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Practical Implementation of Real-time Sensing of Sensor Values using Android Application-1

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Abstract: We can smell, taste, feel, hear and see the gifts of nature but we have always had that curiosity or a strong desire to measure those senses in a more systematic manner and record those values/store those values. Sound from a speaker is loud- This is the reading given by our ears which is one of the five sense organs, but we would like to measure it in terms of units like decibels dB, frequency Hz etc… This is necessary for systematic analysis. For this we need a sensor that is sensitive to the real time processes and their outcome, a processing unit, connectivity elements and output display/elucidation unit. In this paper we carry out real time measurements of %vol of vapour of a volatile liquid (Alcohol), Leakage of hazardous gasses like LPG, Climate-Humidity and temperature and the distance between the source and the obstacle using ultrasonic sensors. All these real time sensor data is monitored wirelessly using a third party developed Android application and installed into an Android OS powered Smartphone and stored into the internal or SD card memory (external memory) of the Smartphone. We have designed an android application named "Sense_graph" which can wirelessly record and monitor real time values. In this paper we also mention the key considerations in sensor selection and operation, they are Accuracy and Resolution, Precision, Sensitivity, Reliability, Response time, Practicality and Cost.

Keywords: Leakage of hazardous gasses like LPG, Climate-Humidity and temperature, ultrasonic sensors, Accuracy and Resolution, Precision, Sensitivity, Reliability, Response time, Practicality and Cost.

I. INTRODUCTION

In this paper we are reading and recording the real time values of the following category of elements or parameters

- Volatile liquid in %vol
- Leakage of hazardous gases like LPG in ppm
- Climatic conditions (Humidity in % and Temperature in ^{o}C)
- Distance between source and obstacle using ultrasonics in cm.

Sensor is the input unit. In this paper we have used alcohol sensor (MQ3) for sensing the vapour of the volatile liquid-alcohol, LPG gas sensor (MQ5), Humidity and temperature sensor and ultrasonic sensors for range/ distance measurement.

Figure 1 shows the block diagram of sensing and monitoring process.

The key considerations of a sensor are

- **Accuracy and Resolution**- A useful sensor provides measurement at an appropriate accuracy. The accuracy of the sensor is the maximum difference that will exist between the actual value and the indicated value at the output of the sensor. Resolution of a sensor is the smallest change it can detect in the quantity that it is measuring.
- **Precision**- Precision is the probability of obtaining the same value with repeated measurements on the same system.
- **Sensitivity**- Sensitivity is defined as he ratio between the sensor output ΔS and the given change in the measured variable Δm. Sensitivity S=ΔS/Δm. If the critical control parameter value changes, it is important that the sensor responds to such a change.
- **Response time**- Response time is defined as the time required for a sensor output to change from previous state to a final settled value within a tolerance band of the correct new value. The dynamic sensor characteristics are important as the sensor must respond significantly faster than the process.
- **Cost**- The sensor used must be economical according to the application.

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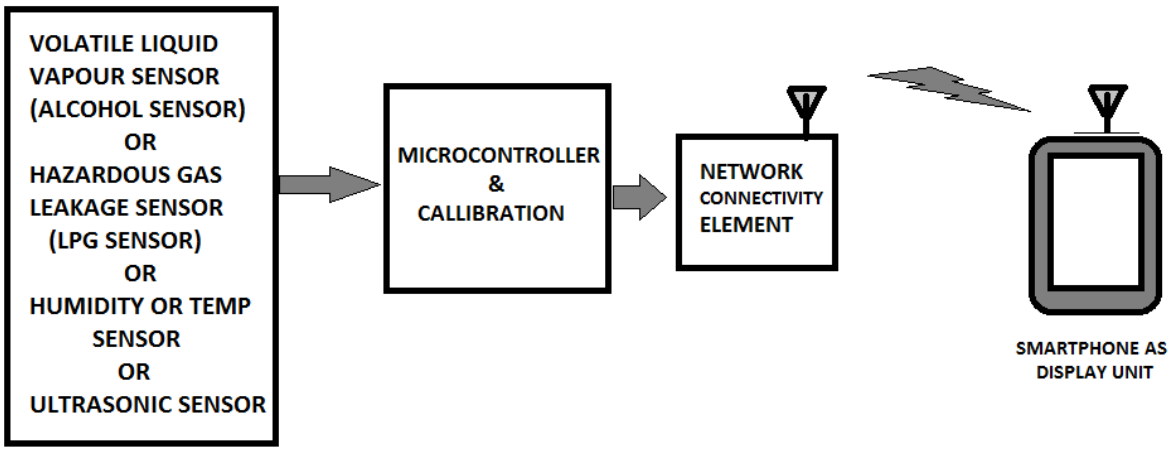

Figure 1 shows the block diagram of sensing and monitoring process.

II. VAPOUR OF VOLATILE LIQUID (ALCOHOL IN %VOL)

Volatility is the tendency of a substance to vaporize. Volatility is directly related to substance's vapour pressure. At a given room temperature, a substance with higher vapour pressure vaporizes more readily than a substance with a lower vapour pressure. Ethanol also called ethyl alcohol or simply alcohol is a volatile, colourless liquid. In the case of alcohol or any other volatile liquid, liquid particles will escape the surface and vaporize the air above the liquid. MQ3 sensor is used to measure the concentration of alcohol in %vol. Figure 2 shows the readings when MQ3 sensor was exposed to the vapours of alcohol.

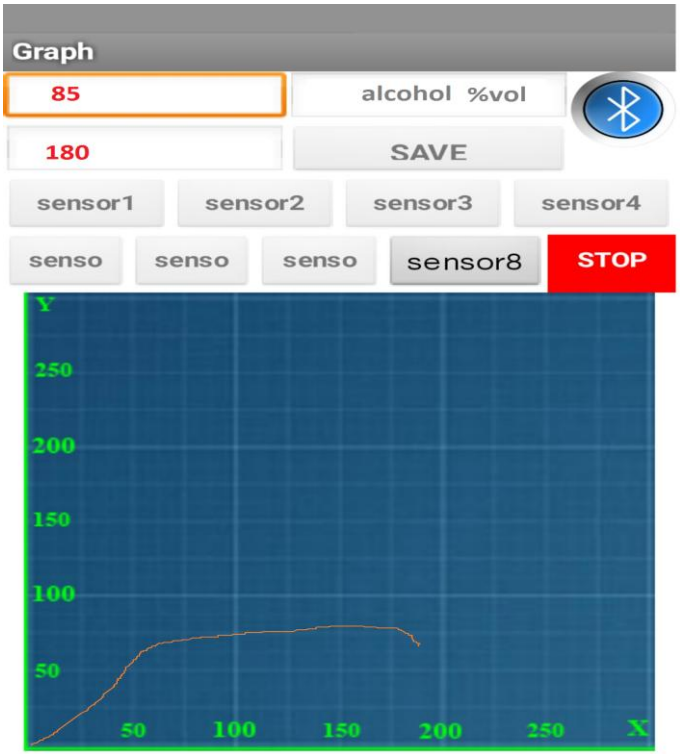

Figure 2 shows the readings when MQ3 sensor was exposed to the vapors of alcohol.

III.LPG GAS DETECTION

LPG (Liquid Petroleum Gas) is also called propane or butane. It is highly inflammable and can lead to domestic or industrial hazards. As its boiling point is below room temperature, LPG will evaporate quickly at normal temperature and pressure and is usually supplied in pressurised steel vessels. MQ5 sensor is used to detect the leakage of LPG and is immediately brought to notice. Figure 3 shows the readings of MQ5 sensor using android application "sense_graph".

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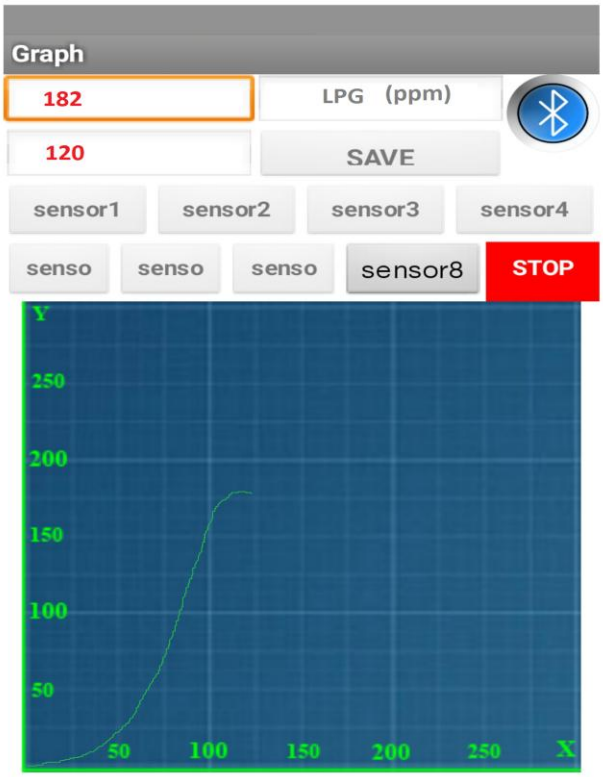

Figure 3 shows the readings of MQ5 sensor using android application.

IV. CLIMATE/WEATHER – TEMPERATURE AND HUMIDITY, DISTANCE MEASUREMENT USING ULTRASONICS

Climate is the weather conditions prevailing in an area over a long period of time. Daily or hourly updates are given by various sources like news, media, sensors etc. Temperature and Humidity are the major parameters to be measured in a given area and altitude. Temperature is measured in ^{o}C, ^{o}F or Kelvin.

$$1^{o}C = 274.15K = 33.8^{o}F.$$

The difference between weather and climate is a measure of time. Weather is what conditions of the atmosphere are over a short period of time. Figure 4 shows the values of temperature recorded in a certain region in ^{o}C at a particular interval of time.

Humidity refers to the presence of water vapour in the atmosphere. It is measured either in relative terms or absolute terms. At any given temperature and pressure, air can hold only certain amount of water vapour. A 100% relative humidity means that the air is saturated and 0% would indicate no water vapour is present. Figure 5 shows the values of humidity recorded in a certain region in % at a particular interval of time.

Ultrasonics are vibrations of frequencies greater than the upper limit of the audible range for humans i.e.; greater than 20kHz. The audible range in humans is 20Hz to 20kHz. The frequencies below 20Hz is called infrasonic waves. Ultrasonic waves can be used to measure the range of an object from the source. The time taken for the ultrasonic wave emitted by the source, and reflected by the object away from the source and back to the receiver at the source is calculated and the distance between the source and the target object is framed. It may be in cm or mm or km. An output of an ultrasonic sensor is read and displayed using android application in figure 6.

V. CONCLUSIONS

In this paper Real-time readings from the sensors were obtained and displayed on the smartphone using the Android Application developed by us. MQ3 sensor was used to measure the concentration of alcohol in % vol. MQ5 sensor was used to detect the leakage of LPG which is highly inflammable and can cause domestic and industrial hazards. Temperature in ^{o}C and Humidity in percentage. The range of object from the source in cm or m was also measured using ultrasonic sensors. In the next paper, gases which are Hazardous to the environment like CO, CO_2 and SO_2 will be measured. We will be doing pressure sensing and distance/range detection using IR sensors.

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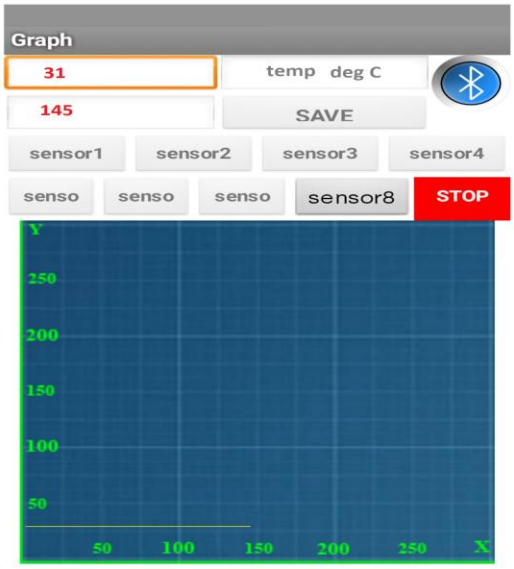

Figure 4 shows the values of temperature recorded in a certain region in °C at a particular interval of time.

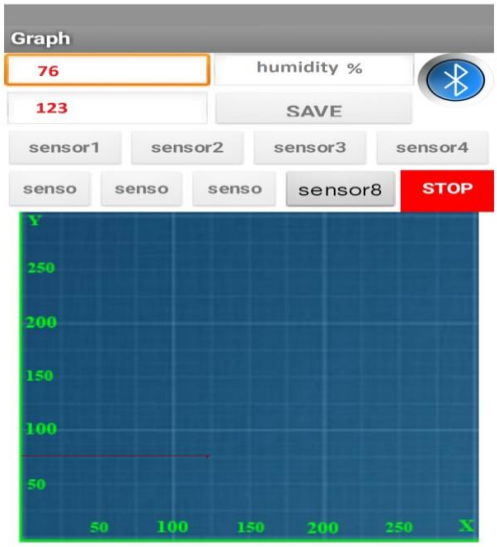

Figure 5 shows the values of humidity recorded in a certain region in % at a particular interval of time.

Figure 6 shows the values of Ultrasonic sensors.

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