Home Automation With Real Time Mapping of Environmental Factors

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Abstract- *With the increasing development of modern technology and Smartphone, smart way of living has turned out to be a major part in the present era of human life. In this paper we presented one Home automation, which is controlled by using Android Smart Phone along with real time plotting of the surrounding environmental factors. A Bluetooth module (HC-05) is used to control the home appliances and different sensors each with a particular function to read and feed data are used to find the basic environmental parameters around you. Home automation not only helps to reduce human efforts but is also energy efficient and time saving. The main objective of home automation is to help handicapped and old aged people that will enable them to control home appliances and alert them in some immediate situations.*

I. INTRODUCTION

To start off with, the word "automation" has a Greek origin. *Auto* means "self" and *Mation* means "moving". Home automation (also known as domotics or domotica) is basically "Internet of Things (IoT)", that is the way that all of our devices and appliances networked together to provide us with a seamless control over all aspects of our home and more. *It* refers to the automatic and electronic control of household features, activity, and appliances. Various control systems are utilized in this residential extension of building automation. Some components of an automated home may include the centralized control of security locks on doors and gates, appliances, windows, lighting, surveillance cameras and HVAC systems (heating, ventilation and air conditioning).

Home automation has greatly increased in popularity over the past several years. One of the greatest advantages of an automated home is the ease with which functionality can be managed on an array of devices: desktop, laptop, tablet or smartphone. Before determining which home automation package is right for you and your family, it is important to become better informed of the features and settings associated with home safety and security systems.

Home automation systems are composed of hardware, communication and electronic interfaces that work to integrate electrical devices with one another. Domestic activities can then be regulated with the touch of a button. From any remote location, users can adjust the controls on home entertainment systems, limit the amount of sunlight given to houseplants, or change the temperatures in certain rooms. Home automation software is often connected through computer networks so that users can adjust settings on their devices.

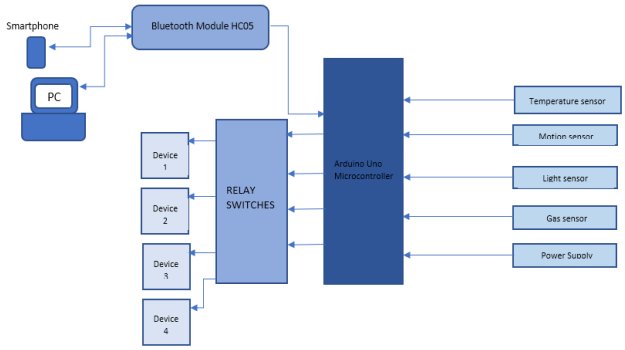
The three main elements of a home security system are sensors, controllers, and actuators. Sensors can monitor changes in daylight, temperature or motion detection; home automation systems can then adjust settings to the preferred levels of a user. Controllers refer to the devices—personal computers, tablets or smartphones—used to send and receive messages about the status of automated features in users' homes. Actuators may be light switches, motors or motorized valves that control a mechanism or function of a home automation system.

1.1 MOTIVATION

Nowadays IoT is ubiquitously in the world to style the niftier world. Due to IoT, we can see many smart devices around us. Many people, including myself, hold the view that cities and the world itself will be overlaid with sensing and actuation, many embedded in "things" creating what is referred to as a smart world. For example, today many buildings already have sensors for endeavoring to save energy, home automation. Cars, taxis, and traffic lights have devices to try and improve safety and transportation; people have smart phones with sensors for running many useful apps; industrial plants are connecting to the Internet, and healthcare services are relying on augmented home sensing to support remote medicine and wellness. One possibility is a global sensing and actuation utility connected to the Internet. Electricity and water are two utilities that can be used for a myriad of purposes. Sensing and actuation in the form of an IoT platform will become a utility. IoT will not be individual systems, but as a critical, integrated infrastructure upon which many applications and services can run. Some applications will be personalized such as digitizing daily life activities, others will be city-wide such as efficient, delay-free transportation, and others will be worldwide such as global

delivery systems. In cities, perhaps there will be no traffic lights and even 3D transportation vehicles. Smart buildings will not only control energy or security but integrate personal comfort, energy savings, security and health and wellness aspects into convenient and effective spaces. Individuals may have patches of bionic skin with the sensing of physiological parameters being transmitted to the cloud which houses his digital health, and to the surrounding smart spaces for improved comfort, health, efficiency, and safety. In fact, smart watches, phones, body nodes, and clothes will act as personalized input to optimize city-wide services benefiting both the individual and society.

II. SYSTEM DIAGRAM & DESCRIPTION



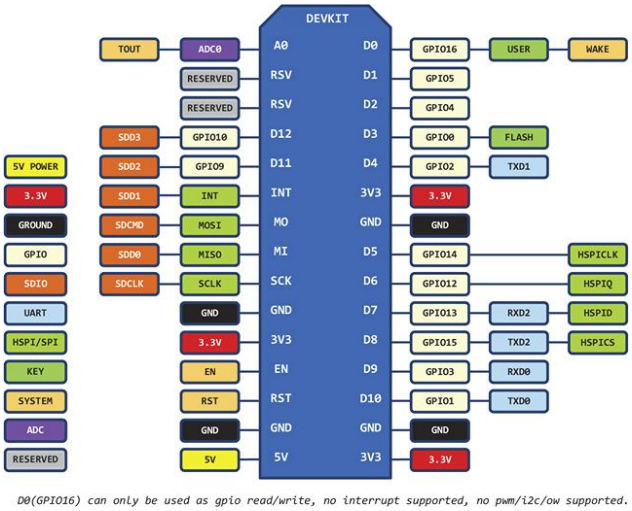
The whole project is based on a very well-known microcontroller, Arduino UNO. *The System is basically segregated in two parts- the first part deals with the automation part of the home. Here all the techniques and method for ease of operating is handled. The other part deals with different kinds of sensors and mapping the real time environmental factors on a graph.*

To automate the appliances, we have 'n' number of relay modules connected to the Arduino UNO, where 'n' is the number of appliances we need to automate. For the other part, that is for calculating the weather parameters, different kind of sensors are connected which reads the data and feeds it back to the microcontroller. Here we have used the following sensors:-

1. DHT22 Temperature Sensor
2. PIR Motion Sensor
3. LDR, Light Sensor
4. MQ-2, Gas Sensor
5. BMP 180, Pressure Sensor

III. COMPONENTS & HARDWARE

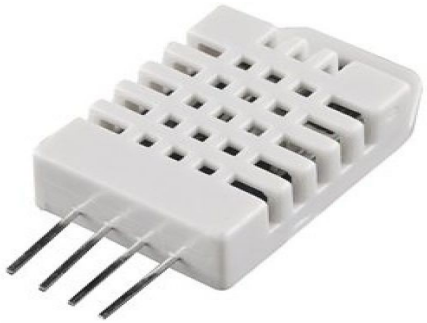
A. *NodeMCU*



D0(GPIO16) can only be used as gpio read/write, no interrupt supported, no pwm/i2c/ow supported.

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

B. *DHT22 Temperature Sensor*

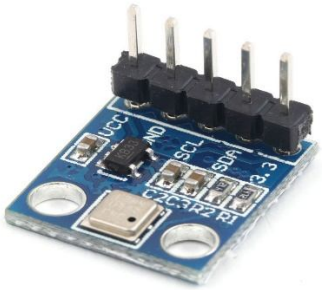


DHT22 capacitive humidity sensing digital temperature and humidity module is one that contains the compound has been calibrated digital signal output of the temperature and humidity sensors.

Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability.

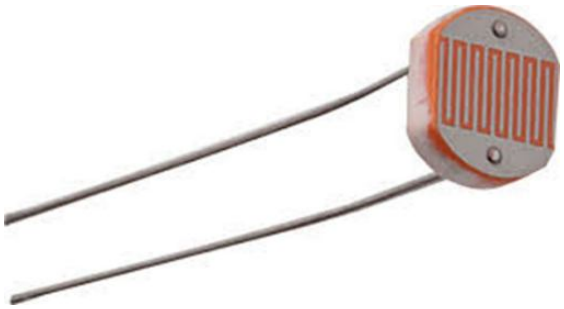
The sensor includes a capacitive sensor wet components and a high-precision temperature measurement devices, and connected with a high-performance 8-bit microcontroller. The product has excellent quality, fast response, strong anti-jamming capability, and high cost.

C. BMP180 Pressure Sensor



This pressure sensor is a BMP-180 based digital barometric pressure sensor module and is functional compatible with older BMP-085 digital pressure sensor with less power consumption smaller in size and more accurate. BMP180 combines barometric pressure, temperature, and altitude. The I2C allows easy interface with any microcontroller. On board 3.3V LDO regulator makes this board fully 5V supply compatible. BMP-180 can measure pressure range from 300 to 1100hPa (+9000m to -500m relating to sea level) with an accuracy down to 0.02hPa (0.17m) in advance resolution mode. BMP-180 is an improved replacement for BMP-085 sensor. BMP-180 uses piezo-resistive technology for high accuracy, linearity, EMC robustness and stability for a longer period.

D. LDR Light Sensor

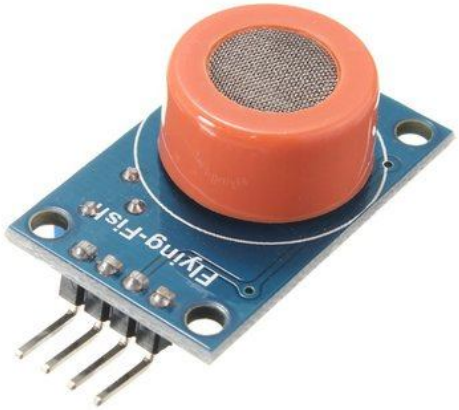


A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when the material absorbs light. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, increasingly electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is increasingly current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common working principle of LDR

E. PIR Motion Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation.

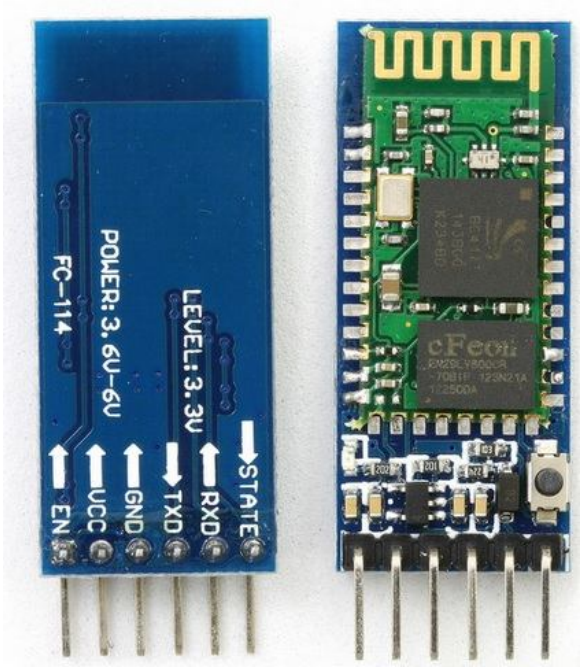
F. MQ-2 Gas Sensor



The MQ-2 is a flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its

reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. They are used in gas leakage detecting equipment's in family and industry and in portable gas detector.

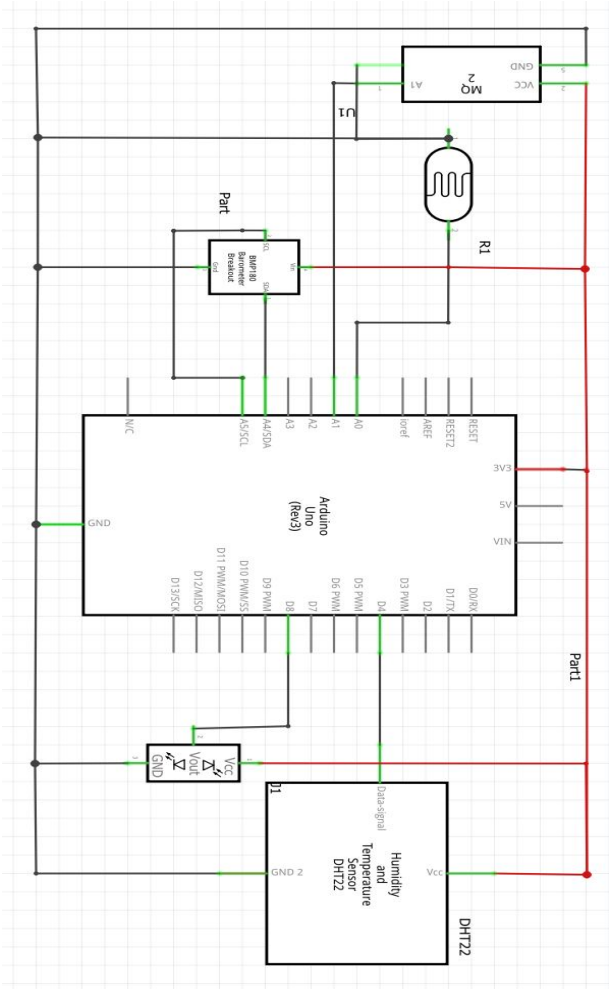
G. HC-05, Bluetooth Module



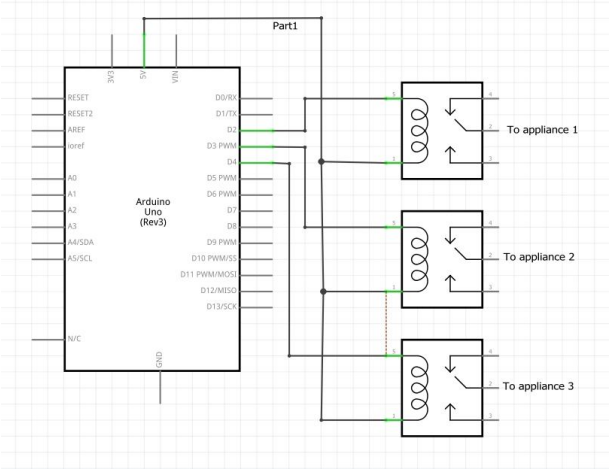
HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

IV. CIRCUIT DIAGRAMS

A. For Weather Parameters



B. For Automating Appliances



V. CALCULATIONS & RESULTS

After connecting all the sensors to the microcontroller board, all we need to do is read the data from them. But what if we want to find out certain parameters that doesn't have a different sensor for them? For example, if we need to find out the ***Dew Point Temperature*** of the

surrounding, all we need is Temperature and Humidity, and with a simple formula we can find it.

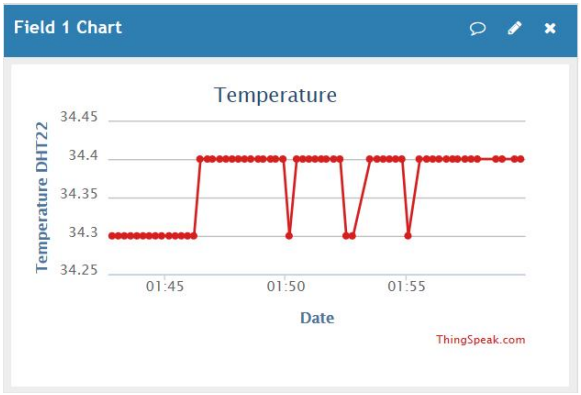
*X= log(h/100) +((17.62*t) / (243.5+t))*
And dew point (dp) is,

*dp = 243.5*X / (17.62-X)*
Here, **'h'** is the humidity and **'t'** is the temperature.

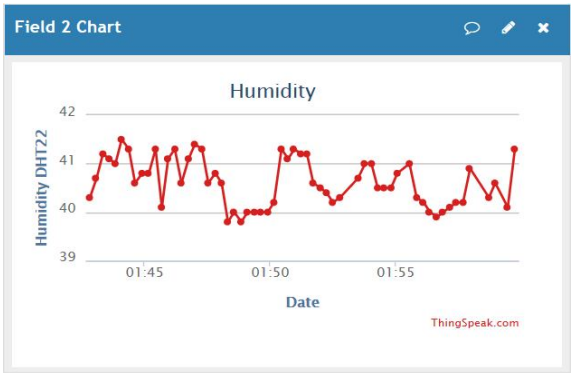
VI. WEBSERVER FOR REAL TIME PLOTTING

Now that we have the sensors feeding the data to the microcontroller, all we have to do is send it to a webserver that is always active over the internet. For this, we use an open source webserver known as Thingspeak. It sends the sensor data privately to the cloud, analyze and visualize the data with MATLAB and triggers a preselected reaction. *"Thingspeak acts as the IoT platform for data collection and analytics that serves as a bridge connecting edge node devices such as temperature and pressure sensors to collect data and data exploratory analysis software to analyze data. ThingSpeak serves as the data collector which collects data from edge node devices and enables the data to be pulled into a software environment for historical analysis of data."*.

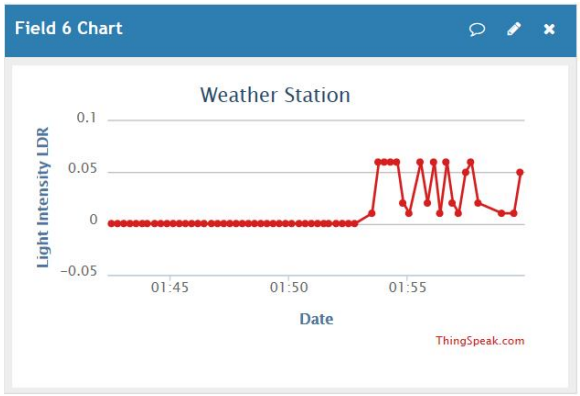
6.1 GRAPHICAL EXAMPLES



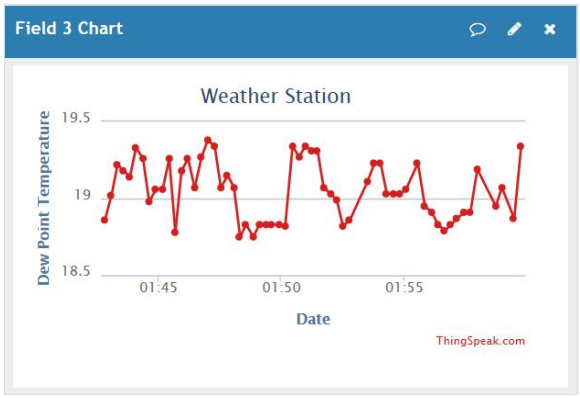
Graph 1: Temperature



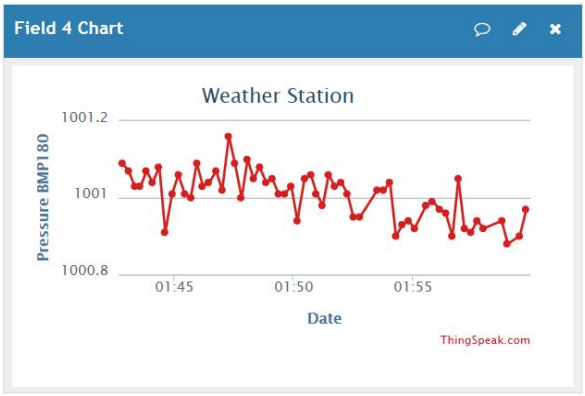
Graph 2: Humidity



Graph 3: Light Intensity



Graph 4: Dew point temperature



Graph 5: Pressure

VI. CONCLUSION

It is evident from this project that an individual control home automation system can be cheaply made from low cost locally available components and can be used to control multifarious home appliances ranging from the security lamps, the television to the air conditioning system and even the entire house lighting system. And better still, the components required are so small and few that they can be packaged into a small conspicuous container.

Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions. More energy can be conserved by ensuring occupation of the house before turning on devices and checking brightness and turning off lights if not necessary. The system can be integrated closely with home security solutions to allow greater control and safety for home owners. The next step would be to extend this system to automate a large-scale environment, such as offices and factories.

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