

Implementaion of High Performance Home Automation using Arduino

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Abstract

In this day and age we individuals are such a great amount of occupied in our lives that we have to control some of our undertakings naturally. Some time we don't recall switching of the lights and other electronic apparatuses in our homes. This prompts increment in our power bills and additionally wastage of force. To take care of this issue the work is done to control the gadgets in our home with cellular telephones and PCs. This prompts a mechanized home whose gadgets can be controlled consequently if there is any action saw for the same. The work is likewise done to distinguish any sort of action in the house for wellbeing reason like fire alerts for identifying fire and fan for stickiness in the house. Arduino Uno, PIR sensor, LM35 and IR Led are utilized as primary segments. Interfacing of parts with Arduino and afterward with MATLAB and XAMP is finished.

Keywords: Arduino UNO, Automation, MATLAB, PIR Sensor, Safety, XAMP

1. Introduction

Home Automation is controlling and managing the basic operations in a household automatically. It is very inconvenient to have to do every single task manually so to make our lives a bit easier, the concept of home automation has been introduced. Home automation necessitate us tot introduce computerized or automatic control to certain electrical and electronic systems either house or factory. These include wiring, lighting, plumber, air conditioner control, smoke indicators, etc. A microprocessor or micro-controller or FPGA based system is used to control the various appliances. These systems control the appliances according to configuration. For example they may be capable to turn on the lights at particular time, or they should quantify the humidity with help of hardware sensor and turn On/Off lights accordingly. Remote control is the most basic example of automation. It lets us control a particular device according to us by sitting within a specific range.

The concept of the project is creating an interface that lets us control certain devices and also allows us to monitor several occurrences around the house. The interface created is on XAMP that has SQL and Apache which enables the user to do the programming related to the circuit. XAMP further transfer data to MATLAB which in turn sends the data to the Arduino and the device can be controlled according to the conditions. The project revolves around making a website that controls all the basic information related to the sensors and does all the necessary monitoring.

In this project our target is to achieve these following functions effectively:

1.1 Controlling Light/Fan

In case we need to control the switching ON and OFF of the lights or fans in a house wirelessly, we can program our Arduino in such a way.

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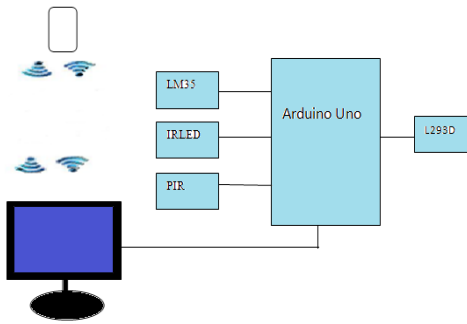


Figure 1. Block diagram of home automation.

1.2 Detecting Fire

In order to detect a fire in the household, we have used LDR which stands for Light Dependent Resistor. We observed the change in the values of the LDR on the serial monitor and according to that we incorporated the same in the code in such a way that it should be able to detect fire. Fire is detected by the intensity of light as LDR is very sensitive to light.

1.3 Detecting Motion

To detect any sort of movement in the house when there is an unwanted entrance or a burglary situation, we used a PIR sensor which detects a movement in the range of 20 feet.

1.4 Learning XAMPP

Another challenge to overcome is learning a new platform XAMPP. It is easily available cross-platform open source web server developed by Apache Friends. XAMPP stands for X-platform, A-apache, M-MariaDB, P-php, P- Perl.

2. Related Work

This field is related to the papers which are related to our project in some manner. There are many papers written on Arduino and home automation also but approaches may be different. It is important that the approach that we follow should be efficient. Some of papers that are related to our work are as follows:

2.1 Efficient Approach for Designing Gesture Controlled Robotic Arm¹

This paper is also based on Arduino platform and is effi-

cient approach to make an arm that can perform the tasks for disable people⁷. Platforms used for the work are same but to obtain different outputs. Accelerometer and gyroscopes are used as sensors to detect any kind of motion that work on principle of change of acceleration due to gravity where as in this paper temperature sensor for humidity, fire alarm for fire detection and PIR sensor for detecting any activity^{8,9}.

2.2 Bluetooth based Home Automation System using Cell Phone²

This paper is also based on making automated home but approach followed is different mainly using Arduino Bluetooth board and by using this various appliances of home are controlled. This approach uses cell phone for implementing the idea.

2.3 Home Automation using Cloud Network and Mobile Devices³

This is also a low cost system which allows remote control of various lights and other devices. The idea is to make the system using clouds computing, integration of multiple-touch cell phones and wireless communication⁶. This is quite different approach from the approach we have used to do the same.

2.4 Home Automation and Security System using Android ADK⁴

In this paper Arduino mega ADK is used where as we have used Arduino UNO which can save the cost of the system. An android application is developed for software design. This is very much similar to our paper but only different Arduino modules are used that makes differences in cost, efficiency and time consumed.

3. Components Used

3.1 Arduino

The main component used is Arduino UNO board that contains microcontroller ATmega 328 that has total 14 inputs and output pins 6 out 14 pins are working as PWM. An USB cable is used for connecting the board to power supply. Some of features of this controller board are given below:

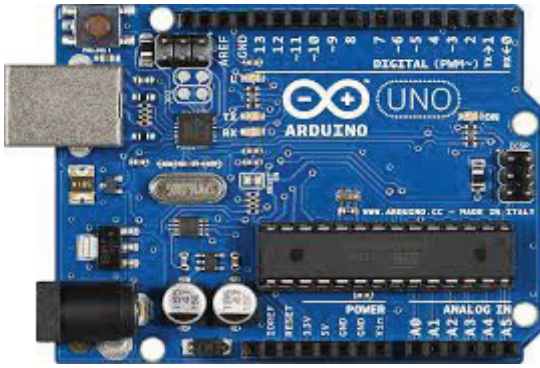


Figure 2. Schematic of Arduino UNO board⁵.

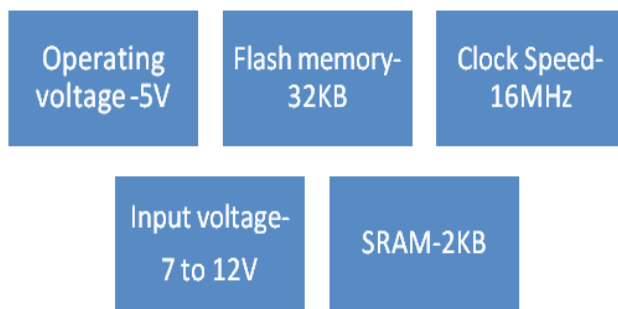


Figure 3. Features of Arduino UNO.

3.2 PIR Sensor

PIR means Passive Infrared Sensor. It is a sensor (electronic in nature) used to ascertain the amount of infrared light radiating from objects. These sensors are commonly used for detecting motion. They don't radiate any energy for detection but uses the energy of another object. That's why they are called passive. They measure or detect the IR emitted or reflected by an object. This technique is used for detection purpose by PIR sensors.

3.4 Infrared LED

Infrared light emitting diodes are special purpose diodes which transmits infrared rays. They are made up of Gallium Arsenide or Aluminum Gallium Arsenide. They

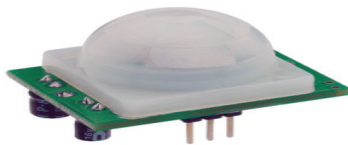


Figure 4. PIR sensor for motion detection.

are mostly used as sensors. They can't be identified with naked eyes whether they are on or off. For this camera in our cell phones can be used because it can show the IR rays give off by IRLED.

3.4 Temperature Sensor

Temperature sensors that we have used in our project is LM35. In these sensors their output voltage is propor-



Figure 5. Infrared light emitting diode.

tional to the temperature. It has an advantage that it does not require any calibration for having accuracies. This is used with single power supply and can measure the variations in temperature precisely.

3.5 L293D

L293D is a motor driver IC. It can act as current amplifier i.e. converts a low current signal to high current signal which is used to run the motors.

4. Working

4.1 Interfacing Arduino with Matlab

Arduino Hardware ships with MATLAB support package. MATLAB help us to communicate with an Arduino board over a USB cable. The package helps us to perform following tasks:

- Obtain analog and digital data from Arduino board.
- Control devices with both PWM and digital outputs.
- Drive DC, servo and stepper motors.
- Work with peripheral devices and sensors connected over I2C or SPI.

MATLAB is high level interpreted language. That's why we are able to see immediate results from I/O instructions

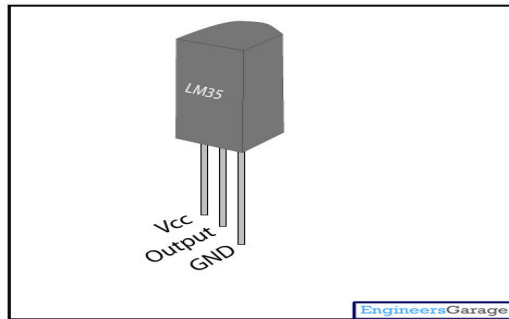


Figure 6. Temperature sensor for humidity.

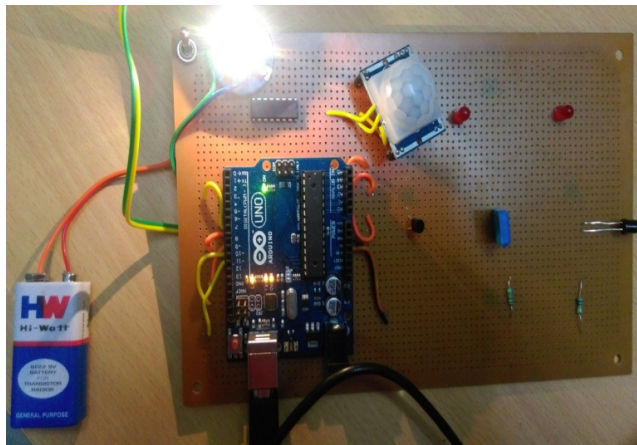


Figure 7. Showing working of bulb.

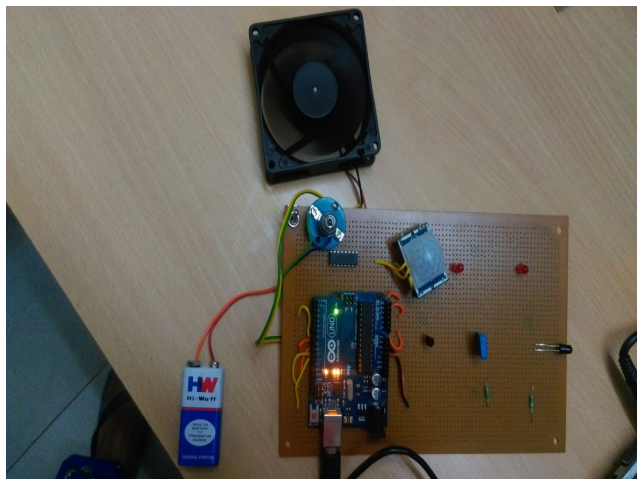


Figure 8. Showing working of Fan.

without any need of compiling. MATLAB supports various built-in math functions that help us to analyze data receive from Arduino. After interfacing the hardware and software and running the code on Arduino the required results can be obtained as shown in the Figures below.

5. Conclusion

Our home automation system is working satisfactorily when we connect equipment to it. We are also able to control equipment from a wireless mobile device. The concept of the project is creating an interface that lets us control certain devices and also allows us to monitor several occurrences around the house. The interface created is on XAMP that has SQL and Apache which enables the user to do the programming related to the circuit. XAMP further transfer data to MATLAB which in turn sends the data to the Arduino and the device can be controlled. The project revolves around making a website that controls all the basic information related to the sensors and does all the necessary monitoring.

6. Future Scope

This project has great reference for future as this is just a prototype and further a lot of work can be done to make all the devices in the house automated. We have developed a website to control the devices so that actions can be taken accordingly also if the fire and humidity are noticed then alarm and fan are activated automatically. Further we can add automatic water sprinklers for wire and more improved design of website can be made to have more information about the operational timing of every device. This means to have an eye on our house and what activities are going on inside can be taken care of.

7. References

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