Smart Window System Using Arm Microcontroller

P.Sivaranjani, P.Keerthana, S.Rajesh kumar, S.Naveen kumar, M.Rankish

Abstract: A number of sudden deaths happened due to inhaling of carbon monoxide (CO) gas which may leak from air conditioner. Carbon monoxide (CO) is a very poisonous gas and can cause dizziness, headache, vomiting and fatigue. People inhale CO gas without their knowledge because Carbon monoxide gas is colorless and odorless. In order to prevent this accident, the system will keep on sensing the accumulation of carbon monoxide (CO) gas using MQ7 gas sensor and automatically open the windows using high RPM motor. ARM microcontroller has been used to implement this project. If the value of CO exceeds the predefined threshold value then the buzzer alarm is triggered. Additionally, the system monitors the temperature and window will be operated based on threshold value which can be modified by customer. Based on the intensity of sunlight, the door can be operated automatically. User is also allowed to set the time using RTC for opening/closing of the door automatically.

Keywords: Carbon monoxide leakage, Motor control, Sensor, Temperature, Window.
Abbreviations: CO, carbon monoxide; AC, air conditioner; CFC, chloro fluoro carbon; ARM, Advanced RISC machine; I2C, Inter-Integrated Circuits; LCD, liquid crystal display; RPM, revolution per minute; PPM, parts per million; IDE, integrated development environment.

I. INTRODUCTION

Nowadays air conditioning is one of the essential electronic devices in our home. Air conditioners are used to remove heat from the interior area so that keep the room at lower temperature. Thus, achieving a more comfortable interior environment. An air conditioner uses a fan to circulate the conditioned air to the interior area of the buildings/car. At initial stage toxics /flammable gases are used in air conditioner which can lead to accident on leakage. The blend most used in direct-expansion home and building comfort cooling most people spend the majority of their time indoors regardless of the season. The Environmental Protection Agency (EPA) has stated the indoor air quality is much poorer than outside air. The main cause of carbon monoxide poisoning and other illness are due to malfunctioning or inefficient central AC system. Many individuals do not know whether there is any leakage of toxic gas or not. Unfortunately, people suffer from various health hazard because of this scenario. Therefore, there is a need for a device to detect the accumulation of CO gas and open the window automatically. The device should alarm the victim in the room and make a life saving route to exit from the room.

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II. LITERATURE REVIEW:

This paper proposed a method where the electrical power consumption can be reduced by using Light Dependent Resistor (LDR) [1]. Various sensor readings are taken from LDR for a single room. The intensity of the light can be measure by using two LDR sensor based on which the lumen of the LED bulb is determined. With the help of LDR the intensity of the bulb is found and the required lumen will be provided by the bulb for the surrounding. Batra, Neera & Batra, N [2] paper presents a car cabin safety has been designed using embedded. Carbon monoxide accumulation inside the car cabin is detected by this system. When the Carbon monoxide value reaches its threshold then it triggers the alarm and display a warning message in LCD display. At the same time window will be open automatically for the ventilation purpose. People usually do not know how to escape themselves from the vehicle when the vehicle drown in water [3]. When the vehicle accidently sinks in water, Automatic window opening system will certainly help the occupant to get out of the vehicle just by opening the side window of the vehicle. When the vehicle sinks in water then the window is open by an electrical signal. Therefore, when the victim does not open the door, the window would open automatically thus saving the life of the victim. An intelligent window system has been developed for monitoring environment and health [4]. This system uses wireless sensor network (WSN) device for operate the window wirelessly. The WSN has been implemented into the component for better performance. These components are used to detect temperature, humidity, smog, toxic gas etc.WSN signal packets are deliver by WSN signal project supported ZigBee protocol that follows the IEEE 802.14.4 standards. The radio frequency can be received by WSN antenna and the hardware system consist of window motor. Students often sleep many times in the evening or in early mornings classes due to wake up during night. Often than not, most would depend on artificial lights such as room lamps and computer lights. The issue here is that natural lighting is not used since students depend on artificial lights, so curtains usually remain closed for long hours which is not a healthy lifestyle. This was proposed by Tan, N. D., Lee, J., Yazid, M. R., & Othman, W. [5] The main objective is to alert the students on the time. The second objective is to instill healthy lifestyle habits in a student's life. The third objective is to make an automatic curtain that opens and closes following the surrounding brightness. In this model, the system will start to detects

intensity of light depending on the daytime. Using a combination of software and hardware designing, a prototype was created and tested.

III. MATERIALS AND METHODS

BLOCK DIAGRAM

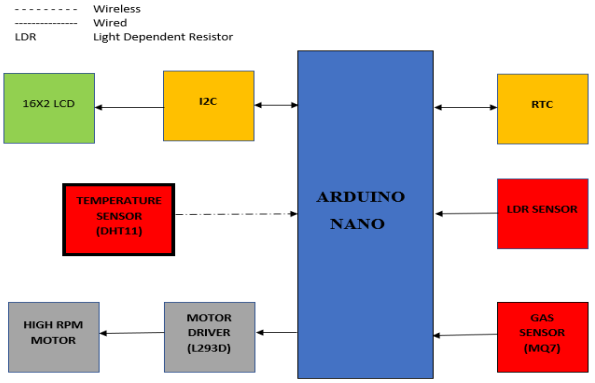

Fig. 1*. Block Diagram of the proposed system*

In shopping malls and hospital, they use automatic door opening system to open the door when a person is detected with the help of sensors such as IR, PIR, Radar etc. In this project Arduino micro controller is used to interface various module. DS1307 Real Time Clock are low cost I2C RTC modules. It is connected to Arduino and it will keep track of real time even when the Arduino board is not powered. RTC module is used to set the time of operation of the window. Bidirectional motor driver is used, which have a L298 IC. Motor driver can be used to run the motor in both the direction. With this motor driver(L298) it is possible to connect to motors at the same time. Motor driver is used to avoid the Arduino from getting damage because it draws high current. The I2C module have two lines: I)SDA-serial data pin(to transfer data between device) and II)SCL-serial clock pin(to general pulse at regular interval) I2C module is used to interface the 16x2 LCD with Arduino in order to reduce the number of I/O pin connected to Arduino. Figure 1 shows DHT11 sensor which measure both the temperature and humidity at the same time. It is low cost sensor and operate at fast speed because of 8-bit MCU in it. An Arduino board will be connected to a 433 MHz transmitter and will send the Temperature value. The 433 MHz receiver is connected to another Arduino board inorder to receive the messages.

IV.FLOW DIAGRAM

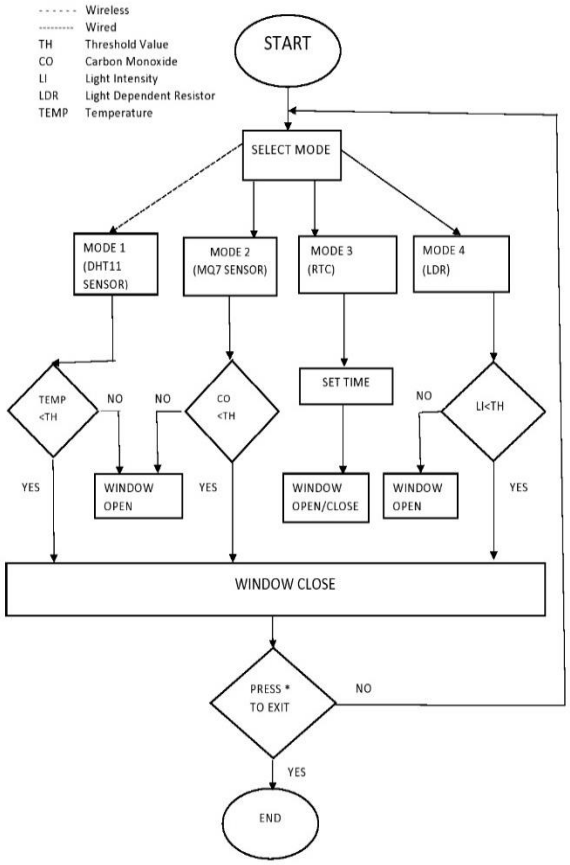

Fig. 2*. Flowchart of the proposed system*

V.MODE OF OPERATION

MODE 1-Based on Temperature
MODE 2-Based on Carbon Monoxide detection
MODE 3- Based on Time
MODE 4-Based on Light Intensity

MODE 1:

This mode uses a DHT11 sensor to monitor the real-time temperature of the environment. A threshold value is set in the programming part so whenever the temperature goes beyond the threshold value then the window will be automatically opened. When the temperature goes beyond the threshold value which is fixed then the window will be automatically closed. The threshold value can be changed in

Fig .3. Mode of operation displayed in LCD

the program to operate in varies circumstances. The DHT11 sensor is connected to the transmitter and the value detected is transmitted wirelessly to the receiver. In the receiver part the RF 433 MHz receiver is connected to Arduino Nano which is used to display the value in the LCD.

MODE 2:
The MQ7 Gas sensor to monitor the real-time ppm (parts per million) of CO gas in the environment. A threshold value is set in the programming part so whenever the ppm value goes beyond the threshold value then the window will be automatically opened. When the ppm value goes beyond the threshold value then the window will be automatically closed. The threshold value can be changed in the program to operate in varies circumstances. The obtained value is displayed in the LCD with the help of I2C module.

MODE 3:
This mode uses an RTC Module that is used to set the time at which the window is opened/closed. The time is already pre-defined in the program so that the window will be automatically opened/closed. The program can also be changed so that user can set an opening/closing time for the window. The obtained value is display in the LCD with the help of I2C module.

MODE 4:
This mode uses a LDR to monitor the real-time light intensity of the environment. A threshold value is set in the programming part so whenever the value goes beyond the threshold value then the window will be automatically opened. When the ppm (parts per million) value goes beyond the threshold value then the window will be automatically closed. The threshold value can be changed in the program to operate in varies circumstances. The obtained value is display in the LCD with the help of I2C module.

VI. RESULTS AND DISCUSSION

Fig .4*. Hardware Setup*

Figure 4 shows the interfacing of motor driver and motor with the Window. The window is moved by the motor automatically which is fixed at the top with the help of the conveyer. The transmitter module has DHT11 sensor which detect and send the temperature value wireless to the receiver which is on the left side. The receiver module consists of RTC, Flame sensor, MQ7 sensor, keypad, I2C, LCD Which are soldered in a single dot board. At the center of the window driver module and a power supply board is fixed. The supply board provide separate 12V supply to the motor driver. Motor driver is used to prevent Arduino from getting damage because motor will draw high current.

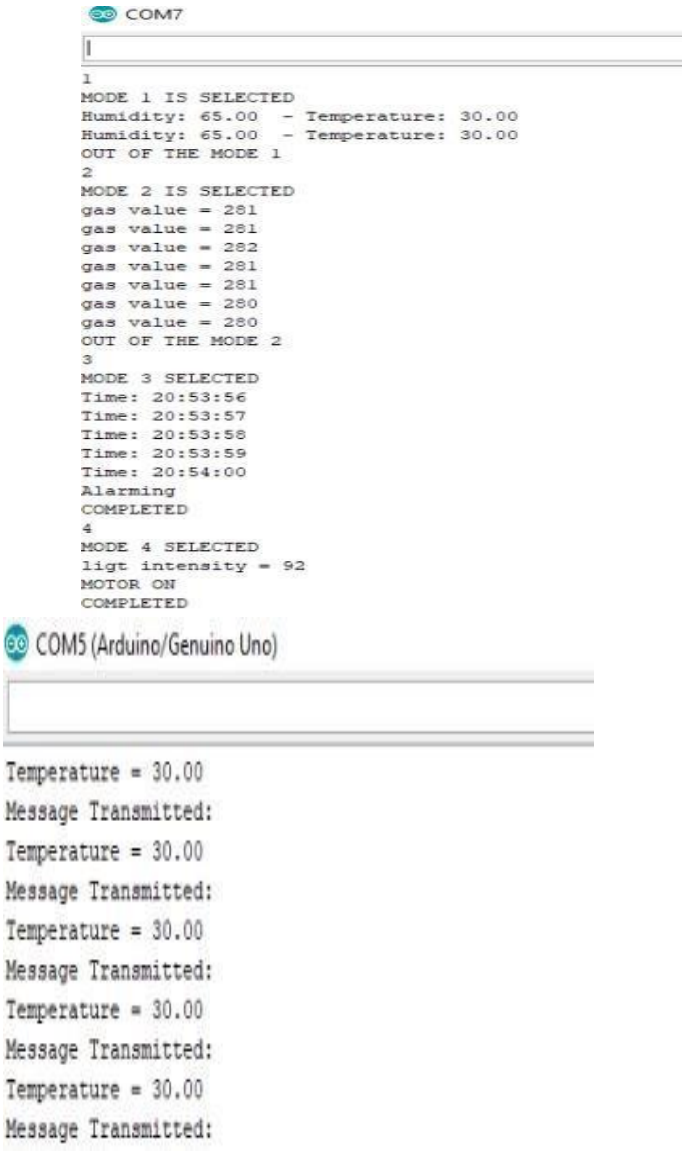

Fig .5*. Transmitter output*

Figure 5 shows the value transmitted by the Arduino UNO by using RF 433MHZ transmitted module and temperature value is measured by DHT11 sensor. Figure 6 shows the varies modes of the receiver section where mode 1 is used to measure temperature (Wirelessly), mode 2 is used to measure ppm value of CO, mode 3 is used to set the timing to operate window, mode 4 is used to measure light intensity.

VII. CONCLUSION

Using ARM microcontroller an embedded system is designed for the detection of toxic gases. Carbon monoxide is a big threat to human life. It is a tasteless, colorless and odorless gas and it cause suffocation, Vomiting, headache, eye irritation. The main idea of this system is to create a simple embedded system with high sensitivity towards accumulation of carbon monoxide inside the room. When the level of carbon monoxide goes beyond the threshold value, the

designed embedded system displays and provides immediate ventilation by opening the windows of the room automatically. Additionally, this system also includes light intensity-based operation, Temperature based operation and Timing based operation. Thus, the system avoids the worse and critical situation inside the room.

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