

Intelligent Home Using Embedded System

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Abstract: Security and Home Automation products keep you safe, manage energy consumption, and provide entertainment. The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity through smartphone and tablet connectivity. Home automation refers to the use of computer and information technology to control home appliances and features (such as windows or lighting). Systems can range from simple remote control of lighting through to complex computer/micro-controller based networks with varying degrees of intelligence and automation. Home automation is adopted for reasons of ease, security and energy efficiency. The brain of the proposed system is Atmega16 microcontroller. The microcontroller is integrated with various units such as automated light and fan control unit, password protected security unit and gas detection and alarming unit. The system communication is based on GSM (Global System Module). Initially the user can set a master password for the security system. The entire house is equipped with motion sensors and when the user is authenticated, the motion sensors are turned off automatically. An automated light and fan system is equipped so that after sensing the presence of individual in the room, light and fan will turn on accordingly. Gas sensors are used to detect gas leaks and alert the user through GSM.

Keywords: Home automation, Global System Module, PIR sensor, Atmega16.

1. INTRODUCTION

Intelligent corresponds to home automation. Home automation is the residential extension of building automation. It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care. A home

automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance scenes for different events (such as dinners or parties), and the use of domestic robots. Devices may be connected through a home network to allow control by a personal computer, and may allow remote access from the Internet. Through the integration of information technologies with the home environment, systems and appliances can communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits.

2. WORKING

The system consists of three units i.e. automated light and fan circuit, digital code lock and gas leakage detection system. These three units are integrated to a micro controller to provide a centralized control over these units. Since there are three units, working of each unit is to be explained separately.

The units are automated light and fan, Digital code lock and Gas detection and alerting system. The LM35 sensor is used to sense the temperature of the room. The LDR sensor is used to measure the intensity of light in the room. The IR sensors are placed in order ie one IR sensor at the entering side of the room and another at the leaving side. If the first IR is cut and then second is cut, it means that a person has entered. If the second IR is cut and then the first is cut in order then it means that a person has left. If the light intensity is low in the room and the temperature is high, then the light and

fan will turn on, provided there are people in the room. First a proper code is entered and the micro controller senses this code. If the correct code is entered, the motion sensor in the room is deactivated and the system is unlocked. In case a wrong code is entered, the motion sensor is activated and if intrusion happens the sensor detects this and alert message is sent to the user. In case the MQ2 LPG gas sensor detects the presence of leaked gas, then the micro controller detects it and sends it to the user via GSM module. The range of sensors can be adjusted to vary the radius of detection. If the gas is detected within the radius of operation, the output pin goes high.

2.1 Circuit Diagram:

An overall idea about the working of the system can be learned from the diagram. The circuits includes PIR sensor modules in order to sense the presence of individual in the room, LDR circuit to measure the intensity of light in the room and LM35 sensor to measure the temperature in the room. The LDR resistance varies inversely proportional to the intensity of light. Since the LDR output may not be sufficient for the micro controller, it is necessary to have an amplifier circuit in order to get either high or low. As the light source moves away from the LDR, the output of the circuit is low. If the light source moves towards the LDR, then the output is high. The LM35 is connected to the ADC pin of micro controller since the output of the LM35 is analogue value but a digital value is required for that. The PIR sensors are actually two modules which designed in such a way that it either gives a high or low (zero) output. It is difficult to integrate all the units of intelligent to a single micro controller, two micro controllers are put in use. The circuit consists of a GSM module 900A for communication with the user, proximity sensor for intrusion detection, MQ2 LPG gas sensor and 4*4 keypad for entering the passcode.

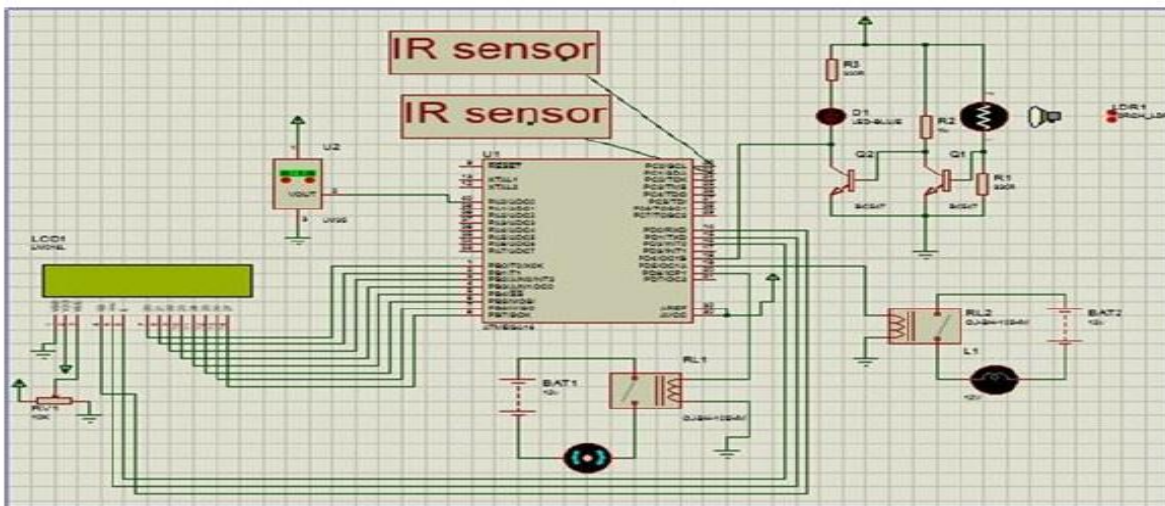


Fig 1 .Circuit Diagram of Automated light and fan

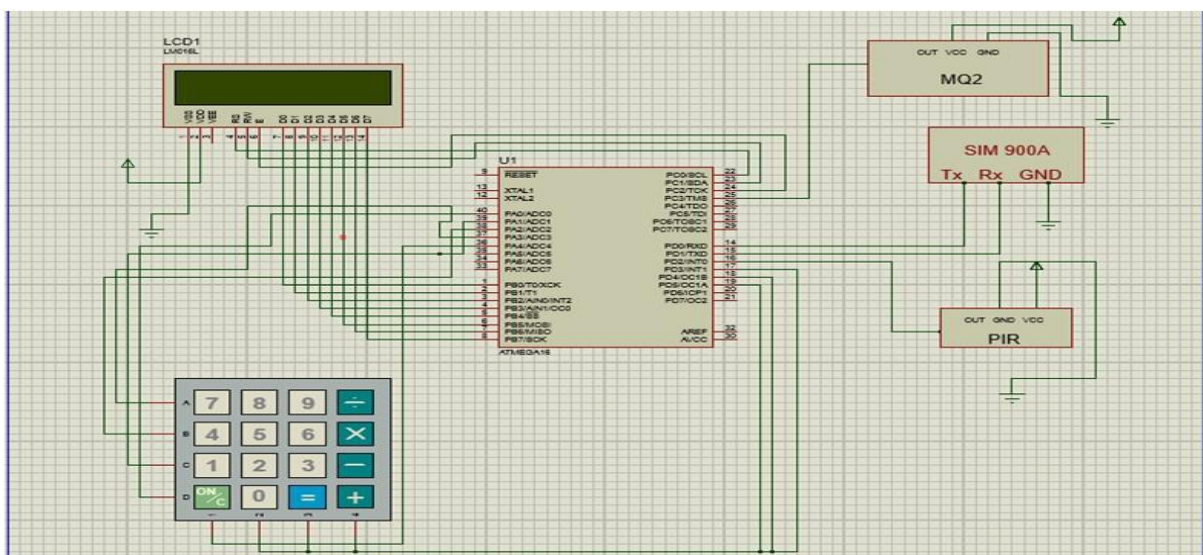


Fig 2 .Circuit Diagram for Digital code lock and Gas Leakage Detection

3. FUNCTIONAL BLOCK DIAGRAM

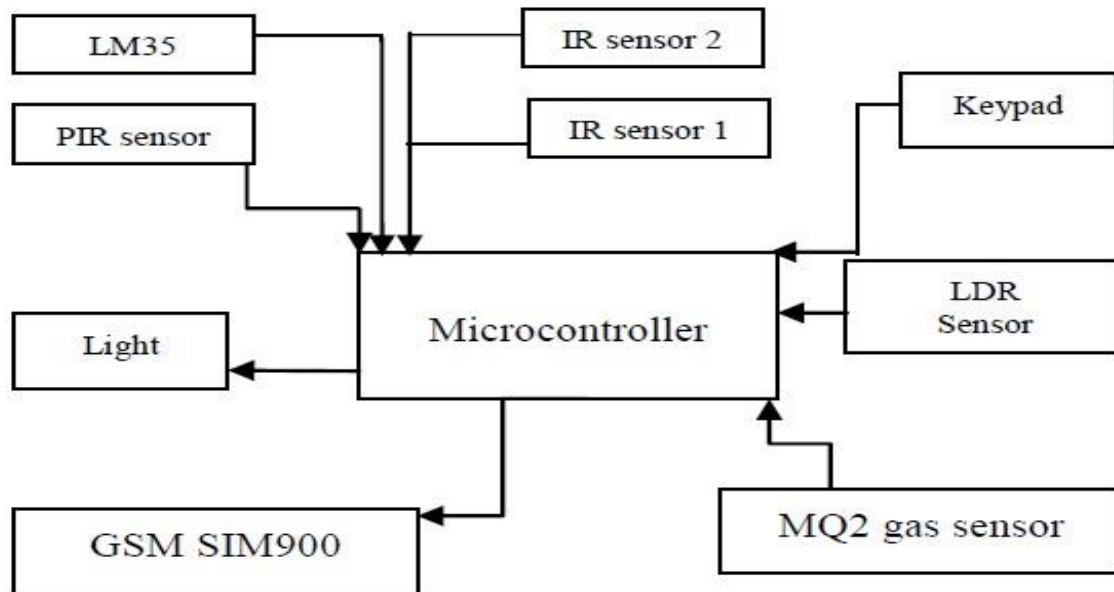


Fig: 3. Block Schematic

The block diagram of the system is shown in Fig. 3. This functional block comprises of a microcontroller ,GSM SIM900,LM35,keypad,and lot of sensors.as shown in above figure when this sensors give a particular input to the microcontroller gives a particular output to the required devices, for example if a gas detection is found then then sensor MQ2 detects it and gives the input to microcontroller and in response the microcontroller sends an output to the GSM SIM900 telling it to send an emergency message signal to the user and the respective authorities. Similarly here we have a circuit of automatic light and fan i.e the IR sensor and the temperature sensor detects the presence of light and temperature and also with the help of two IR sensors we detect the presence of the persons in the room. And thus with the presence of person in the room and the light intensity microcontroller switches on the light and with the detection of temperature it switches on the fan. Each of the sensor pin maintains high and low with the presence of the required input to the microcontroller. Here we use two IR sensors to maintain the count of people entering the room, this is done by incrementing the count when a person cuts the first sensor and then the second and decrements the count when the person first cuts the second sensor and then the first one.

4. HARDWARE

a) Atmega16 Microcontroller:

The AVR ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the AVR ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers The AVR ATmega16 provides the following features: 16K bytes of In-System Programmable Flash Program memory with Read-While-Write capabilities. 512 bytes EEPROM. 1K byte SRAM. 32 general purpose I/O lines. 32 general purpose working registers. A JTAG interface for Boundary scans. On-chip debugging support and programming. Three flexible Timer/Counters with compare modes. Internal and External Interrupts. A serial programmable USART. A byte oriented Two-wire Serial Interface.

b) GSM Module:

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer

applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design. SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm SMT type suit for customer application. An embedded Powerful TCP/IP protocol stack Based upon mature and field-proven platform, backed up by our support service, from definition to design and production.

c) LM35:

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self-heating and does not cause more than 0.1 C temperature rise in still air.

d) PIR Sensor:

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human eye because it radiates at infrared wavelengths, but can be detected by electronic devices designed for such a purpose. Here in this paper this sensor which detects the presence of the human and maintain the power control of the room.

e) LDR:

LDRs (Light Dependent Resistor) are used as sensors. LDR is a variable resistor whose resistance is inversely proportional to the intensity of the incident light. As it is a passive transducer, a potential divider circuit is used to obtain the corresponding voltage value from the LDRs. The higher the intensity of light, lower the LDR resistance and hence lower the Output voltage (V_{out}) and vice versa. Testing of LDR- Before mounting any component in the circuit it is a good practice to check whether a component works properly or not so that you can avoid consumption of time in troubleshooting. For testing LDR set the range of multi meter in resistance measurement. After that put the leads on the legs of LDR (LDR have no polarity so you can connect any lead with leg). Measure the resistance of LDR in the light or brightness, resistance must be low. Now cover LDR properly so that no light beam fall in it, again measure the resistance it must be high. If you got the same result means that LDR is good.

5. SOFTWARE

a) Win AVR:

Win AVR is a suite of executable, open source software development tools for the Atmel AVR series of RISC microprocessors hosted on the Windows platform. Includes the GNU GCC compiler for C and C++. Win AVR is a high level programming language dedicated to simplifying complex functionality by using dedicated component libraries of functions. Win avr is therefore ideal for speeding up software development times and allowing those with little programming experience to get started and help with projects. Win avr software is used to program AT mega micro-controller.

b) Proteus:

The Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level micro-controller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development. Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete micro-controller based designs. For the first time ever, it is possible to develop and test such designs before a physical prototype is constructed. This is possible because you can interact with the design using on screen indicators such as LED and LCD displays and actuators such as switches and buttons. Here instead of HT12E transmitter we were connected a LED to the corresponding pin. If the LED is ON, it indicates that the micro-controller is transmitting a signal.

6. OPERATIONAL FLOWCHART

The operational flow chart for the working of automatic light and fan circuit. is as shown below in Fig 4 .

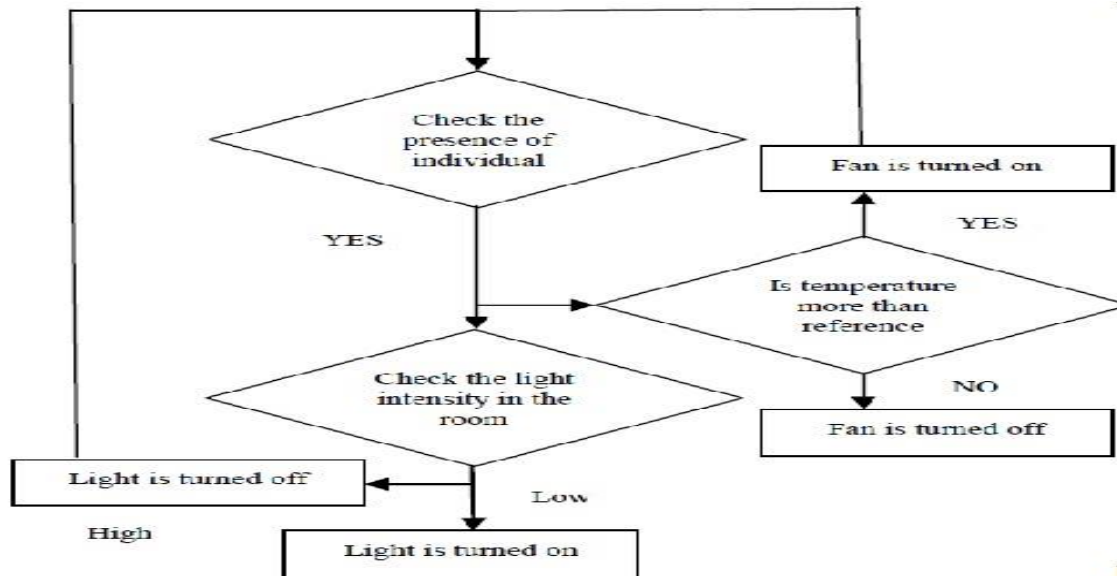


Figure 4: Operational Flow Chart

7. CONCLUSION

In this paper, we proposed an intelligent home using embedded systems. Automatic light and fan control unit, Gas detection and alerting system, Digital code lock was designed and tested. The automatic light and fan control unit determined the count of visitors and was able to control the light and fan circuit depending on the presence of persons. The light and fan will function only when there is a person in the room. The fan is controlled according to the room temperature. The MQ2 gas sensor detected the presence of LPG gas and an alert was sent via GSM. The digital code lock identified the correct password and unlocked the system and an alert was sent for incorrect password and it detected the intrusion through proximity sensor and alarm went off. The system gave us an improved security system, with this household theft can be reduced, domestic accidents can be avoided. We feel that this system is efficient and useful because it is flexible, user friendly comparatively inexpensive and reliable. Figure shows the circuit soldered on PCB board. For convenience the temperature variations are done by bringing the soldering iron close to the LM35 so that a temperature rise is seen and taking away the soldering iron, the temperature goes back to the normal level. First the password is set as "1276". If the user enters the correct password, the motion sensor is deactivated and the person can access the room. If an intrusion occurs, the motion sensor is activated and an alert message is sent to the user through GSM ie. "INTRUDER ALERT". MQ2 is equipped to detect the gas leak. If gas leak is detected, an alert message is sent to the user through GSM. LPG gas leakage is tested by bringing in a lighter towards the MQ2 sensor. The lighter is not lighted but slightly pressing the button would leak the gas.

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