

AUTOMATIC CONTROL OF HOME APPLIANCES

Priyadarshini R¹, Jini Fathima S², Hariharan E³, ArunKumar S⁴, Pavithra K⁵

^{1,2}UG Students, Department of Electrical and Electronics Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

³UG Student, Department of Mechatronics Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

⁴UG Student, Department of Electronics and Instrumentation Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

⁵UG Student, Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

Abstract - Automation is the application and creation of technology to control and monitor the production performed with minimal human assistance. In this modern era, starting from home to industries everything is being automated, where we lag to have a single device to monitor all the essential works. So far we have separate devices and sensors to monitor individual purposes in a specific manner. The main objective of this is to connect all the purposes in a home like automatic door open and close, lights/fans on and off, gas leakage alert, alerting the overflow of tank water, temperature and humidity alert in necessary cases. This is been monitored by keeping sensors in the essential places and then get integrated to a single device where the user could monitor and get alerted with that same single device.

Key Words: NodeMCU, RF transceiver, PIR sensor, MQ-6 Sensor, Ultrasonic sensor, Temperature humidity sensor.

1. INTRODUCTION

Smart home automation system is distinct popular in modern days that give numerous of application that make everything uncomplicated and easy to control. In these days, home appliances are using wireless technology and could be accessed by internet that will make people life easier. Home Automation System is one of the ways which provides support as well as to control the electrical appliances and monitor them with mobile applications. This work explain the enhancement of recent technology in home automation like automatic door open/close, switch on /off of light and fans, tank water level indication, temperature and humidity monitoring and gas leakage detection and alerting using NodeMCU.

2. LITERATURE SURVEY:

Inorder to finalize the work, the reviews of literature have been taken. In this paper 1, RF module based wireless secured home automation system using FPGA .For security purposes a special algorithm of SDES is been used.[1]

In paper 2, Home automation using ATmega 328 microcontroller whereas all the electrical devices in a household are monitored and controlled using the user's mobile phone.[2]

In paper 3, Room temperature based automation on air conditioning. The combination of heating and cooling unit in a single air conditioner makes this system more economical where lot of techniques been implemented to control the combination of cooling and heating element which makes it more automated. [3]

3. HARDWARE

3.1 Arduino:

The Arduino is a microcontroller which is very simple to interface with sensors. Arduino pro mini is such a small and compact board as compared to the other boards. As it is compact, it is suitable for most of the applications. It is an open-source where the user could modify and use the board .Node MCU has been designed with inbuilt Wi-Fi which is used to integrate many components because it has number of analog and digital pins. The reason for Arduino promini selection is due to its smaller size, operating voltage of 3.3V or 3V, resonating frequency, USB to serial connections, prototyping and low cost. So Arduino Pro mini is used to interface with sensors in several places in home which is further integrated and controlled using NodeMCU as a whole in a particular place.



Fig - 1: Arduino Promini

3.2 NodeMCU:

Node MCU is an open source software and hardware development environment that is built around a very inexpensive system in a chip called ESP8266-12E wifi module. This can be programmed in a very low level machine instructions where it has an inbuilt wifi module. It combines features of WIFI access point and station +microcontroller. Since NodeMCU is been cost efficient, inbuilt Wi-Fi and smaller than Arduino, it is been preferred in our system where it could integrate all the sensors that are been kept in different places of the home. Node MCU is an open source IOT platform that could integrate Sensors and act as an microcontroller with an inbuilt wifi module. As it is comparatively easier and user friendly this is been used in most of the projects than Arduino and other microcontrollers.

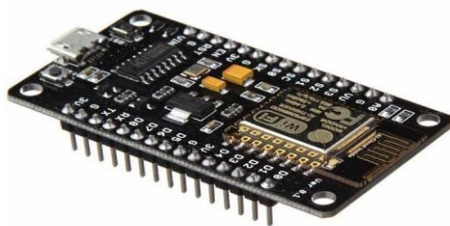


Fig - 2: NodeMCU

3.3 RF Transceiver:

An RF module is an electronic device used to communicate with other devices wirelessly by transmitting and receiving radio signals between two devices. A transceiver is a meld of both transmitter and receiver as a sole combination. It can work upto 100 meters even when there is an obstruction between them. In our home automation, the RF transceiver is integrated with Arduino promini and transmit data to the another RF transceiver where it further send data to NodeMCU. There are two modes of transmission, namely: half

duplex, and full duplex. In half duplex, the sender can send and receive data, but one at a time whereas in full-duplex the sender can send and receive data simultaneously. So here we use full-duplex mode transceiver because it offers best performance and maximizes the bandwidth. There are multiple channels available for various systems installed in adjacent rooms. Some of its consumer applications like wireless alarm systems, garage door openers, smart sensor applications and wireless home automation systems.



Fig - 3: RF Transceiver

3.4 PIR Sensor:

Passive Infrared sensor is a pyroelectric device that could sense the motion and detect the human been moved in and out of a particular range. PIR sensor works entirely by detecting infrared radiation emitted by or reflected by objects. Since PIR sensor is small, inexpensive, user friendly, works both in day and night and also requires only low power, it can be used in the automotive door open/close and also in case of automatic on/off of fans and lights in our home When PIR has been configured in a differential mode, it specifically becomes applicable as a motion detector device. Incase of a security system, the electronics in the PIR typically control a relay. Under no motion been detected the relay will be closed and in case of motion detection, the relay will open the circuit. Also by using the NodeMCU the data have been transferred to the cloud and then it can be controlled using Android applications too. Thus the PIR sensor detects whether the human has moved in or out of the sensors range.



Fig - 4: PIR Sensor- Motion detector

PIR Sensor-Configuration and Specification

VCC	This pin powers the module
High/low output	Digital pin-high(when motion is detected) and digital pin is low (when no motion detected)
Ground	Connect to the ground

3.5 MQ-6 Sensor:

MQ6 gas sensors are the foremost and essential compact sensor for gas leakage. The MQ-6 sensor module is provided with a Digital Pin and due to this, the sensor is operated even without a microcontroller and it also becomes convenient when you are trying to detect gas. For measuring the gas in ppm the analogue pin has to be used, the analogue pin is TTL driven and works on 5V so that most common microcontrollers can be used that is Arduino. During gas leakage and to know the level of LPG gas the user is alerted through small speakers or buzzers. The MQ6 gas sensors held at the kitchen is integrated with the help of Arduino Pro mini then the data is transmitted to NodeMCU using transceivers.



Fig - 5: MQ-6 -Gas Sensor

MQ-6 -Configuration and Specification:

VCC	This pin powers the module
Ground	Used to connect the module to system ground
Digital out	Used to get digital output
Analog out	This pin outputs analog voltage based on intensity of gas.
Detection Range	100-10000ppm

3.6 Temperature and Humidity:

A Humidity and temperature sensor is a device that detects and measures water vapor and also temperature due to the presence of resistive element in it (Negative temperature co-efficient) i.e. when temperature

increases, resistance decreases so that current will increase so by calculating the amount of current we can measure the temperature. The humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in air. In short, DHT-11 sensor includes a resistive element for temperature measurement and it is a NTC temperature measuring devices. It also consists of capacitive humidity sensing element. Here we can monitor the temperature and humidity and also at certain condition we can switch on AC / fan which is needed accordingly.



Fig -6: DHT-11 Temperature and Humidity Sensor

DHT-11-Configuration and Specification:

VCC	Used to powers the module
Data	Output both temperature and Humidity through serial data
Ground	Used to connect the module to system ground
Temperature range	0-50 degree celsius
Humidity range	20-80%

3.7 Ultrasonic Sensor:

Normally, people fails to notice the overflow of the tank water which results in wastage of water and electricity. Inorder to overcome this, ultrasonic sensors are been used. It sends sound waves to water tank and detects the reflection of waves. Initially, the sensor must be triggered using Arduino and received as ECHO. The Arudino will read the time lapse between triggering and receiving by using formula: Distance =(travel time/2)*speed of sound, where speed of sound is 340 m/s. By measuring the total length of water tank, calculate the water level by subtracting the resulting distance which comes from sensor from the overall length of watertank. Thus the distance of the water level is been calculated. If the tank is empty at certain distance then the Arduino will "TURN ON " the water pump by

driving relay and if the water is filled upto certain limit means the arduino will "Turn OFF" the relay automatically.



Fig -7: HCSR-04 Ultrasonic sensor

HCSR-04-Configuration and Specification:

VCC	This Vcc pin powers the module
Ground	Used to connect the module to system ground
Trigger	Input pin. It measures by sending ultrasonic waves.
Echo	Output pin.
Frequency	40 HZ
Measuring angle	15 degree

4. METHODOLOGY:

Initially, PIR sensor detects the motion of the human and sends the signal to the RF transceiver where it's been controlled using micro controllers like Arduino, NodeMCU and smart phones. This pave way for the user to control and get alerted automatically like automatic door open/close and autotomatic lights/fan on/off . Similarly in kitchen, using MQ-6 sensor the leakage as well as the level of LPG gas can be detected and alerted to the user. In addition to that, the overflow of tank water can also be detected using Ultrasonic sensor and its been alerted and controlled by the users through smart phones. Whereas the room temperature and humidity range is monitored using DHT-11 which regulates the temperature and humidity in which the air cooler / heater can be operated by controlling them through the users smart phone by receiving signals from transceivers using sensors in diverse rooms of our home.



In a nutshell, the RF transceiver is integrated with Arduino promini and it transmit signal from the respective sesonors to the another RF transceiver where it further send data to NodeMCU then the devices in our home is operated by driving the relay. And also the data from NodeMCU which has inbuilt Wi-Fi is sent to cloud then it can be controlled using mobile applications. Finally, the smart home automation system is integrated using a single smart device through transceivers and microcontrollers in appropriate places.

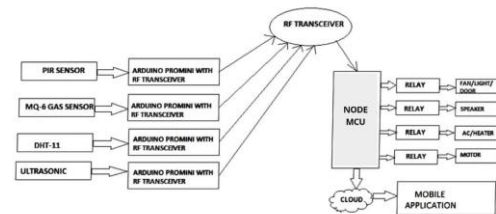


Fig 7 -: Block diagram

5. ADVANTAGES AND BENEFITS:

Automation is an inevitable one in all the places where we move towards more updated technologies like machine learning, robotics and so on. In smart home automation, we have made a device that integrate various sensors been kept in our home and can be monitored in our smartphone. Our device stands out where the sensor kept near the tank maintains long range, user friendly, integrated with multiple sensors, cost efficient NodeMCU and so on. So far many automated devices are available whereas this device could integrate various purposes of a sensor in a single device. Thus this device would help people in alerting and providing safety to the people in various aspects of their life.

6. FUTURE SCOPE:

1. Increased efficiency, control and customization of devices
2. Consumption of energy can be made better
3. Advanced sensors can be implemented for commercial purpose and it can be integrated and developed.
4. More Home automation smart devices that work well with each other and it can be integrated to customized smart controls.
5. Development of Mobile Technology and access the control using smartphones will becomes ease.

7. CONCLUSION:

Automation has been done in all the places where we have all the sensors and devices individually to store and record the data. When we look into it, it's observed that all these sensors are not been integrated in one single device. Here automatic door open/ close, fans and lights on/off, gas leakage and gas level alert, temperature and humidity alert (ie) all such sensors are integrated by a device and it is been alerted to the user. Hence automatically home safety is done through this single device. This could benefit the user rather than in monitoring all the sensors individually.

REFERENCES

- [1] B.Muralikrishna, J.Sri Varshini, A.Narayana Murthy, N.Anil Santhosh G.Saipavan kumar, B.Sai venkateswara rao, "RF module based wireless secured automation system using FGPA," in JATIT & LLS , vol. 77, July. 2015.
- [2] S.Anusha, M.Madhavi, H.Hemalatha,"Home Automation using ATmega328 Microcontroller and Android Application" in IRJET .vol.2,Sep.2015.
- [3] S.P.Alex Prabu, J.Jaya Nancy Sujitha, A.Patrick Inbaraj, E.Mohana sundaram "Room temperature based Automation on Air Conditioning" in JJAREEIE, vol.6, March 2017.