MULTIFUNCTIONAL HOME AUTOMATION

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Abstract : Home Automation is a way to have things around the home happen automatically. The aim of this paper is to develop a resident-friendly multifunctional home automation system using Arduino board. The proposed smart home shall have automatic control of LPG, automatic plant watering system and automated room light control. The paper deals with the development of an advanced technology gas sensor for detection, monitoring and controlling system for LPG leakage. DC motor is used to automatically control the gas regulator knob. The paper also describes the gardening system to cater the requirement of water to the plants. The paper further deals with automatic ON/ OFF of the lights of the house, with the help of a sensor that detects the entry and exit of the persons. The data output from the sensors is input to the Arduino board. The controller in turn triggers the signal to the concerned functional motor to operate. The operation of the relevant motor controls either regulator knob or waters the garden or switches on/off of lights depending on the particular sensor actuation. The proposed system can be further extended to include more functions as per the requirement.

IndexTerms **- smart home, gardening system, Arduino, .**

I. INTRODUCTION

Home automation is building automation for a home, called a smart home. A home automation system will control lighting, climate, entertainment systems and appliances. It may also include home security such as access control and alarm systems. Before the development of electronic household gas detectors in the 1980s and 90s, gas presence was detected with a chemically infused paper that changed its colour when exposed to the gas. Since then, many technologies and devices have been developed to detect, monitor, and alert the leakage of a wide array of gases.

In gardening watering plants is the most important cultural practice and most labor intensive task in daily greenhouse operation. Without water no plants, no life so watering system ease & the burden of supplying water to plants when they need it. Knowing when and how much to water are two important aspects of watering process.

To save the power consumption in our daily life an "Automated Room Light Controller" is developed as a reliable circuit that takes over the task of controlling the room lights. When somebody enters into the room then the lights in the room will be switched ON and when the person leaves the room then the light will be automatically switched OFF, enabling conservation of energy.

This paper deals with the development of an advance technology gas sensor for detection, monitoring and control system of LPG leakage. Using DC motor the stove knob is automatically controlled. In gardening the problem can be perfectly rectified if we use Automatic Plant Watering System Depending on Soil Moisture in which the irrigation will take place only when there will be intense requirement of water, as suggested by the soil moisture. To save energy and the efforts required to switch on the lights, instead of manually switching on/off the lights. A controller based on the motion of persons visiting particular room can be employed.

2. Proposed System

The aim of this paper is to develop a system to monitor for liquid Petroleum Gas (LPG) leakage to avoid fire accidents providing house safety feature where security has been an important issue. The system detects the leakage of the LPG using gas sensor and alarm for some period of time and it actuates the motor and turns the regulator off.

The design of a wireless LPG leakage monitoring system is proposed for home safety. The system detects the leakage of the LPG and alerts the consumer about the leak. An added feature of the system is that the approximate consumption is indicated in terms of alerting by buzzer and automatically stove knob will be turned off. Whenever the system detects the increase in the concentration of the LPG in the room it immediately alerts by activating an alarm and simultaneously the regulator will get off. The device ensures safety and prevents suffocation and explosion due to gas leakage**.**

Gardening to water plant is controlled by the Arduino board to give the signal to the motor. Temperature sensor and humidity sensor are connected, whenever there is a change in temperature and humidity of the surroundings these sensors sense the change in the temperature and humidity and initiates signal to Arduino board and thus the motor is activated.

3. Block Diagram of The System

The block diagram of Multifunctional Home Automation LPG Leakage Detection, Watering Garden, Control And Energy Saving of Lamps is shown in the below figure.

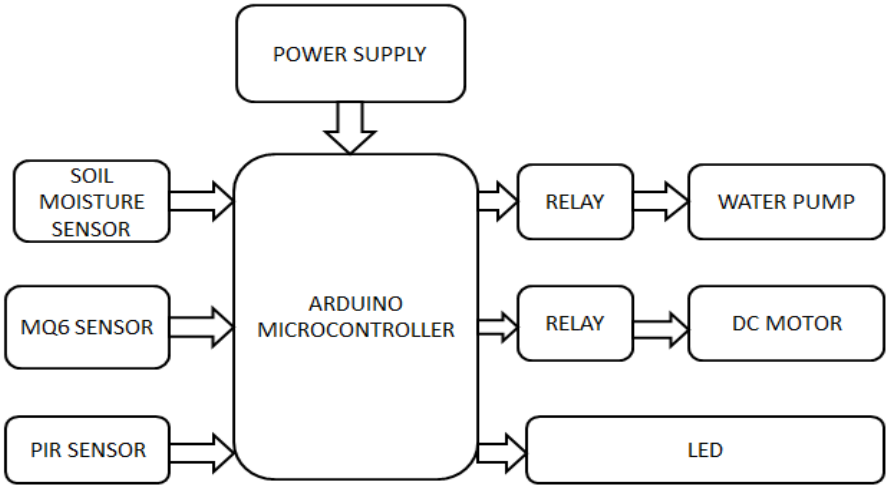


Fig 4.1: Block Diagram of Multifunction Home Automation

The Arduino Microcontroller plays major role in the entire system.

The MQ6 sensor detects the gas leakage and sends the signal to arduino.Then the arduino analyses the analog signal from the gas sensor and sends digital signal to the buzzer and relay. The buzzer and relay gets activated and the buzzer sound will be heard by the user. The relay after getting activated, sends the signal to DC motor.Then the DC motor which is connected to the gas regulator to turn it OFF.

The Soil moisture sensor detects the moisture content in the soil. If it less than the specified value then the signal is sent to the arduino. The arduino then sends the signal to relay and the relay will be ON. Thereby the motor pump gets activated and water will be sprinkled in the garden upto the required level.When the required amount of moisture level is detected by the sensor then the signals are sent to the relay to turn OFF the water pump.

The PIR sensor senses the motion of the person and if there is any motion, it sends the signal to Arduino, then the arduino turns ON the Light.The Light remains in ON position until the person stays in the room. As soon as the person leaves the room the sensor detects the signal and automatically turns OFF the light.

4. System Flow chart

The activities of the Automation system are depicted in the flow chart below.

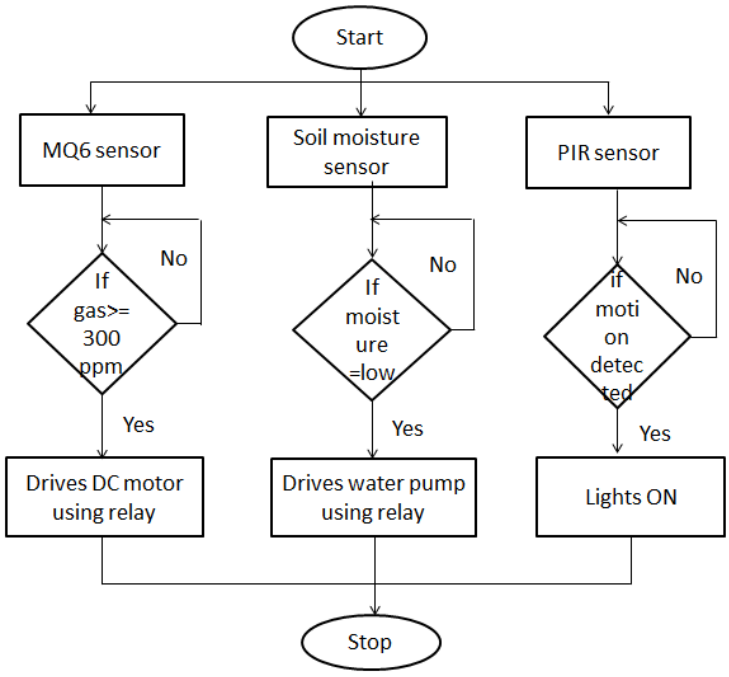


Fig 4.1: Flow chart

5. Details of the system requirements and specifications

5.1. Hardware Requirements

5.1.1. Arduino Uno

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartzcrystal, a USB connection, a power jack, an ICSP header and a reset button. Each of the 14 digital pins can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

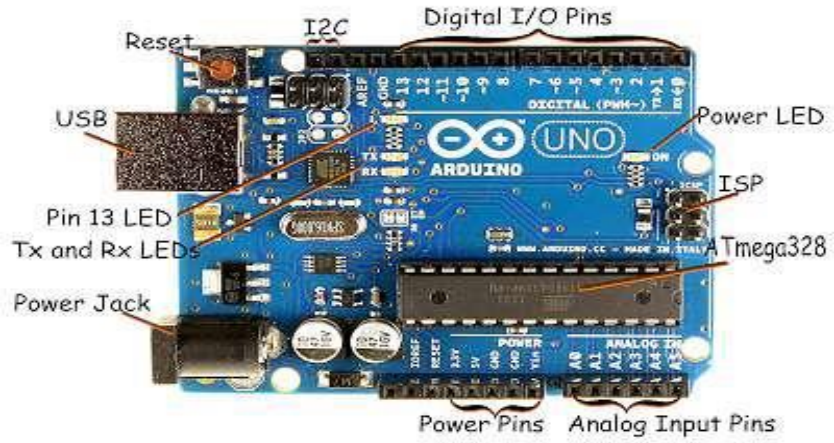


fig 5.1: Arduino UNO

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits ofresolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference () function.

5.1.2. MQ6 sensor

The Figure shows a photo of MQ-6 sensor. In clean air, the sensor has a high resistance and in presence of gas the sensor conductivity increases. The sensor has a simple drive circuit shown in Figure. A voltage (heating voltage) is applied between Pin 2 and 5 with a resistance of 26 ± 3Ω to heat the sensor to the working temperature. When Tin Oxide is pre-heat in presence of oxygen, oxygen is adsorbed on the crystal surface with negative charges. The donor electrons on the crystal are transferred to the adsorbed oxygen thus leaving positive charges in a space charge layer. This creates a surface potential which acts as potential barrier against electrons resulting in flow, the high resistance of the sensor in clean air. The presence of reducing gas such as LPG, the gas molecules are adsorbed on the material surface reducing the surface density of the negatively charged Oxygen ions thus increasing concentrations of electrons and the conductivity of the sensor. This results in increase of sensor output voltage.

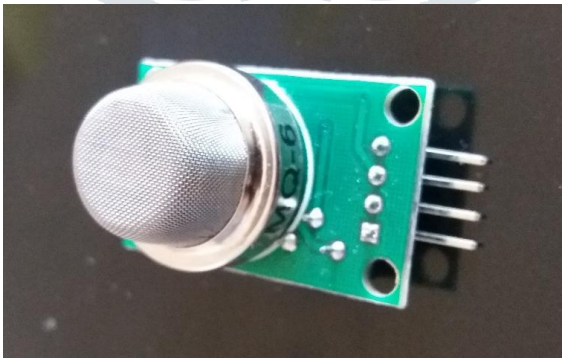


Fig 5.2: MQ6 Sensor

5.1.3. DC Motor:

The DC motor is required to turn off the regulator once the leakage of LPG gas is detected by the sensor.

Fig 5.3: DC Motor

5.1.4. Relay:

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically.

Fig 5.4: Relay

5.1.5. Soil Moisture Sensor:

This moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low tech sensor, but ideal for monitoring an urban garden, or your pet plant's water level. This is a must have tool for a connected garden. This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance). It will be helpful to remind to water the indoor plants or to monitor the soil moisture in the garden. A Chinese built YL-69 sensors come with a 'middle-man' circuit which allows to get two outputs: one is an analog readout of the resistance between the sensor's probes and the second is a digital output (essentially, HIGH or LOW, 5v or 0v) depending on whether the humidity is above or below a threshold which can in turn be adjusted by a built-in POTS. The YL-69 sensor has two pins which need to be wired to be the two pins on the YL-38 Bridge. On the other end of the YL-38 have four pins which represent VCC, GND, D0 and A0. VCC and GND are power pins which should set to 3.3/5V and ground respectively.

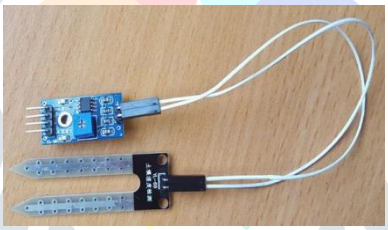


Fig 5.5: Soil moisture sensor

5.1.6. Water Pump:

Pump (or sub pump, electric submersible pump) is a devicewhich has a hermetically sealed motor close-coupled to the pump body.

Fig 5.6: Water pump

5.1.7. PIR Sensor:

A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. They are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

Fig 5.7: PIR Sensor

5.1.8. LED:

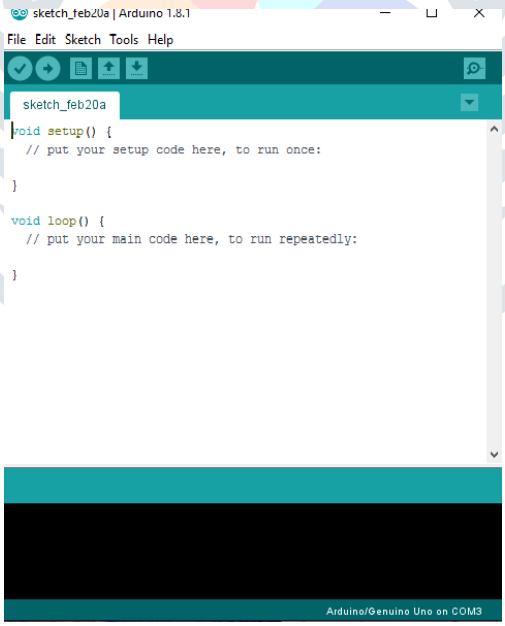
A light-emitting diode (LED) is a semiconductor device that produces light from electricity. An LED is a type of diode that makes one colour of light when electricity is sent through it in the expected direction (electrically biased in the forward direction).

Fig 5.8: LED

5.2. Software Requirements

5.2.1 Arduino IDE

The Arduino Uno can be programmed using the Arduino Software (IDE). Select "Arduino/Genuino Uno" from the Tools > Board menu (according to the microcontroller on the board). The ATmega328 on the Uno comes pre-programmed with a boot loader that allows to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.
The boot loader can be bypassed and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP.



5.9 Embedded C Programming

6. Advantages

- The sensor has excellent sensitivity combined with a quick fast response time.
- The system is highly reliable, tamper-proof and secure.
- In the long run the maintenance cost is very less when Compared to the present systems.
- It is possible to get instantaneous results and with High accuracy.
- Time saving.
- Automatic operation.
- Saving manpower.
- Low power consumption. Easy to use.

7. Applications

1. This system can be used in houses for watering plants upto a required level at required time, security in gas leakage condition to prevent accidents and also to save power consumption by controlling lights.
2. Multifunctional home automation system can be used in small scale industries as it consists of garden, kitchen and lamps usage.
3. The system can be used function halls as it is used by many people and there by requires lot of safety, energy saving and water conservation.
4. Multifunctional home automation system can be used in factories as it consists of garden, usage of gas and lamps for lighting.
5. The system can also be used in colonies, cities and make them smart colonies and cities.

8. WORKING OF HOME AUTOMATION:

The below figure shows the working model of home automation system.

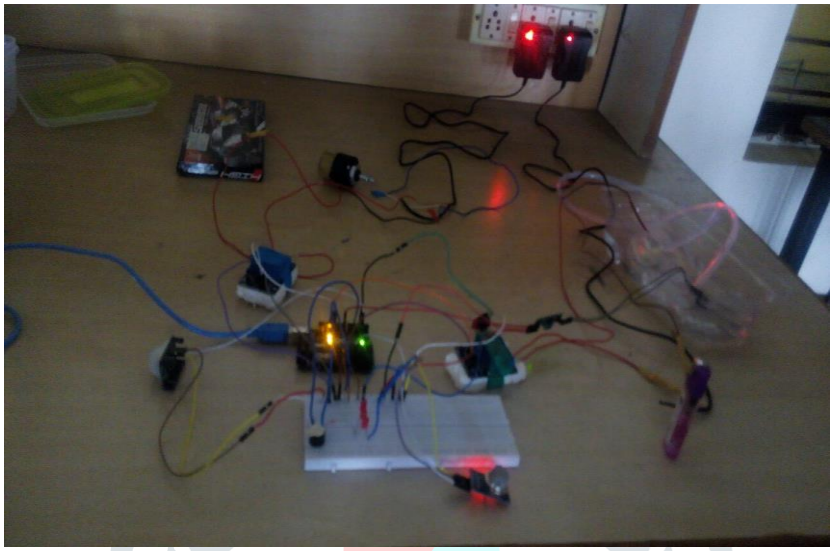


Fig 7.1: Working of home automation

6.2. FUTURE SCOPE

The home automation system proposed in this paper can be improvised by adding a Web scraper which can predict the weather and water the plants/crops accordingly. If rain is forecasted, less water is let out for the plants. Also, a GSM module can be included so that the user can control the system via smart phone. A water meter can be installed to estimate the amount of water used for irrigation and thus giving cost estimation. A solenoid valve can be used for varying the volume of water flow. Furthermore, Wireless sensors can also be used. In future the home automation system can be developed with wireless network which is more convenient. Using wireless network the different sensors can be placed in different places. This system can also be applicable to various loads like pressure, force and etc. by increasing the number of ports of the microcontroller.

8. CONCLUSION

The main objective of this paper is developing the gas leakage detection and control system, automatic watering of the plants, automatic control of lights. This system detects leakage of LPG gas and as an emergency measure the system will turn off the regulator, while activating the alarm. The leakage is detected with the help of MQ-6 g a s sensor. Sensor sends a signal to microcontroller. In the next step microcontroller sends an active signal to other externally connected devices. The cost involved in developing the system is significantly low and is much less than the cost of gas detectors commercially available in the market. In this paper, it is suggested to use the relay and Water pump to provide water to the plants. The system can be automated in such a way that, management of water at regular intervals to plants. PIR Sensor allows sensing the motion, to detect whether a human has moved in or out of the sensors range. When the sensor detects the human presence, it automatically lights on otherwise lights off.

9.REFERENCES

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