Automatic Gas Cylinder Management

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Abstract- **In the present scenario, we face a huge issue sometimes as we may require cooking during late night or there may be huge invited guests at home or any other work related to our LPG. However it would be too late to realize the value of that gas unless we realize it is finished, by then it is too late as they normally take 2-3 days to deliver a new gas. The aim of our project is to design and develop a device which is capable of detecting the depletion of gas and book automatically, to switch off the regulator when the gas is not used and to track the status of cylinder delivery. The RFID enabled cylinder management system would help improve productivity, as well as improve the quality, reliability and efficiency of the cylinder management process. We use RFID tags in this project for checking the status of cylinder delivery. It is a solution for the society to conserve the energy in the best possible way. Making the cylinder automatic relieves home-makers from the pain they take whenever there is the utmost requirement for the cylinder and you do not know when the cylinder will go empty.**

I. INTRODUCTION

In busy daily life, public expect every single work to be automated, may it be at office or at home. They do not want to contribute their precious time towards household despite of working outside and earning a lot of money. Home-makers take up a lot of pain in cooking food and if the cylinder is empty with no prior indication then she has to take up some other means to cook food for the family. We have come up with the project of automatic gas cylinder management where we continuously monitor the level of gas in the cylinder and book it once it has reached a minimum weight. Whenever the gas level becomes low a booking message will be sent to the booking centre and also to our mobile. Gas booking process is completed and we get an acknowledgement to our mobile that the gas is booked. And also when there is no movement of people in the kitchen or if the gas is not used for a longer time then the regulator is automatically switched off which in turn avoids any leakage in gas and no one is present to notice it. This avoids sudden fire accidents caused by carelessness of people. Whenever a cylinder is booked and is to be delivered, sometimes it may happen that the cylinder is taken by a wrong person. Our project avoids this by providing an RFID tag to each cylinder with a unique identification code, with which only the person having the unique number can get the particular cylinder.

Our project is programmed using an 8051 microcontroller with part number P89V51RD2. We use the microcontroller with this part number because it provides the facility of In-System Programming. We Program the microcontroller in normal mode with 4KB ROM, 128 bytes RAM, at an operating frequency of 11.0592 MHz and one data pointer. Our project requires less memory hence we are not using any external memory.

II. AUTOMATIC BOOKING DEVICE

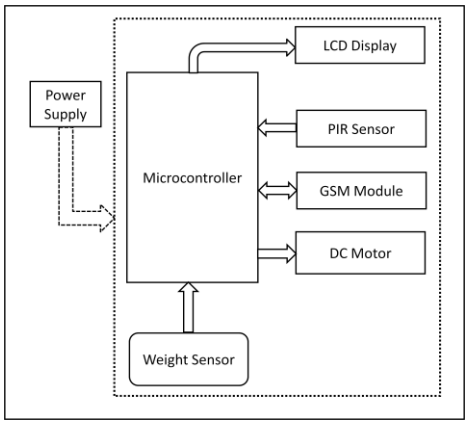

Fig 1 Automatic booking device block diagram

Automatic booking device is one of the modules in our project which is installed at the base of the cylinder. As shown in Fig 1, it consists of components like 8051 Microcontroller, GSM module, load cell type weight sensor, PIR sensor, DC motor and LCD display. Each component can be briefed in three parts that is, Working, Interfacing and Control.

2.1 8051 Microcontroller

The microcontroller we use is of Philips made with part number P89V51RD2. We use the microcontroller with this part number for its special feature of In-System Programming. In In-System Programming, without removing the connections of the module it can be directly programmed. This makes programming much simpler and easier. There are two modes of operation of the microcontroller i.e., X2 Mode and Normal Mode. In X2 mode, we can use 64KB of ROM, 1KB of RAM, two data pointers and operating frequency of 40MHz. In Normal mode, we have 4KB of ROM, 128 bytes of RAM, one data pointer and operating frequency of 11.0592MHz. Since we require only less memory we utilize the microcontroller in normal mode. There are four ports in the microcontroller and each port has 8 pins. Each pin should be connected with 10kΩ resistors which are given inbuilt by the manufacturer for ports 1, 2 and 3 but for port 0 the choice to connect or not is given to the user. If we are connecting any external memory to port 0 then, pull up resistors are not required. When any other external devices are to be interfaced then they are connected to port 0 through the pull up resistors.

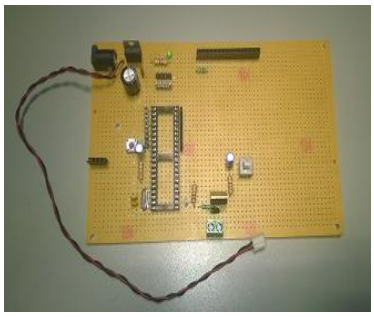

Fig 2 Minimal connection requirements for the microcontroller

The reset pin in the microcontroller is connected to a reset switch along with RC components. RC components are used in order to remove the vibrations caused by the switch before it settles down at a value either ON or OFF. Since we do not use any external memory we connect the External access pin to the ground throughout the project. XTAL1 and XTAL2 pins are connected to a crystal outside the microcontroller with two capacitors of 38pF each. This crystal is inductive type and cannot be fabricated inside the microcontroller because it may produce some noise resulting in change in response. Some RC oscillators can be fabricated inside. Care should be taken to see that any external device connected to the microcontroller should operate with the same baud rate of 9600 baud.

2.2 GSM Module

GSM means Global System for Mobile communications. It is a serial port device. GSM module has different modules based on the facilities they provide to the user may it be calling facility, messaging facility, video conferencing etc., Since our automatic booking project only requires SMS facility we use SIM300 Module which is one of the basic modules. This is shown in Fig 3. It consists of four pins Tx, Rx, Vcc and GND. Tx and Rx pins are connected to Rx and Tx pins of Microcontroller. SIM card is inserted at the socket provided at the back of GSM module.

An LED is provided for the indication of network access. Initially when the SIM is inserted the LED blinks faster and when the SIM gets registered itself to the network, the blinking rate reduces. Various instructions are given to the GSM module to make it active.

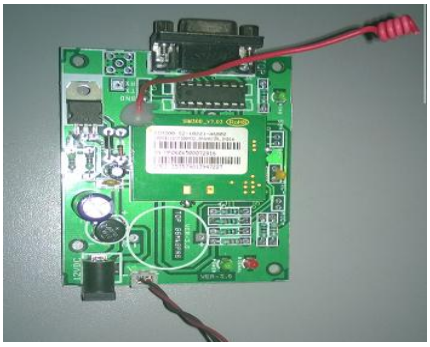

Fig 3 GSM SIM300 Module

"AT" command is given to wake up the GSM module, similarly the GSM module is functioned by adding the command with AT. For example, "AT+CMGF=1" instruction is given to set the GSM to text mode.

2.3 Weight Sensor

In our project we use load cell type weight sensor as shown in Fig 4. It consists of two ends one is fixed end and the other one is a reference end (free end). Cylinder is kept on the free end such that its weight is calculated based on the strain caused.

Fig 4 Load cell type weight sensor

The strain gauge can weigh a maximum of 40KG since we have considered the maximum weight of the cylinder, the least count for the weight to be expressed in binary data is 157 gms. This is calculated as

40000/255 = 156.863 ≈ 157 gms

i.e., for binary data **00000001 means 157 gms**

00000010 means 314 gms

The analog weight is converted to digital bits using an A/D converter which is connected to the strain gauge fixed end.

2.4 PIR Sensor

PIR Sensor means Passive Infrared Sensor. This is used to sense any movement of human beings. It is shown in Fig 5. In our project, we use it to continuously monitor the motion of people in front of the gas stove. If there is no movement of people for a longer time then an output is generated to switch off the regulator. PIR Sensor works on the basis of Infrared rays. Change in colour is determined when there is detection of movement of people. Each object can absorb the colour differently. Based on the amount of Infrared

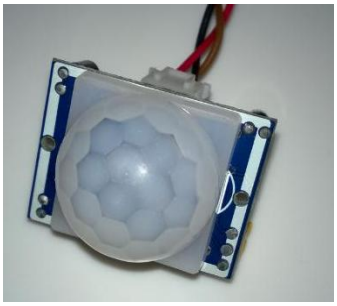

Fig 5 PIR Sensor

rays absorbed, motion is detected. A delay time is given for detecting movement after which the DC motor rotates to switch off the regulator.

2.5 DC Motor

Fig 6 DC Motor

We use a normal DC motor with a gear. It is a 12V 160 rpm motor shown in Fig 6. This DC Motor is used in our project to show that there is no movement of people for a longer time by rotating once. To drive the DC Motor PIR Sensor sends a high signal when there is no movement for a certain period of time. It continuously monitors the same and drives high output whenever necessary. This output can be used to drive another mechanical part that can switch off the regulator automatically without human intervention.

2.6 LCD Display

Fig 7 2X16 LCD Display

The LCD model we used in our project is JHD162A. It has 2x16 character type display (i.e., 2 rows and 16 columns) as shown in Fig 7. In the display, each character has 7x5 pixels. It consists of 16 pins. Vcc, Vss, LED+, LED- and VEE for power supply. RS pin is used to select between data register and command register. When RS=0, data register is selected and data is sent to the LCD. When RS=1, command register is selected to send commands to the LCD. Read Write signal is used to either read the data in the LCD into the microcontroller or write the data to the LCD to display. Four LEDs are placed at the corners of the LCD to provide backlight to the display.

III. HAND-HELD DEVICE

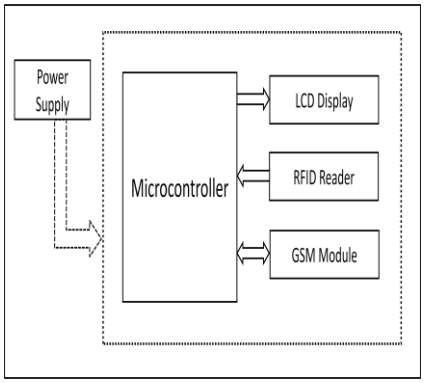

Fig 8 Hand-held device block diagram

The hand-held device as shown in Fig 8 has Microcontroller, LCD Display, RFID Reader and GSM module. Microcontroller, GSM module and the LCD display have the same specifications as those used in automatic booking device. In hand-held device since both GSM module and RFID reader are serial port devices they are multiplexed and used whenever required alternatively.

RFID Reader

Fig 9 RFID Reader

RFID reader used here is of 125 KHz frequency and its range is 1 inch. We use RFID reader here to ensure that the cylinder is delivered to an authorized person or not. We use a unique RFID card consisting of a unique 8 digit number which should match with the one given to the user.

Fig 10 RFID Tag

The RFID Tag consists of a wounded antenna and a memory card which has the 8 digit number.

IV. ADVANTAGES

- Simple in design and easy to operate.
- High reliability.
- Lot of time and energy is saved.
- Stress relief for Home-makers.

V. CONCLUSION

Our project is done with the most basic utilities and hence easy to handle without any confusion. We are using GSM SIM 300 module since we require only messaging facility. We have tried to make the simplest apparatus with less cost and more durability. Whenever the cylinder is replaced, the weight sensor has to be reset manually using a simple switch connected in the circuit. Care has to be taken to see that the weight on the strain gauge does not exceed its maximum value that is 40 kgs. It also avoids illegal selling of cylinders where the cylinder is sold to an unauthorized person. This is avoided by using RFID Reader and the unique tag given to each different cylinder.

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