can be useful for real time.
- Object counting using image processing has huge applications where automation is to be introduced and time of counting is to be reduced.
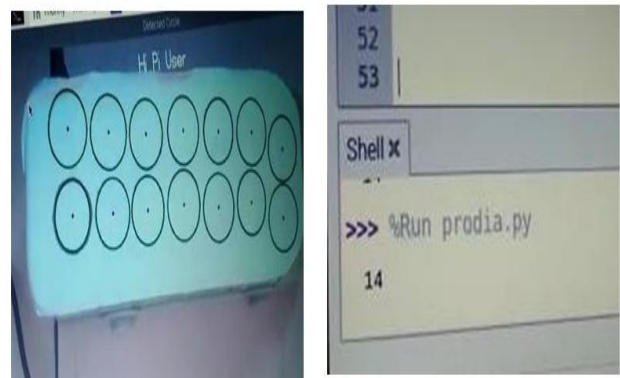- This system gives us awareness of leakage of gas in industries, Home, Hospitals.

Fig 9. Detection of cylinders and counting of cylinders.

Before Gas leakage DetectionAfter Gas leakage Detection
Fig 10. Gas Leakage Detection System.

V. CONCLUSION & FUTURE SCOPE

Automation in LPG cylinder monitoring system has been successfully developed and through this project we have gained much experience especially in the field of image processing and also in programming of the microcontroller.

This project can be used to detect the leakage of LPG. We can easily get the accurate number of cylinders present in the vehicle by image processing. The accuracy of the algorithm depends on camera used, size of objects, whether or not objects touching and illumination conditions.

So, adding all this advantages we concluded that we can overcome the human error and this system helps us to avoid any accident related to LPG cylinder. The further designing will be using GSM module. By this it will alerts the required person.

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