International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2020): 7.803

Gas Leakage and Detection System

Dr Sreeja Mole S S

Professor and HOD, Department of ECE, Christu Jyothi Institute of Technology and Science, Janagon, India
sreebommy[at]gmail.com

Abstract: ***Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time.***

Keywords: Gas cylinders, explosion, leakage, sensor, liquid petroleum, stepper motor

1. Introduction

The objective of this paper is to detect any leakage of LPG/CNG based cars, small scale factories or in home appliances also. It will detect the leakage and will close the knob of the system to stop the supply of the gas. Stepper motor is there that could be attached with the knob and will close the supply by rotating it. For assistance and LCD of 16x2 is also there. An alarm is there also the stop the alert the user as soon as leakage is found. Gas sensors are employed in a wide range of applications in the fields of safety, health, instrumentation etc... Common examples are domestic/commercial alarms for explosive or toxic gases, or in automotive application as gas leakage detectors for LPG powered cars and exhausts detectors inside any fuel powered truck/car. Such sensors, nowadays, are found also in applications involving air quality control systems and pollution monitoring. Today's sensors, while featuring a high sensitivity to a wide gases variety, are very compact in size and have significantly reduced their power consumption to better adapt to portable solutions.

LPG consists of mixture of gases like propane and butane. These gases can catch fire easily. LPG is used as propellant, fuel and as a refrigerant. When a leak occurs, the leaked gases may lead to explosion. The number of deaths occurring due to explosion of gas cylinders has increased. So the leakage should be controlled to protect people from danger. Bhopal gas tragedy is an example for accidents due to gas leakage. Gas leakage detection is not only important but controlling the leakage is also important. Liquid petroleum gas is generally used in houses and industries. In homes, LPG is used mainly for cooking purpose. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG leaks can happen, though rarely, inside a home, commercial premises or in gas powered vehicles. Leakage of this gas can be dangerous as it enhances the risk of explosion. An odorant such as ethanol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. In such cases, a gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. A number of research papers have been published on gas leakage detection techniques. In this project, advanced gas leakage detection technology is used. Building a system with a gas sensor is not as easy as it could appear. Despite the sensor could be treated, basically, as a variable resistor (which value depends on gas concentration in air) the practical implementation in a project should be done considering some design rules, especially if the final circuit is a device to be used in a field where reliability is strongly required (e.g. safety). As an example the internal elements of a sensor (heater and gas sensitive resistors) have to be constantly kept under control to avoid failures leading to a wrong alarm indication; furthermore, if the application needs to achieve a good measurement accuracy, factors like environment temperature, sensor life etc have to be taken into account. All those features and controls require introducing in the project a certain amount of external circuitry (including components like comparators, temperature sensor, spare logic etc. This project aims to show how a microcontroller can be employed to replace a lot of external components while adding extra functionalities at a cost comparable as a simple integrated comparator. In the prototype that we are going to present, the hardware and microprocessor firmware have been optimized to implement a smart LPG gas alarm (LPG stands for Liquefied Petroleum Gas) for cars running on LPG/CNG so that it can raise alarm before any fatal incident happens.

2. Methodology

LPG consists of mixture of gases like propane and butane. These gases can catch fire easily. LPG is used as propellant, fuel and as a refrigerant. When a leak occurs, the leaked gases may lead to explosion. The number of deaths occurring due to explosion of gas cylinders has increased. So the leakage should be controlled to protect people from danger. Bhopal gas tragedy is an example for accidents due to gas leakage. Gas leakage detection is not only important but controlling the leakage is also important. Liquid petroleum gas is generally used in houses and industries. In homes, LPG is used mainly for cooking purpose. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG leaks can happen, though rarely, inside a home, commercial premises or in gas powered vehicles. Leakage of this gas can be dangerous as it enhances the risk of explosion. An

Licensed Under Creative Commons Attribution CC BY

odorant such as ethanol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. In such cases, a gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. Meenakshi Vidya et.al. proposed the leakage detection and real time gas monitoring system. In this system, the gas leakage is detected and controlled by means of exhaust fan. The level of LPG in cylinder is also continuously monitored. K.Padmapriya et.al.. proposed the design of wireless LPG monitoring system. In this project, the user is alerted about the gas leakage through SMS and the power supply is turned off. Selvapriya et.al. proposed the system in which the leakage is detected by the gas sensor and produce the results in the audio and visual forms. It provides a design approach on software as well as hardware. L.K.Hema et.al.. proposed the smart sensor technology. In this flexible reliable smart gas detection system is developed. In this, the leakage is detected and controlled by using exhaust fan. B. D. Jolhe et.al.. In the existing method, different gas sensing technology is used. The LPG gas leakage is detected by the semiconductor sensor. Nowadays LPG accidents occur very common. The main reason of these accidents is due to the leakage of LPG. This leakage of LPG starts when we forget to close the main regulator valve. This is the basis of these kinds of accidents. Already there are some sorts of remedial measures such as when the leakage is detected, alert message International Journal of Engineering Research & Technology (IJERT) ISSN: 22780181 Published by, www.ijert.org NCACS-2015 Conference Proceedings Volume 3, Issue 15 Special Issue - 2015 1 is sent to the fire station and the owner. The other remedial measure is that when the leakage is detected, exhaust fan is switched on. The first mentioned method has the disadvantage that there is no control action taken, it needs a manual controlling which puts human into direct risk. The second method has the disadvantage that if the wiring of the exhaust fan is not proper then it will cause immediate explosion due to the flow of AC. In all these mentioned method above, there is only detection no control action is taken. Another method is also been employed which involves detecting as well as controlling of the LPG leakage. This process starts when the gas leakage occurs; the gas sensor senses it and gives an output to the micro controller. The micro controller used here is AT89C51 which converts this output into digital format and sends it to the GSM module, RF link, liquid crystal display(LCD) and to the motor driver. The GSM module sends an alert message to the user(s) and also to the fire station to alert them. The RF link is responsible for producing the alarm to alert the neighbours in case of absence of the user at home where as the LCD displays the warning message. For the controlling purpose, stepper motors driven by motor drivers are used which closes the main power supply and the cylinder's valve to stop the flow of current and LPG gas.

The proposed system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle driven by stepper motor for closing the valve. The closing of the cylinder knob stops the flow of gas and prevents fire outbreak. We are increasing the security for human by using the combination of a relay and the stepper motor which will shut down the electric power of the house. Also by using a GSM module, we are sending an alert message i.e., SMS (Short messaging services) to warn the users about the LPG leakage and a buzzer is provided for alerting the neighbours in case of the absence of the users about the LPG leakage. The aim of this system is to reduce the probability of explosion due to gas leakage. The main advantage of this system over the manual method is that, it does all the process automatically and has a quick response time. The block diagram of the system is shown in Figure 1

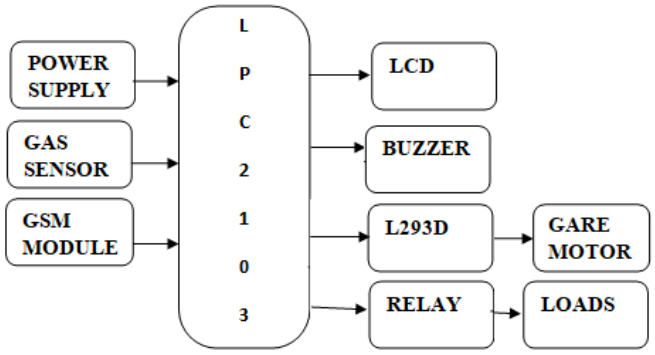

Figure. 1 Block Diagram

The LPC2101/02/03 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation that combines the microcontroller with 8 KB, 16 KB, or 32 KB of embedded high speed flash memory. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical performance in interrupt service routines and DSP algorithms, this increases performance up to 30 % over the Thumb mode. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2101/02/03 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces, ranging from multiple UARTS, SPI, and SSP to two I2Cs, and on-chip SRAM of 2 KB/4 KB/8 KB make these devices very well suited for communication gateways and protocol converters. The superior performance also makes these devices suitable as math coprocessors. Various 32-bit and 16-bit timers, an improved 10-bit ADC, PWM features through output match on all timers, and 32 fast GPIO lines with up to 13 edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems. The VIC accepts all of the interrupt request inputs and categorizes them as FIQ, vectored IRQ, and non-vectored IRQ as defined by programmable settings. The programmable assignment scheme means that priorities of interrupts from the various peripherals can be dynamically assigned and adjusted. In addition, the CPU interrupt vectors may be re-mapped to allow them to reside in either flash memory (the default) or on-chip static RAM.

The LPC2101/2102/2103 incorporates a 8 KB, 16 KB or 32 KB flash memory system respectively. This memory may be used for both code and data storage. Programming of the flash memory may be accomplished in several ways. It may be programmed In System via the serial port. The application program may also erase and/or program the flash while the application is running, allowing a great degree of

Licensed Under Creative Commons Attribution CC BY

flexibility for data storage field firmware upgrades, etc. The entire flash memory is available for user code as the boot loader. In Power-down mode, the oscillator is shut down and the chip receives no internal clocks. The processor state and registers, peripheral registers, and internal SRAM values are preserved throughout Power-down mode and the logic levels of chip output pins remain static. The Power-down mode can be terminated and normal operation resumed by either a reset or certain specific interrupts that are able to function without clocks. Since all dynamic operation of the chip is suspended, Power-down mode reduces chip power consumption to nearly zero. Power-down current is increased with RTC active. However, it is significantly lower than in idle mode. A Power Control for Peripherals feature allows individual peripherals to be turned off if they are not needed in the application, resulting in additional power savings during active and idle mode, Configuration A or B sensor composed by TEL: micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. SIM808 module is a GSM and GPS two-in-one function module. It is based on the latest GSM/GPS module SIM808 from SIMCOM, supports GSM/GPRS Quad-Band network and combines GPS technology for satellite navigation. GSM uses voice coders/decoders or voice coder is firmware and chips sets that digitize the human voices Voice that is sampled and channelized is housed in the voice coder. Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or electronic. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke.

The switch contacts on a relay can be "normally open" (NO) or "normally closed" (NC)--that is, when the coil is at rest and not energized (no current flowing through it), the switch contacts are given the designation of being NO or NC. In an open circuit, no current flows, such as a wall light switch in your home in a position that the light is off. In a closed circuit, metal switch contacts touch each other to complete a circuit, and current flows, similar to turning a light switch to the "on" position.

3. Implementation Results

The implemented outputs is shown in Fig 2 to Fig, 18

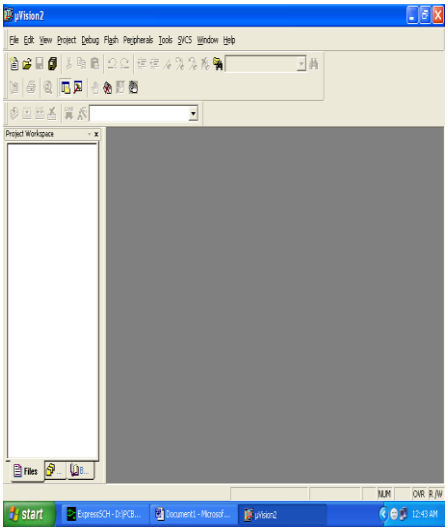

Figure 1: Project window

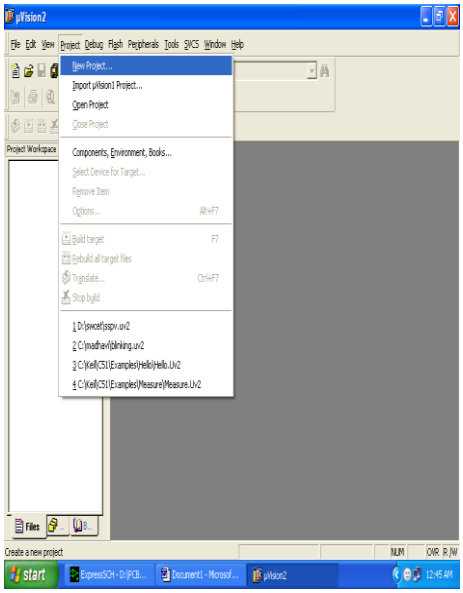

Figure 2: New project

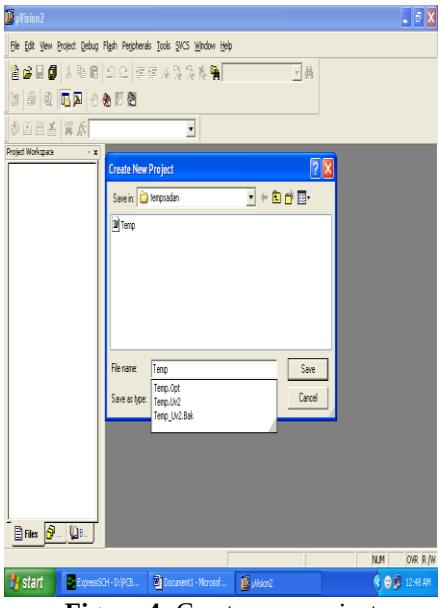

Figure 4: Create new project

Licensed Under Creative Commons Attribution CC BY

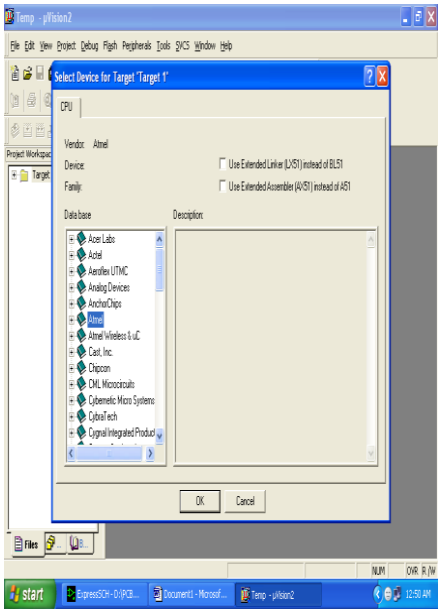

Figure 5: Select target device

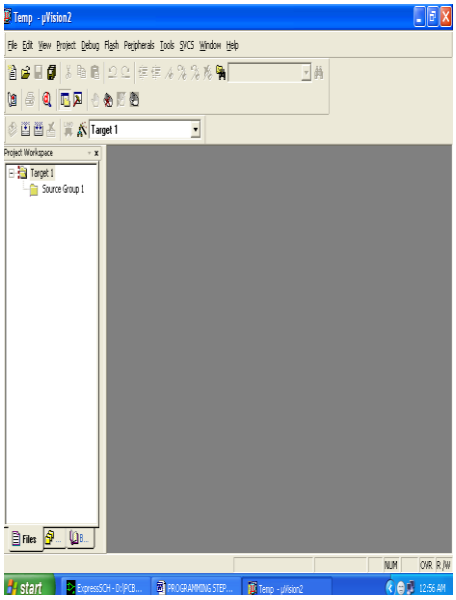

Figure 8: Source group 1

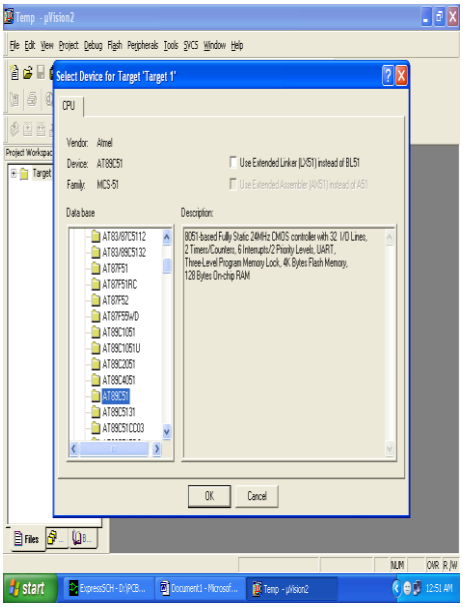

Figure 6: Select device for target

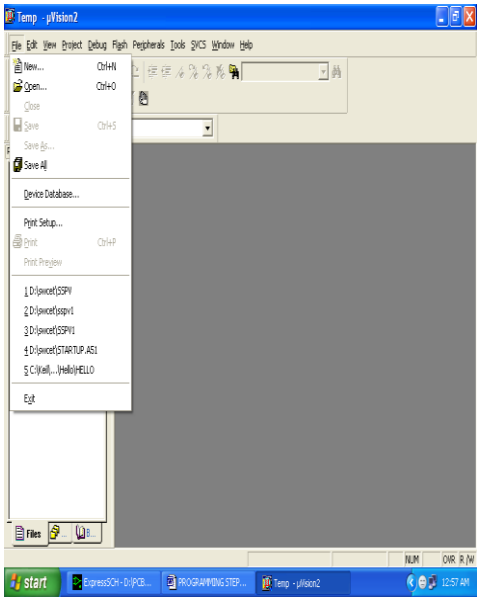

Figure 9: Creating New file

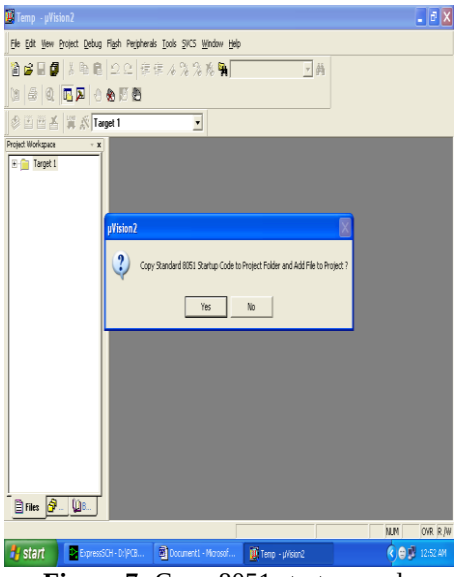

Figure 7: Copy 8051 start up code

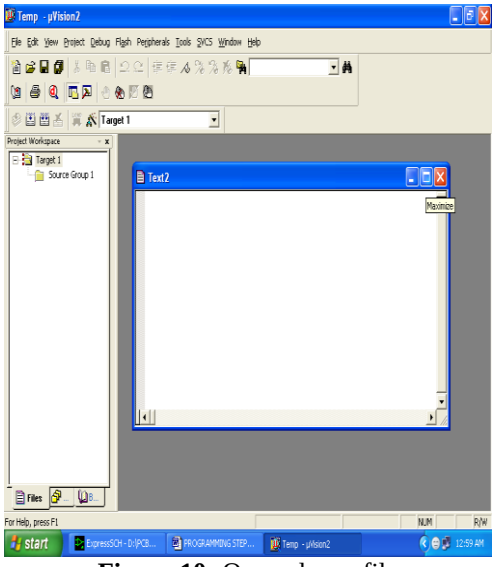

Figure 10: Opened new file

Licensed Under Creative Commons Attribution CC BY

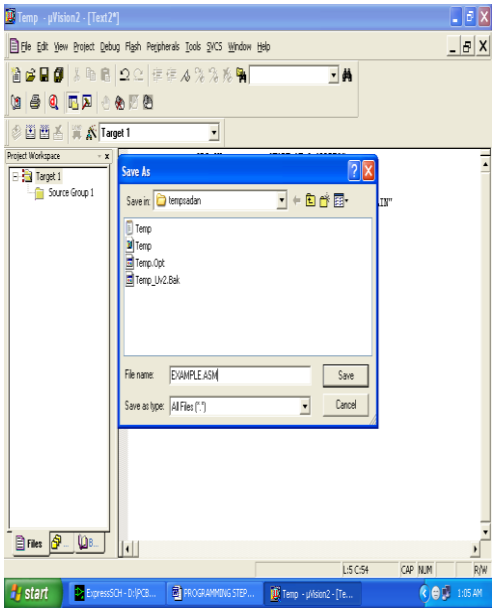

Figure 11: Save the File

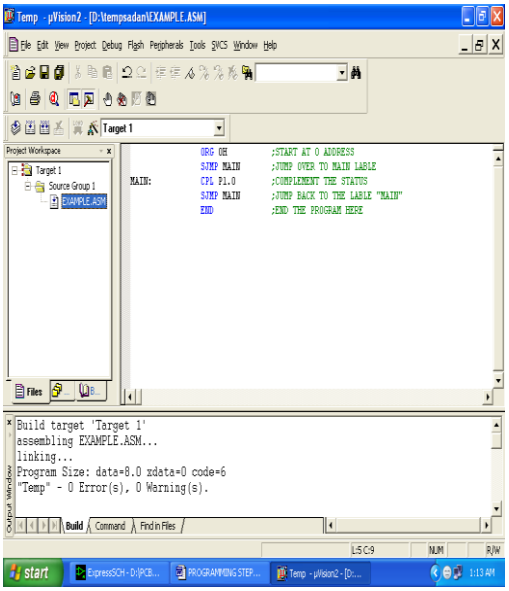

Figure 14: Compilation

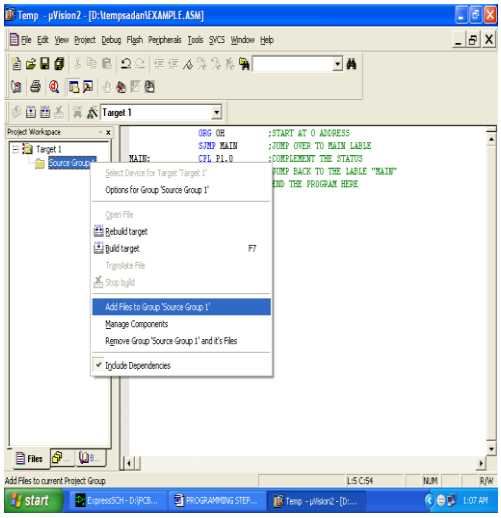

Figure 12: Add files to the source group

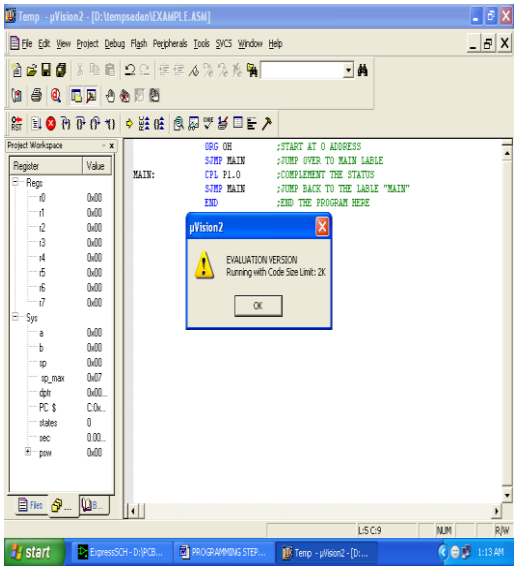

Figure 15: Building

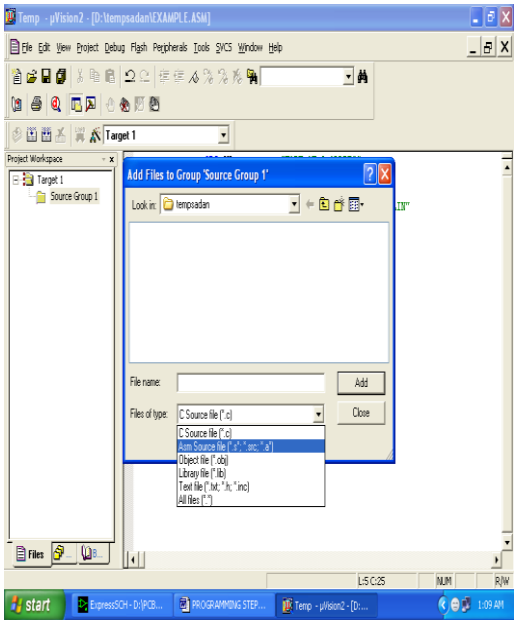

Figure 13: Adding files to the source group

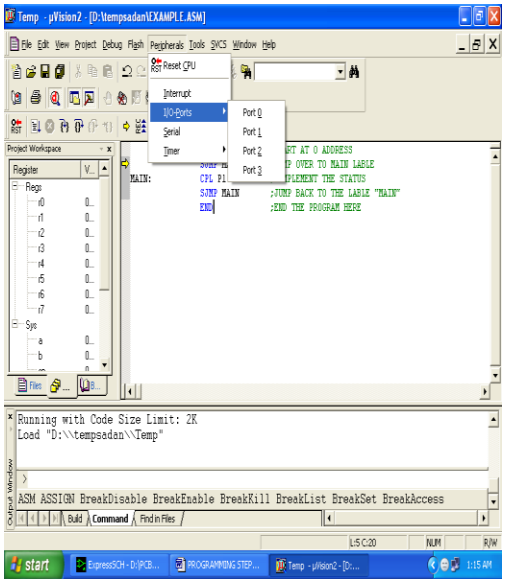

Figure 16: Selecting the Ports to be visualized

Licensed Under Creative Commons Attribution CC BY

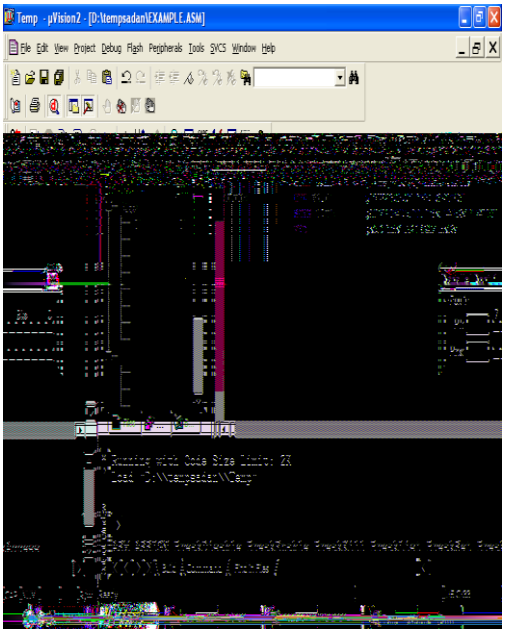

Figure 17: Start debugging

4. Conclusion

The paper gas leakage detection and control system has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

References

[1] P.Meenakshi Vidya, S.Abinaya, G.Geetha Rajeswari, N.Guna ,"Automatic LPG detection and hazard controlling " published in April 2014.
[2] K.Padmapriya, Surekha, Preethi, "Smart Gas Cylinder Using Embedded System", published in 2014.
[3] C.Selvapriya, S.Sathyaprabha, M.Abdul rahim," LPG leakage monitoring and multilevel alerting system", published in 2013.
[4] L.K.Hema, Dr.D.Murugan, M.Chitra," WSN Based Smart System for LPG Detection & Combustible Gases", published in 2013.
[5] B. D. Jolhe, P. A. Potdukhe, N. S. Gawai," Automatic LPG Booking, Leakage Detection And Real Time Gas Measurement Monitoring System", published in 2013.
[6] Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma," GSM Based Gas Leakage Detection System", published in 2013.
[7] R.Padmapriya, E.Kamini,"Automatic LPG Booking, Leakage Detection and a Real Time LPG Measurement Monitoring System", published in 2013.
[8] V.Ramya, B.Palaniappan,"Embedded system for Hazardous Gas detection and Alerting", published in 2012.
[9] A.Mahalingam, R.T.Naayagi, N.E.Mastorakis, "Design and Implementation of an Economic Gas Leakage Detector", published in 2012.
[10] M.B.Frish, R.T.Wainner, B.D.Green, M.C.Laderer, M.G.Allen, "Standoff Gas Leak Detectors Based on Tunable Diode Laser Absorption Spectroscopy", published in 2011.

Licensed Under Creative Commons Attribution CC BY