Home Automation System

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***Abstract*—Home automation systems achieved excellent efficiency within the last decades and it will increase the comfortability of our life and it will also make our life much easier. Having the ability to manage aspects of our homes, and having the feature to respond automatically to events, it's changing into an additional popular and necessary because of security and value purposes. At present most home automation systems carry smartphones and microcontrollers. A smartphone application is employed to regulate and monitor the house appliances using different kinds of communication techniques. During this paper, we tend to propose an advanced home automation system that is capable of replacing the old generation light control system.**

Index Terms— Home automation, Arduino uno, sensors, LED

I. INTRODUCTION

A. Background information

The home automation system is growing quickly, they are acquainted with providing comfort, convenience, and quality of life. People just like the comfort of maintaining and changing the standing of appliances from any part of the globe using remote access. It is eventually becoming the need of every person and also, we are living in the world wherever everything goes to be automatic from our washing machine to ceiling fan and also other electric appliances.[1]

The world revolves around the word automation and the ones that are automated are said to be next-generation because they limit the involvement of humans.[1] They are self-sustaining to control on their own and thereby, saving time and cost by being a lot more efficient than the manual ones. The popularity of smart home automation systems began to extend because a completely different technology began to arise. Smart home automation systems turn into an energy efficient and more cost-effective technology for customers.

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B. Overview of this report

The main objective of our project is to save energy and to reduce the electricity usages cost. From our project, we can analyze the environment lighting, the light sensor will adjust the lighting condition in our home as well as the humidity temperature sensor will detect the surroundings temperature and turn the fan on or off and also the ultrasonic sensor will detect the presence of a person and turn the electric appliances on or off, hereby, light or fan. The process repeats every day. In this project, the goal is to reduce the amount of energy consumed and thereby reduce the cost incurred due to energy loss thus proving to be a cost-effective strategy.

II. LITERATURE REVIEW

Home Automation Systems:
A smart home is an emerging technology growing continuously now. The systems using wireless communication can be made by linking up stand-alone appliances that are present at home or office and integrating to form a co-operating network. The user application layer makes use of web browsers, pocket PC or a central console. Voice commands can also be used for controlling the appliances.[2]
Thinking of Smart Home Technology:
When the electrical equipment like charger, lamp light is plugged in but it is not in use, there still has the flow of electricity. That will lose the electrical energy about five to ten percent of regular uses.[2] It causes many accidents such as the conflagration from an electrical short circuit. Many of us forget to unplug devices when they go out of the house. On the other hand, if they go out with forgetting to unplug, they must go home to pull the plug out to avoid the risk, so it is a waste of so much time. In order to solve these problems, smart home technology will be the best solution.
Features of Home Automation System:
In recent years, wireless systems like Remote Control, Bluetooth, have become more popular in-home networking. In automation systems, by the use of wireless technologies, we are gating several advantages which are time-consuming, cost-effective, that could not be achieved with the use of a wired network only.[2] Automation reduces waring costs, we can control devices from anywhere in the world, and we can easily add any new device also we can build security system for our smart home.
Home Automation and Security System:
Home Automation and Security System based on GSM (Global System for Mobile Communications**)** and Android application implies that whenever a person enters the house then an SMS will be sent to the house owner's mobile phone automatically indicating the presence of some person inside the house and the house owner can take some preventive measure in order to protect his house from the burglar. The best part of a smart home is that owner can control the home appliances vary easily using an android application present in

the mobile phone which will reduce human hard work. The list of all home appliances along with TURN ON and TURNOFF buttons will be provided in an android application. By clicking on that particular button, the person will be able to TURN ON and TURN OFF the home appliances using a simple android application.[3]

Benefits and risks of smart home technologies:
There are lots of benefits of smart home technology. It saves energy, makes things less effort, saves time, saves money, improves society, provides comfort, improves the quality of life, provides care, and increases property value. But there are some risk issues, like most of the company how related to smart homes are new in the market. So, they might have some errors with their parts, they may not have enough expert labor for installation.[4]

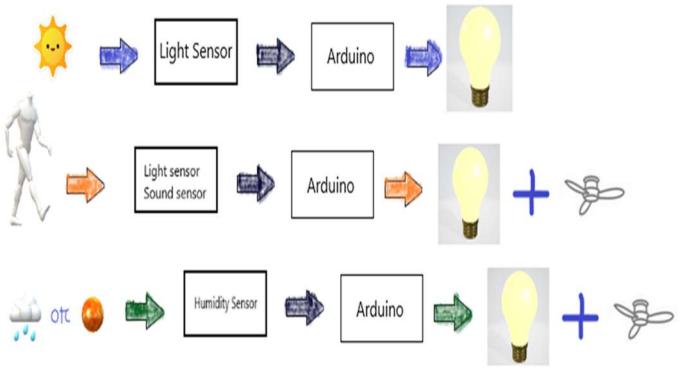

Figure 1:Pictorial view

III. PROPOSED SYSTEM

The main objective of our project is to save the energy and to reduce the electricity usage cost by analyzing the environment lighting, the light sensor will adjust the lighting condition in our home as well as the humidity temperature sensor will detect the surroundings temperature and turn the appliances on or off and also the ultrasonic sensor will detect the presence of a person and turn the electric appliances on or off, hereby, light or fan. [3] Mainly, the proposed circuits include sensing components such as light sensor which will receive the inputs from the Arduino UNO and will glow the LED accordingly moreover the ultrasonic sensor will receive the wave and send the response to the Arduino UNO for turning on appliances such as lights, fan etc. Furthermore, the humidity temperature sensor will receive the temperature of the surroundings and send the response to Arduino UNO for turning on the fan in the room. The Arduino UNO is programmed in such a way that it will receive the responses from the sensor and analyze the data according to the flowchart, along with it will automatically adjust the appliance's working condition as accurately as possible.[4]

A pictorial description of the model is given below:

IV. COMPONENTS

Sl. No	Components	Specification
1	Arduino UNO R3 v 1.00	22 pins, 6-20V Operating Voltage
2	LED (3 types; Red, Blue, Yellow)	5V Operating Voltage, 5 mm
3	Arduino Alphanumeric LCD breakout board	16*2 pins
4	Grove Light Sensor	Photo-resistor enabled
5	Grove Ultrasonic Ranger	Sound ranging probe
6	Arduino Humidity and Temperature breakout board	Full capable, Celsius or Fahrenheit, percentage view

V.ARDUINO UNO

Here, the Arduino UNO board is a microcontroller board, based on the Atmega328 series controllers, utilizing an IDE or integrated development environment for writing and compiling codes and making it usable in the microcontroller. It includes 14 digital input and output pins, 6 of them are PWM and also 6 separate analogue inputs to connect with the electrical components. There might be more than 1 sensor or motor or switches attached to it at once. It also consists of a 16 MHz ceramic resonating function, external PSU (power supply unit), USB port and jack, an ICSP circuit header and a reset button. With the operating voltage of 5V, the input voltage limit is 7V-20V.[5]

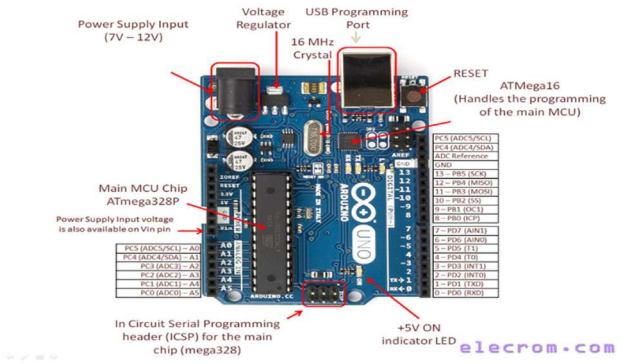

Figure 2: Arduino UNO

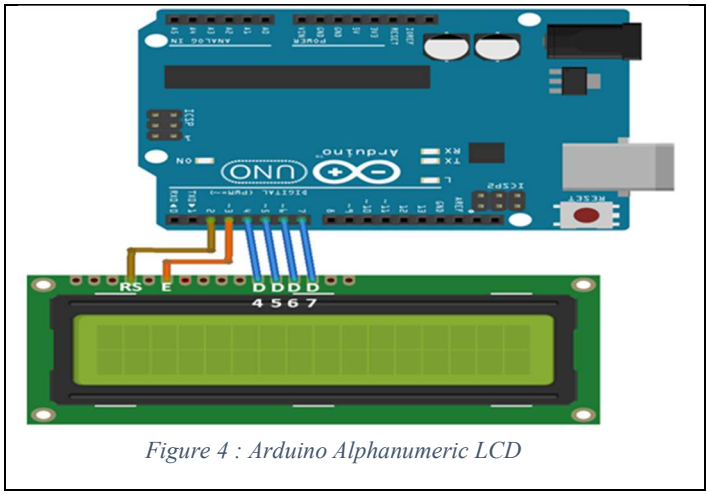

Figure 4 : Arduino Alphanumeric LCD

VI. LEDs/BULB

LEDs are light emitting PN diodes, when electricity is passed through it emits lights. The LED light emitting material is constructed of semiconductor which is colorless and helps in radiating the light rays to visible condition. There are two terminals in an LED. The anode is made up of p-type materials and the cathode is manufactured with a gold layer which helps in reflecting light rays whereas gallium arsenide phosphide present in the gold layer helps to emit the red or yellow light. While the green LED is also available. The LEDs are illuminated based on the instructions provided in the Arduino UNO.[6]

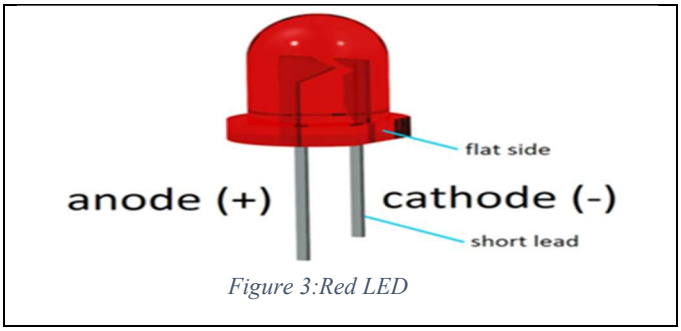

Figure 3:Red LED

VII. ARDUINO ALPHANUMERIC LCD

LCD (Liquid Crystal Display) screen is a way to showcase a module via an electronic pulse generated within a certain system. Here, an LCD screen is connected with an Arduino UNO board and the main factor it will work on is that the screen will turn on or off based on the set of instructions provided through the Arduino UNO. It has 16*2 configuration, where the 16 represents how many characters in can show on a line, and there are 2 lines here. Most commonly 5*8-pixel grid is how the characters are shown, and 2 registers are logged here, data and common register. [7]

VII. LIGHT SENSOR

A light sensor is basically a photoelectric apparatus, which is also known as a light dependent resistor. It mainly detects the intensity of the light and decreases when the light intensity is increased. The light sensor has a photoresistor (LDR sensor) to detect the intensity of light, calculated in Luminous Intensity (LUX). Naturally, the value of resistance of the photoresistor decreases when the intensity of light increases. A specific chipset (OpAmp, LM358) on board produces voltage following the intensity of light. Finally, the output value is the analogue value, depending on the intensity of light.[8]

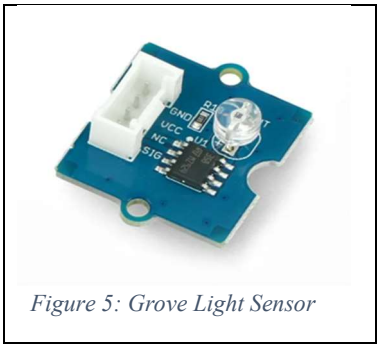

Figure 5: Grove Light Sensor

IX. Ultrasonic Ranger (Sound Sensor)

Ultrasonic Ranger is a type of sound sensor, built model is HC-SR04, which can measure distance by emitting ultrasound at 40kHz. The ultrasound has air as its medium and if there is any object or any obstacle on its path, the wave will bounce back to the source, making a presence known in the vicinity of the sensor. The supply voltage is 5v and ECHO and TRIG pins are there to attach it to the I/O of the Arduino board.[9]

Figure 6: Grove Ultrasonic Ranger

X. DHT11 Humidity-Temperature Sensor

DHT11 is a temperature and humidity sensor, issuing a digital output through any interface, like Arduino raspberry etc. It's a part of the DHTXX series family, and the other sensor is DHT22. Both can measure relative humidity, and calculate the temperature. Consisting of 3 components, a resistive humidity sensor, an NTC (negative temp coefficient) thermistor and an 8-bit microcontroller, the last one converts the analog signal from both the sensors and sends out a digital signal.[10]

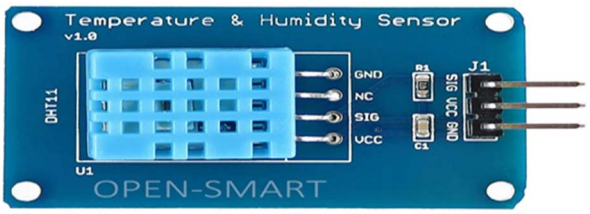

Figure 7: Temperature sensor

XI. WORKING PROCEDURE

The functionalities of our prototype are very simple and easy with some basic implementation. The light sensor is connected to the Arduino UNO and sends the response according to the flowchart. If the value of lux is less than 40 then the sensor will produce a signal which will be detected by the Arduino UNO and emit the light in the room and if the value of lux is more than 40 the sensor will detect that it's day-time then the sensor will produce a signal and Arduino UNO will keep the light turn off. Additionally, we have also used a grove ultrasonic ranger which reads the appearance of an object near it and if the object is less than 60 centimeters then the electric appliances in the room will turn on. In addition, an Arduino DTH11 humidity temperature breakout board is used to read the temperature of the environment in Celsius.

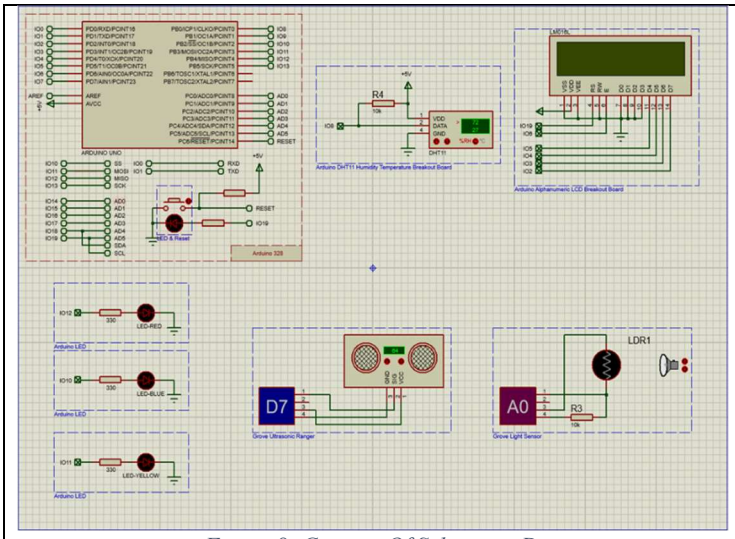

Figure 8: Capture Of Schematic Diagram

If the temperature is less than 24 degrees Celsius then the fan in the room will automatically turn off and if the temperature is greater than 24 degrees Celsius the fan of the room will automatically turn on if the ultrasonic ranger detects that someone is in the room. The speed of the fan will depend on the increasing temperature. If the temperature is little higher than 24-degree Celsius then it will rotate in slower speed and if the temperature increases in a greater amount, then the speed of the fan will be higher. In the same way the light sensor will detect the intensity of the light and the brightness of the light will be adjusted.

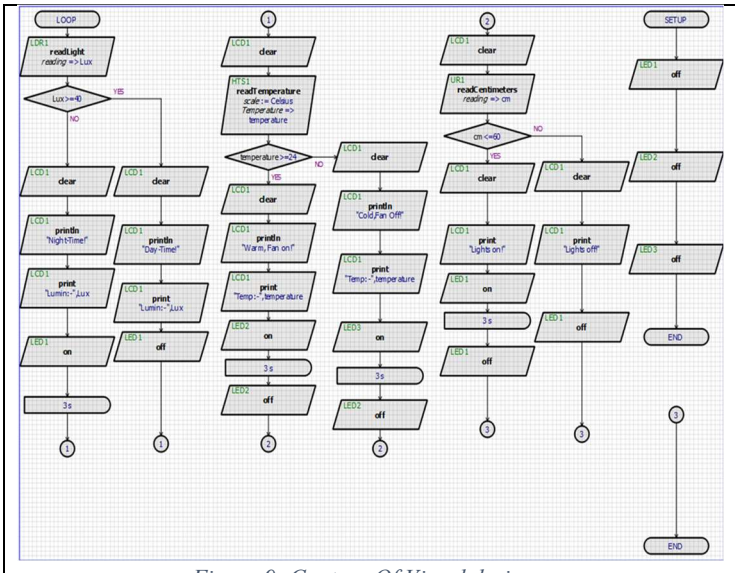

Figure 9: Capture Of Visual designer

Besides, the Arduino Alphanumeric LCD Breakout Board was used to display the current operation going on in the microcontroller and the state of the electric appliances which were used in the project. The system was designed using Proteus and the working method was defined in a flowchart. The sensors which are working in the system were taken from

the visual designer from the peripherals section. So, the pins which are connected with the sensors were not defined, the pins were automatically assigned by the Arduino UNO and the sensors or the LEDs were perfectly grounded. The usages of such a methodology could be used not only in home automation, it could be also used in cars, streetlights, etc. [11]

XII. RESULTS AND DISCUSSION

Device Name	Input Data	Verified Results	Remarks of observation
Arduino UNO board	Digital Signals	Switching on fan and bulbs using LED	Hardware is accurate
Grove Light Sensor	Outside light intensity	Dim or increase LEDs glow according to the intensity of outside light	Hardware is accurate
Grove Ultrasonic Ranger	Sense motion using sonic waves	Turns fan and light on in presence of someone in the room	Hardware is accurate
DHT11 Humidity and Temperature Sensor	Senses water amount in the air and the heat index	Turns the fan on and off, also the speed determines on the temperature	Hardware is accurate

XIII. LIMITATIONS

The sensors which are used in the system could detect the presence of a single person if more than one person simultaneously crosses the door. While sleeping in the room, if it's night-time then the person needs to turn off the light manually otherwise it will glow. For this case, the person needs to turn off the light manually. We failed to make it off automatically. In the same way, if anyone feels cold our system will not be able to detect the human body temperature. And the fans need to be turned off manually. We could use the Arduino UNO Buzzer for increasing home security. Suppose the buzzer could be used as an alert system if a fire breaks out in our home.[11]

XIV. CONCLUSION

The aim of this project was to design and perform a smart home automation system to control and monitor electronic devices like light, fan in the house and monitoring of the temperature degree & Humidity percentage, also automation of light by using motion and light sensors inside. We used sensors to send information to the system to control devices and receive statuses of the appliances. The target has been carried out successfully. These devices are controlled by the Arduino control board. As a result, the system can be monitored and controlled from the Arduino board. Moreover, the light, fan, ultrasonic ranger, temperature & Humidity sensors work correctly with excellent results. This system also uses power saving using a motion light sensor to switch on and off lights within the room-space. A significant advantage of this system is that it controls every device via the sensors. Finally, the developed system offers a versatile, economical and remotely manageable smart home automation system.

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XV. References

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