

SMART MONITORING AND CONTROL SYSTEM FOR HOME AUTOMATION

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Abstract - Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. The proposed project presents the complete design of an IoT based sensing and monitoring system for smart home automation. It uses Arduino IDE platform for collecting and visualizing monitored data and remote controlling of home appliances and devices. The selected platform is very flexible and user-friendly. The sensing of different variables inside the house is conducted using the NodeMCU-ESP8266 microcontroller board, which allows real time data sensing, processing and uploading/downloading to/from the Arduino IDE. The main focus of the project is to monitor and control water purity level of tank, leakage of gas and fire security.

Key Words: node MCU, Flame sensor, gas sensor, pHsensor, GSM module, Temperature sensor.

1. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects—devices, instruments, vehicles, buildings and other items embedded with electronics, circuits, software, sensors and network connectivity that enables these objects to collect and exchange data. Applications of IoT are home automation, energy management, media, entertainment, agriculture, security, environmental monitoring, infrastructure management etc. Home automation can quickly bring the future in to our homes by incorporating security, climate, and household gadgets and transforms our regular home into a futuristic smart home. These smart home systems can be used for simple or elaborate tasks by integrating devices and gadgets inside and outside of your home. A simple definition for home automation is the ability to do tasks automatically and monitor or change status remotely. Common tasks include turning off lights when no one is in the room, locking doors via smartphone, automates air condition systems that can sense and memorize temperature settings and appliances that help you reduce the time you spend in the kitchen.

Node MCU is an open source LUA based firmware developed for ESP8266 wi-fi chip. By exploring functionality with ESP8266 chip, Node MCU firmware comes with ESP8266 Development board/kit i.e. Node MCU Development board. Since Node MCU is open source platform, their hardware design is open for

edit/modify/build. Node MCU Dev Kit/board consist of ESP8266 wi fi enabled chip. The **ESP8266** is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer ESP8266 WiFi Module .

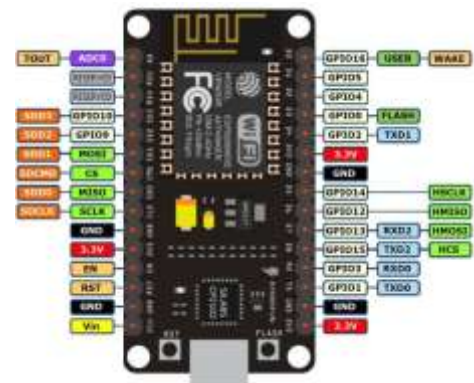


Fig-1: pin diagram for Node MCU ESP8286.

pH, commonly used for water measurements, is a measure of acidity and alkalinity, or the caustic and base present in a given solution. It is generally expressed with a numeric scale ranging from 0-14. The value 7 represents neutrality. The numbers on the scale increase with increasing alkalinity, while the numbers on the scale decrease with increasing acidity. Each unit of change represents a tenfold change in acidity or alkalinity. The pH value is also equal to the negative logarithm of the hydrogen-ion concentration or hydrogen-ion activity. pH values for some common solutions are listed in the table to the right.



Fig-2: Diagram for pH sensor.

The MQ6 (LPG Gas Sensor) is a simple-to-use liquefied petroleum gas (LPG) sensor. It can be used in gas leakage detecting equipment in consumer and industry

applications, This sensor is suitable for detecting LPG, iso-butane, propane, LNG. Avoid the noise of alcohol, cooking fumes and cigarette smoke. The sensitivity can be adjusted by the potentiometer. Features of MQ6 gas sensor are Operating Voltage is +5V, Can be used to detect LPG or Butane gas, Analog output voltage: 0V to 5V, Digital Output Voltage: 0V or 5V (TTL Logic), Preheat duration 20 seconds, Can be used as a Digital or analog sensor, The Sensitivity of Digital pin can be varied using the potentiometer.



Fig-3: Diagram for MQ6 gas sensor.

A flame sensor is a crucial safety component on your gas furnace. During the ignition sequence, your gas furnace undergoes a process where a spark or a hot surface ignitor will actually ignite the gas. As the gas is ignited, the flame sensor creates a current of electricity. The electricity is measured in micro amps. If the furnace's control board does not read the proper level of micro amps, the furnace will stop giving the system fuel to avoid an explosion. Over time, if the flame sensor is not cleaned properly, oxidation or carbon buildup can hinder the flame sensor's ability to function properly, which can result in a malfunction of the furnace. The way to establish if a dirty flame sensor is to blame for a furnace malfunction is to take a micro amp draw reading, which an expert heating technician can give you. If a dirty flame sensor is the reason, the heating expert will clean the sensor with steel wool. If dirt was the sole factor, we will see a significantly higher amp reading. If the reading shows no change, the technician will carry on with the furnace repair diagnostic process.



Fig-4: Diagram for LM393 Flame Sensor.

2. RELATED WORK

A Smart Home (SH) is the integration of technology that enables users to achieve a better quality of living. SH can help to improve security, comfort, convenience, an energy management. SH aids elderly and disabled people by providing them a safe and secure environment. Basically,

SHs can be categorized into two types namely, wired and wireless systems. Wired systems use optical fibers, bus lines, and power lines. SH can simultaneously work on wireless and wired systems. SH automation systems have gradually become all-purpose portable controllers that provide convenience to people in their daily routines. A SH is an environment where heterogeneous and electronic devices are connected together to deliver smart services to individuals. A SH is designed to improve the standard of living, safety, security, and reduce energy consumption and resources. In addition, SH plays an important role in community development. In an SH environment, smart appliances can be directly connected to the home network, and the commands are given by users to individually control each appliance. Smart devices can automatically react when commands are given either through voice, smartphone, or computer. Majority of control applications are interrelated to lighting, motion, security, entertainment, and temperature. The use of smart phones and computers are crucial because they are technological benchmarks in the modern era.

The project that manage home appliances through IoT, where the temperatures, fire, and gas were controlled by using different sensors. This type of system is useful when the user is away because it monitors temperature, detects liquid petroleum gas leakage and fire, and provides brief information on household safety when fire and gas leakage are detected. In other words, the gas sensor detects the leakage and immediately alerts the user through an SMS to the mobile phone and the people at home by turning on the siren and displaying the message on a mobile phone through application. Similarly, an SMS is automatically sent. It determines a range of temperatures, fire, and gases because it uses different sensors. In addition, the data uploaded to the web server are updated and can be retrieved from anywhere in the world. In summary, IoT is used to enhance the safety standards, where the communication between sensors and transducers is wirelessly resolved by using one chip through Wi-Fi.

3. PROPOSED WORK:

The proposed project is to monitor and control the home appliances. It is going to cover three modules namely Temperature based fire detection, Gas based fire detection, water purity check. Main objective of the project is being proactive. This project mainly focuses on monitoring the above mentioned modules and sends intimation to owner if the house is in danger via GSM module. If the modules cross its threshold level, then it gives the alert to the respective members before it happens. Temperature based fire detection module measures the temperature of the room and predicts the fire occurrences in the house based on threshold value which is fixed. Gas based fire detection module senses the gas leakage and alerts the user that the house is in danger. Water purity check module is to check the purity level of water and intimates the user to clean the water tank in the house. All the modules are connected as a system and used in the house.

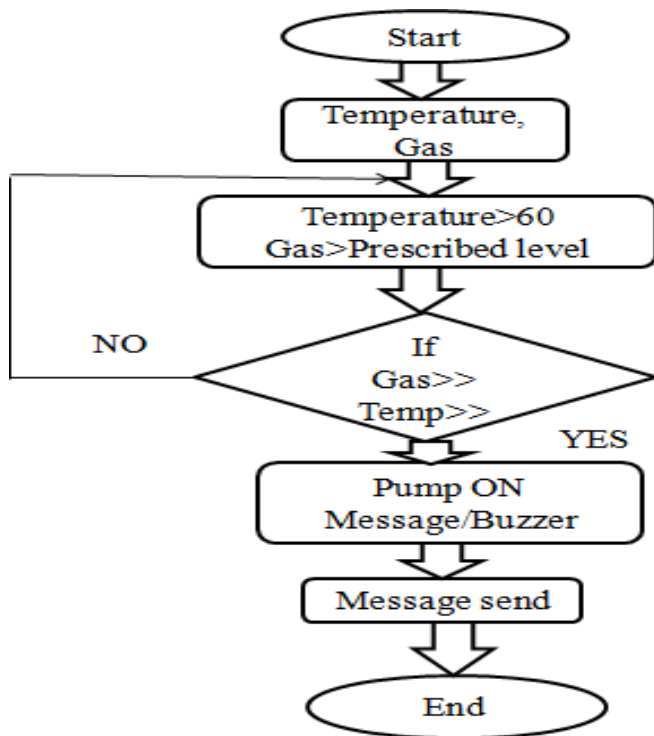


Fig-5: Flow chart for interfacing node MCU with gas and flame sensor.

3.1 TEMPERATURE BASED FIRE DETECTION

Initially, the temperature is monitored regularly using Temperature Sensors which measure the amount of heat energy or even coldness that is generated by an object or system. It allow us to “sense” or detect any physical change to that temperature producing either an analogue or digital output. When the temperature level crosses the threshold value, it sends an alert SMS to the owner and turns on Buzzer/Siren at the same time and indicates basic level of danger. It may end in danger.

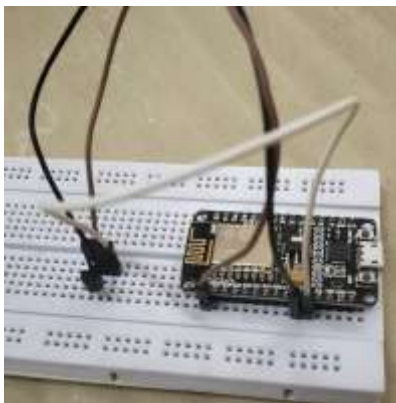


Fig-6: Connection diagram for interfacing LM35 temperature sensor with Node MCU

3.2 GAS DETECTION

Secondly, detects the LPG gas leakage. If the LPG gas level crosses the threshold level, then it sends SMS to the user using GSM modem. Also, the LPG detector system turns on the buzzer to indicate the person nearby to the system. And at the same time Relay is turned on. Node MCU has in-build Analog to digital convertor so we need not connect any external ADC IC.

This module proves really helpful in cases, when there is no one in the house that has an LPG gas cylinder in it. Due to some negligence, there might be LPG gas leakage which can lead to measuring accidents. GSM based LPG detector can avoid such situations by sending an alert SMS to the owner and turning on Buzzer/Siren at the same time.

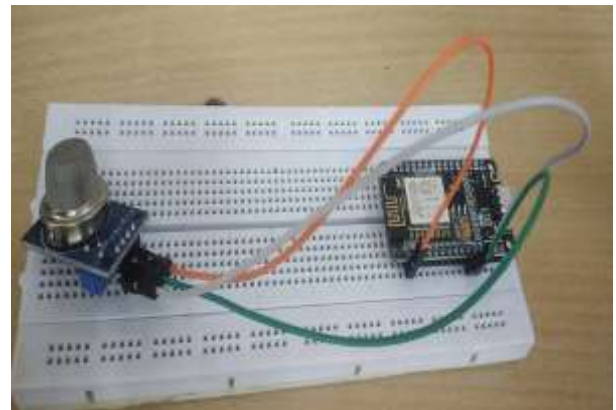


Fig-7: Connection diagram for interfacing MQ6 gas sensor with Node MCU.

3.3 FIRE DETECTION

The third level of project is very important and also critical when both the temperature and gas is detected, there is more chance for fire. In order to avoid this when both temperature and gas are detected, automatically alert SMS is send to the owner and also neighbors and nearby fire station stating that chances to fire is high. Intimation is send as DANGER to the receivers.



Fig-8: Connection diagram for interfacing flame sensor with Node MCU.

3.4 WATER PURITY CHECK

pH meter basically works on the fact that interface of two liquids produces a electric potential which can be measured. In other words when a liquid inside an enclosure made of glass is placed inside a solution other than that liquid, there exists an electrochemical potential between the two liquids.

Purpose of the pH sensor is to check the purity level of the water. If water is impure, it leads to illness. As a precautionary activity, the purity level of the water is measured in this module. If water reaches its impurity level, then an alert message is send to the house owner/tenant.

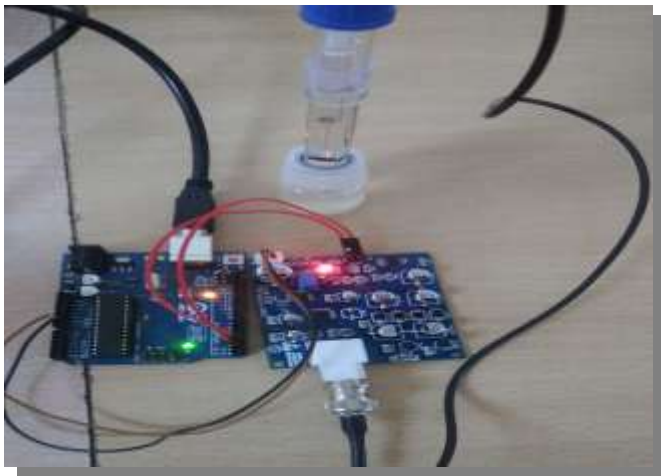


Fig-8: Connection diagram for interfacing pH sensor with Arduino.

ADVANTAGES

Savings: Smart thermostats and smart lightbulbs save energy, cutting utility costs over time. Some home automation technologies monitor water usage, too, helping to prevent exorbitant water bills. Certain devices even offer rebates.

Safety: Many home automation technologies fall under the umbrella of home security. Consumers purchase these devices because they want to make their homes safer and more secure. Automated lighting thwarts would-be burglars, and motion sensors help people enter doors and walk hallways late at night Security cameras offer benefits through either remote monitoring of package deliveries or real-time video of home inhabitants or unwanted visitors.

Convenience: Because home automation technology performs rote tasks automatically, end users experience great convenience. Lots of smart gadgets are compatible with one another, and you can set different triggers between devices to automate regular home processes. For instance, you could set your smart locks to turn on your smart lighting when you unlock the front door.

Control: Consumers also choose smart home devices to better control functions within the home. With home automation technology, you can know what's happening inside your home at all times.

Comfort: Some people use smart technology to record shows or to play music throughout the home. Connected devices can also help create a comfortable atmosphere—they provide intelligent and adaptive lighting, sound, and temperature, which can all help create an inviting environment.

Peace of Mind: Finally, many consumers invest in home automation technology for peace of mind. A new mom or dad can check on their little one thanks to smart cameras and other technologies. Or, if you can't remember whether you closed the garage after you left, you can verify remotely with an app.

CONCLUSIONS

In this paper, the project has proposed the idea of smart homes that can support a lot of home automation systems. A smart home contains a connection between wireless communication, sensors, monitoring and tracking. Smart homes are a huge system that includes multiple technologies and applications that can be used to provide security and control of the home easily. The project has proposed the idea of smart homes that can support a lot of home automation systems. A smart home contains a connection between wireless communication, sensors, monitoring and tracking. Smart homes are a huge system that includes multiple technologies and applications that can be used to provide security and control of the home easily.

FUTURE ENHANCEMENT

There are a variety of enhancements that could be made to this system to achieve greater accuracy in sensing and detection.

a) There are a lot of other sensors that can be used to increase the security and control of the home like pressure sensor that can be put outside the home to detect that someone will enter the home.

b) A smart garage that can measure the length of the car and choose which block to put the car into it and it will navigate the car through the garage to make the parking easy for the homeowner in his garage.

ACKNOWLEDGEMENT

We would like to thank all academic staff in our university for supporting us in each research. Project work at the end of term always becomes a great deal and requires great amount of work. but sometimes guidance and co-operation of other people directly or indirectly help to temp this problem.

We are thankful to our Assistant professor Ms. S. Vijaya Sharmila, who guided and taught IoT. Without her the core understanding of course work could not have been possible. Last but not least, we are thankful to everybody who directly or indirectly helped us in this project.

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