

IoT ENABLED WATER HEATING SYSTEM

*Project report submitted in partial fulfillment of the requirement for the
degree of*

BACHELOR OF TECHNOLOGY IN ELECTRONICS AND COMMUNICATION ENGINEERING

By

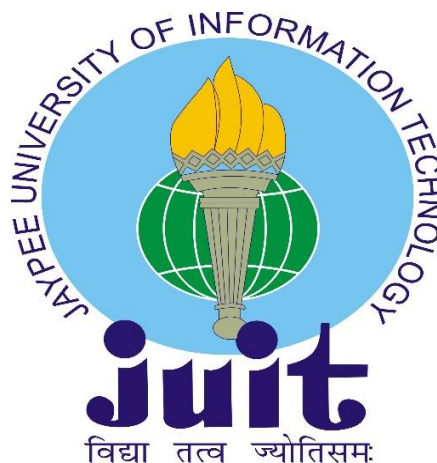
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DECLARATION BY THE SCHOLAR

I hereby declare that the work reported in the B-Tech thesis entitled “ **IoT ENABLED WATER HEATING SYSTEM**” submitted at **Jaypee University of Information Technology, Waknaghat India**, is an authentic record of my work carried out under the supervision of **Dr. Emjee Puthooran**. I have not submitted this work elsewhere for any other degree or diploma.

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CERTIFICATE

This is to certify that the work reported in the project report entitled “**IoT ENABLED WATER HEATING SYSTEM**” which is being submitted by **RISHAV KASHYAP(151078), RISHAB UPMANYU(151097) & ARPIT JINDAL(151111)** in fulfillment for the award of Bachelor’s of Technology in the field of Electronics and Communication Engineering by the Jaypee University of Information Technology, is the record of candidate’s own work carried out by him/her under my supervision. This work is original and has not been submitted partially or fully anywhere else for any other degree or diploma.

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Thanking you

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ABSTRACT

Now-a -days, the utilization of Internet of Things and home automation together has expanded significantly. Home automation and IoT in the arena of data is a developing day by day. Home automation and IoT are controlling various acitivities that are associated with home and the trend setting innovations. In this undertaking we are building up a model exhibit various parts of IoT, such as controlling gadgets electronically, utilising when required just by the outside conditions, exchanging On/Off machines with cell-phone gadgets from an alternate arena. It enables the customer to perform diverse activities of home from a remote spot. Home security is a field of home mechanization that has whole electronic role in today's World. The focus on the security parts of homes and workplaces have become important. This can be accomplished by nearby administering the systems by remote control aplications. These frame-works help to shield homes from criminals, interlopers and thieves. The security of home begin with the well-being of the home and the home well-being starts with property holders finding a way to ensure their home and its inhabitants. The ubiquity of home security automation has expanded enormously lately because of expanded reasonableness and effortlessness of the frameworks.

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CHAPTER 1

INTERNET OF THINGS

1.1 Introduction

The Internet of things or IoT is something that is responsible for the increase of availability of Internet into physical devices and ordinary gadgets. Incorporated with various devices, Internet networks and various types of equipment (for example: sensors, actuators, etc.) these devices or so called gadgets can im-part and communicate with the rest over the Internet, and they can be controlled, monitored and checked remotely.

In the era of Internet of Things, a thing can be an individual with heart embedded display, home-stead creature with a chip trans-ponder, a vehicle that has worked by embedding sensors to cautioning the driver when tire pressure is low or some other common or might be manmade item that can be provided an IP address and can exchange information over a system with such unique Id's.

Progressively talking, unions in an group of joint ventures are using IoT to work all the way more precisely, better customers to convey upgraded client administration, improve basic leadership and increment the estimation of the business in the organizational sector.



Figure 1.1

1.2 HOW IoT WORKS?

An IoT system includes web-empowered devices that use components such as installed processors, sensors and co-rrspondence equipment to gather, send (transmit) and follow up on information they sense from their surrounding environment. IoT gadgets share the sensor information which they have gathered by associating with an IoT door or other edge gadget where information is either sent to the cloud (server) to be dissected or broke down locally(large data centers). Now and again, these devices communicate with other related devices and follow up on the data they acquire from each other. These devices do the greater part of the work without human involency, in spite of the fact that individuals can communicate with these devices- consider an example, to set them up, give them guidelines or access the information.

The availability made and the systems administration with correspondence conventions utilise these web-empowered devices to a great extent to rely upon the particular IoT applications sent.

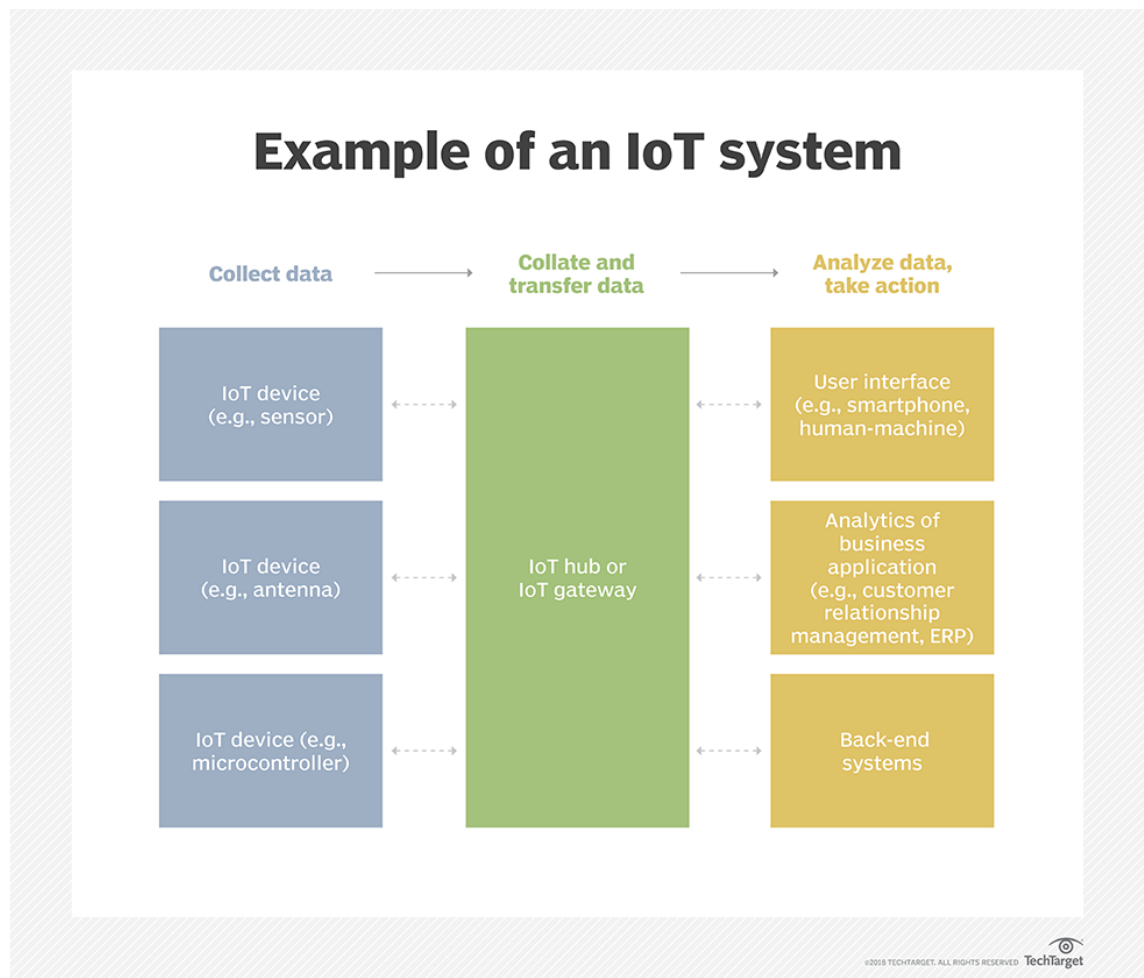


Figure 1.2

1.3 Benefits of IoT

The Internet of Things offers a number of benefits to organizations, enabling them to:

1. monitoring and controlling overall business processes.
2. improving the satisfaction and experience of the customer.
3. time and money savvy.
4. Enhancing the productivity of an employee.
5. sum-up and adjust with various business-models.
6. for better business purposes and deloyment of better decisions.
7. more profitable thus evaluate more of revenue.

IoT help companies to re-think on the ways they approach their businesses and markets and give these organisations tools to improve their business strategies.



Figure 1.3

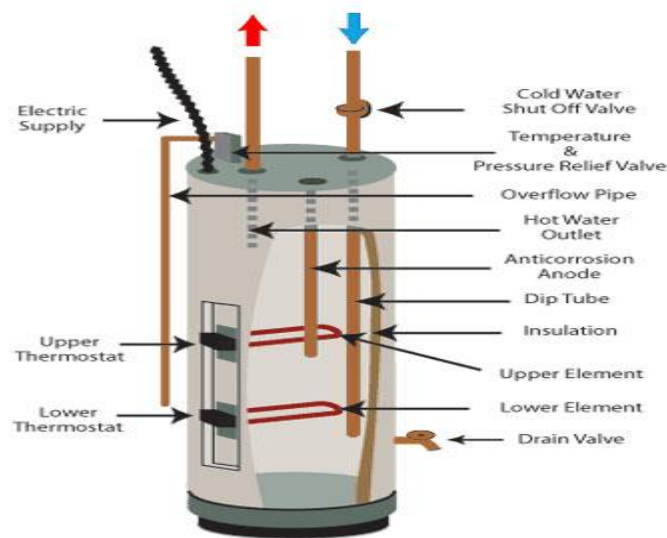
CHAPTER 2

ELECTRIC WATER HEATING SYSTEM

2.1 The Heating Process

The electric unit is generally wired to a 220volt circuit. To heat the water to a certain temperature, the ebb and flow goes through electrical obstruction warming components normally two, one at the base of the tank and the other at the center.

Regulator is a switch that detects water temperature. Power is conveyed to the every component in the system with the help of this switch. At the point when the temperature drops, the change closes to permit current stream, and it opens when the temperature achieves its preset breaking point. Indoor regulators have a advantage for setting the most extreme water temperature: by and large between 130 degrees and 140 degrees Faharenheit, or as low as around 120 degrees Faharenheit for expanded reserve funds and burn insurance.



Electric Water Heater

Figure 2.1

2.2 How do electric water heaters work?

The cold water that is poured along a water warming device that can be heated again by utilizing the recovered warm vitality from a shower with the goal that the water does not require much of vitality in order to be heated before utilizing the shower, or a dishwasher, or might be sink. The water entering a capacity tank is generally near 10°C but by recuperating the boiling water from a shower, or a dishwasher, the temperature of the water entering the holding-tank can be raised to 26°C, sparing required to build the temperature of a given measure of water by 14°C. This water is then heated up further to 37 °C before leaving the tank and setting off to the normal shower.

When re-utilizing the water from a shower (120-160 liters) or shower (~60-90 liters) the waste water temperature is around 20-25 degrees Celcius. An inhouse greywater reusing tank holds 150-175 liters taking into consideration most of waste water to be put away. Using an inherent copper heat trade with dissemination siphon the leftover warmth is recuperated and exchanged to the virus feed of a combi-evaporator or high temp water chamber, diminishing the vitality utilized by the current focal warming framework to warm water.

(In a tank, cold water enters the chamber and ascends to the top as it warms up. Not at all like with gas, the warming component is inside the tank. In a ceaseless stream framework cold water entering the unit triggers a PCB, which thus controls up the warming component. This grouping of occasions takes longer with power since it requires investment for the components to heat up, where as the impact of a gas fire is moment)

2.3 Impact and cost

Hot water represents 18% of the normal family unit service bill. Standard units set aside to 60% of the warmth vitality that is generally lost down the channel when utilizing the shower.

Introducing a water recycler decreases vitality utilization and in this way ozone harming substance discharges and the general vitality reliance of the family unit.

Common retail cost for a local channel water warm recuperation unit vary from around 400 to 1,000 Canadian dollars. For normal family unit, water warming is generally the 2nd most elevated well-spring of vitality request. The vitality reserve funds results in a normal restitution time for the underlying speculation of two to ten years as indicated by Canadian Center for Housing Technology, Natural Resources Canada and US DOE.

A two year autonomous investigation of unwanted water heat recuperation frameworks introduced in private houses in the United Kingdom discovered reserve funds of 380-kWh and 500-kWh per individual per anum.

2.4 Advantages and Disadvantages

Advantages	Disadvantages
Available as storage and continuous flow	Recovery rates for storage are poor
No products of combustion so no chance of any leakage of harmful gases	Flow rates not as good as gas counterparts
Electricity more available than gas	If there is a breakdown in insulation it could be fatal
	Hot water delivery temperature will not be accurate
	Not as reliable as gas counterparts
	Difficult to maintain
	Energy inefficient operation compared to competitive products.

2.5 Water Heater Safety

Safety is an important concern when it comes in relation to humans. Any activity that is mislead can lead to tragedy. So proper use of equipments and coponents must be there for sake of the matter. Below are listed the Water Safety hazards that can occur and the consumer need to be precacious regarding that.

The temperatures associated with heating can cause harms to anybody and direct contact with any of the heating component working on high voltages can results in devastating events.

2.5.1 Devastation

Water radiators possibly could explode and might result in huge harm, damage, or even demise if certain well-being gadgets are not introduced. A security gadget called a temperature and weight relief (TPR or T&P) valve, is regularly fitted on the highest point of the water radiator to dump water if the temperature or weight turns out to be excessively large. Many of the pipes code necessitate that release pipe may be associated with valve for coordinating progression of released high temp water to the channel, normally an adjacent floor channel, or outwards of the living area. Some of construction regulations permit the release pipe to end in the carport.

On the off chance that (gas/propane) terminated water radiator is introduced in carport or storm cellar, most of the pipes code necessitate it can be raised at any rate 18 inches (or 46 cm) over the floor to diminish the potential for flame or explosion because of spills/spilling of burnable fluids in carport. Besides, certain neighborhood code order that tank-type warmers in new and a retrofit establishments must be verified to a nearby divider by tie or grapple to avert spilling and breaking of the water and gas pipes in case of a tremor or disaster.

Most of the seasoned houses where water radiator is a piece of space warming heater, and pipes code permit, a few handymen introduce a programmed gas shutoff, (for example, the "Watts 210") notwithstanding a TPR valve. At the point when the device detects that temperature comes to 99°C (i.e. 210 °F), it stop the gas supply and anticipates in future warming. Likewise, a development tank or outside weight relief valve must be introduced to anticipate weight development in the pipes from bursting channels, valves, or the water warmer.

2.5.2 Scalding or Thermal Burns

Burning's a genuine worry with most of the water radiators. Human's skin is adaptable to high temperature rapidly, in under 5 seconds at 60°C (140°F), yet much slower at 53°C (127°F) - it takes around an entire moment for a severely area's of the human skin. The adults and youngsters frequently get genuine burns because of inabilities or moderate response times. In the United States of America and somewhere else usually practice to put a hardening valve on the outlet of the water radiator is demonstrated. The aftermath of blending cold and hot water results in the hardening valve which is alluded to as "tempered water".

The hardening valve blends enough cold-water with the boiling water from the radiator to keep the active water temperature constant at a progressively moderate temperature, regularly set to 50 °C (122 °F). With-out hardening of a valve, decrease of the water warmer's set-point temperature is the most immediate approach to lessen burning. Be that as it may, for sanitation, boiling water is required at a temperature that can cause burning. This might be cultivated by utilizing a supplemental warmer in a machine that requires more blazing water. Most private dishwashing machines, for instance,

incorporate an inner electric warming component for expanding the water temperature over that given by a residential water warmer.

2.5.3 Contamination of Bacteria

The two interfering well-being issues influence water radiator temperature—the danger of bringing from unnecessarily heated water more more than 55°C (131°F), and the danger of breeding of microbes provinces, especially Legionella, in water that isn't sufficiently hot to slaughter them. The two dangers are conceivably hazardous and are adjusted by seting the water indoor's radiator regulator to 55°C (131°F). The European Guidelines regarding Controlling and Prevention of Travel Associated Legionnaire's Disease suggest, boiling water ought to be keep away at 60°C (140°F) and dispersed so a temperature of in any event 50°C (122°F) and ideally 55°C (131°F) is accomplished inside one moment at purposes of utilization.

In the event that there's a dish-washer with out a sensor radiator, it might detect a water temperature inside a scope of 57 to 60°C (135 to 140°F) for cleaning ideally, yet hardening valves kept close to 55°C (131°F) can be connected to fixtures to abstain from singing. The temperatures of tank over 60°C (140°F) may create lime-scale stores, which could in future develop harbor microscopic organisms, in the water tank. High temperatures might likewise build carving of crystal in the dish-washer.

The indoor tank regulators aren't a solid manual for the temperature insid the tank. Gas ended water tanks might have no temperature alignment appeared. An indoor electric regulator describes the temperature at the peak of the indoor regulator, how so ever water lower in the tank can be extensively cold. An outlet sensor or thermometer is a superior sign of water temperature.

CHAPTER 3

TEMPERATURE SENSOR

3.1 General

A temperature sensor is a device that compares the temperature of an object or of its condition and changes over perusing into an electrical signal. Regular types of temperature sensors includes thermocouples, opposition temperature identifiers (RTD), thermistors, neighborhood temperature sensor ICs, and remote warm diode temperature-sensor ICs. Thermocouples, RTD and thermistors are detecting components with electrical properties that typically change with the temperature. Temperature-sensor ICs uses the physical characteristics of transistors on pass as the detecting component. Temperature sensor used for clinical evaluation meet the clinical thermometry particular of ASTM E1112 for precision. Remote warm diode temperature sensors use an outside bi-junction bi-polar transistor used as the detecting component and include all the sign molding hardware important to gauge temperature utilizing at least one outer transistors.

The wide range of choice for silicon-based temperature sensor IC can bolster an assortment of its uses including restorative, mechanical, server farm, and portable. Not with standing temperature sensors, heating controllers and thermostat IC can be linked. Our water heat controller IC display and controlling temperature level in our framework for heating applications.

3.2 Digital Thermometer—(DS-18B20)

The DS-18B20 is a programmed thermometer which gives 9 bit to 12 bit degree Celsius temperature approximations and has an capacity to alert with non-volatile client programmable upper and lower trigger focuses. The DS-18B20 conveys over a one wire transport that by definition requires just a single information line for (and ground) correspondence with a chip. Also, the DS-18B20 could be control legitimately from the information line ('parasite control'), diminishing the requirement for an outside power supply.

Each DS-18B20 has a unique 64 bit sequential code, which enables various DS-18B20 to work on a same one wire transport. In this respect, it is easy to use one microchip to control numerous DS-18B20s appropriated over a substantial region. Uses that could be gained by this component include HV-AC environmental controls, hardware, temperature checking frameworks inside structures, or apparatus, and procedure observing and control structures.

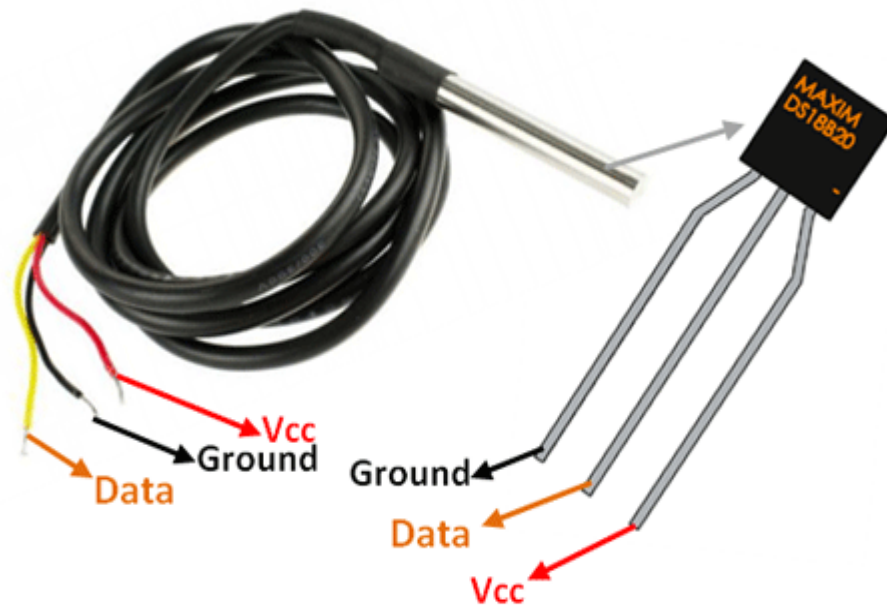
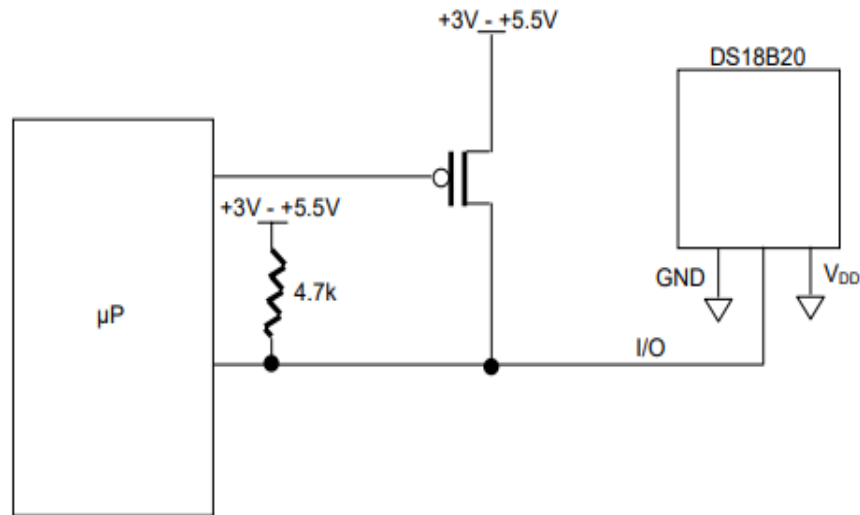


Figure 3.1

3.3 DS-18B20-Key Features

- Only One Port Pin Requirement for Unique 1-Wire Interface Communication
- Reduce Component Count with Integrated Temperature Sensor and EEPROM
 - o Temperature measurement from - 55°C to +125°C (- 67°F to +257°F)
 - o $\pm 0.5^{\circ}\text{C}$ Precision from - 10°C to +85°C
 - o 9 to 12 Bits Programmable Resolution
 - o External Components are not Required
- User Definable Non volatile (NV) Alarm Settings with Alarm Search Command Identifies Devices with Temperatures Outside Programmed Limits can be flexibly used
- Only 2 Pins required for paristic power for Operation (that are DQ and GND)
- Distributed Applications of Temperature-Sensing are more simplified with Multidrop Capability
 - o 64 Bit Unique Serial Code Stored in On- Board ROM for each device.
- Available in 8pin SO, 8pin μSOP and 3pin TO 92 Packages

STRONG PULLUP FOR SUPPLYING DS18B20 DURING TEMPERATURE CONVERSION



USING V_{DD} TO SUPPLY TEMPERATURE CONVERSION CURRENT

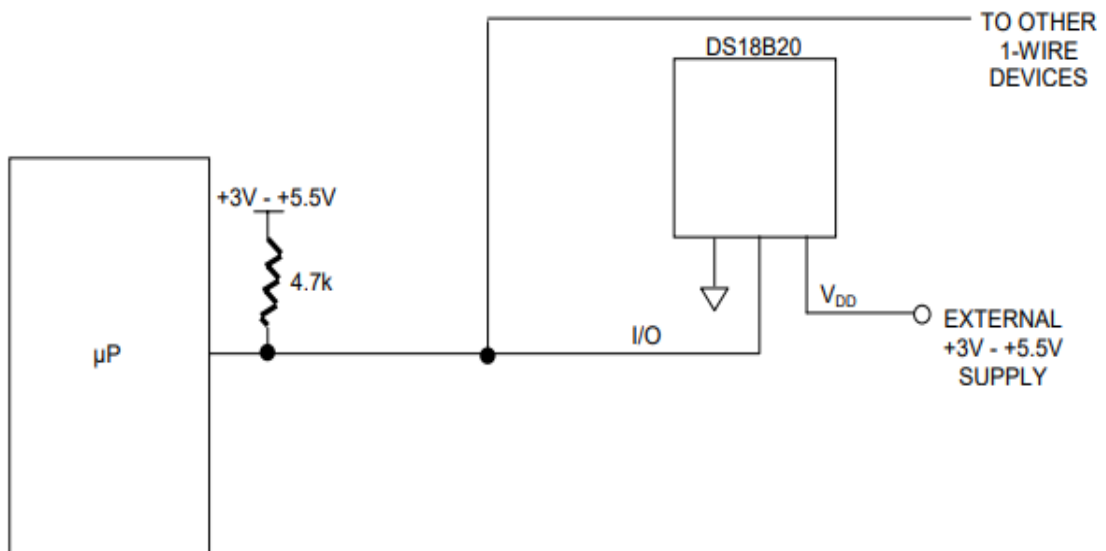



Figure 3.2

3.4 Data Sheet

PRELIMINARY



DS18B20

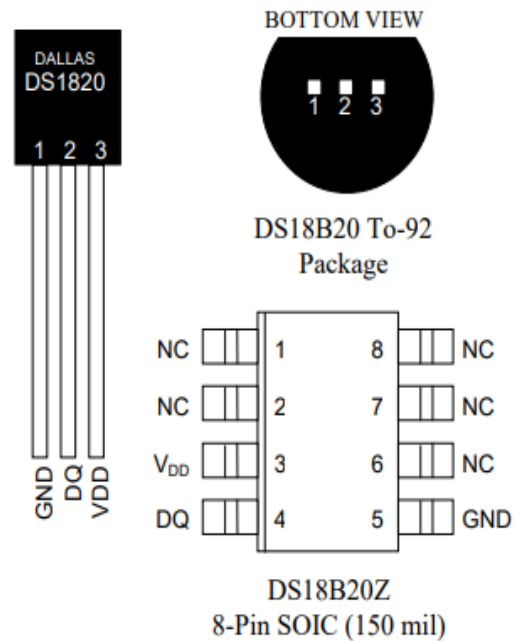
Programmable Resolution 1-Wire[®] Digital Thermometer

www.dalsemi.com

FEATURES

- Unique 1-Wire interface requires only one port pin for communication
- Multidrop capability simplifies distributed temperature sensing applications
- Requires no external components
- Can be powered from data line. Power supply range is 3.0V to 5.5V
- Zero standby power required
- Measures temperatures from -55°C to +125°C. Fahrenheit equivalent is -67°F to +257°F
- ±0.5°C accuracy from -10°C to +85°C
- Thermometer resolution is programmable from 9 to 12 bits
- Converts 12-bit temperature to digital word in 750 ms (max.)
- User-definable, nonvolatile temperature alarm settings
- Alarm search command identifies and addresses devices whose temperature is outside of programmed limits (temperature alarm condition)
- Applications include thermostatic controls, industrial systems, consumer products, thermometers, or any thermally sensitive system

PIN ASSIGNMENT



PIN DESCRIPTION

- GND - Ground
- DQ - Data In/Out
- V_{DD} - Power Supply Voltage
- NC - No Connect

Figure 3.2

3.5 Applications/Uses

- Consumer Products
- Industrial Systems
- Thermally Sensitive Systems
- Thermometers
- Thermostatic Controls

CHAPTER 4

Wi-Fi Module

4.1 Introduction

The Wifi-Module ESP8266 is a freely SOC with coordinated TCP/IP convention heap that can give any micro-controller permission access to your Wi-Fi organize. The Wifi Module or ESP8266 can either support an application or off-loading all Wi-Fi organizing storages from other application processors. Each Wifi module or ESP8266 comes pre-modified with an AT order set firmware, which states that you can importantly connect this to your Arduino device and get about as much WiFi storage as a WiFi Shield offers (and that is simply out of the container). The Wifi module or ESP8266 is very cost effective board with an regular and immense developoement of network.

The Wifi-module has a ground-breaking enough ready handling and storage ability that enables it to be coordinated with the sensors and other application explicit gadgets through its GPIO with very small advancement in advance and insignificant stacking amid runtime. The ESP8266 underpins for applications and Bluetooth coexistence interfaces, it contains a self-aligned RF enabling it to work under every single working condition, and requires no outside RF parts. Its high level of on-chip incorporation takes into account negligible outer hardware, including the front-end module, is intended to involve insignificant PCB region.

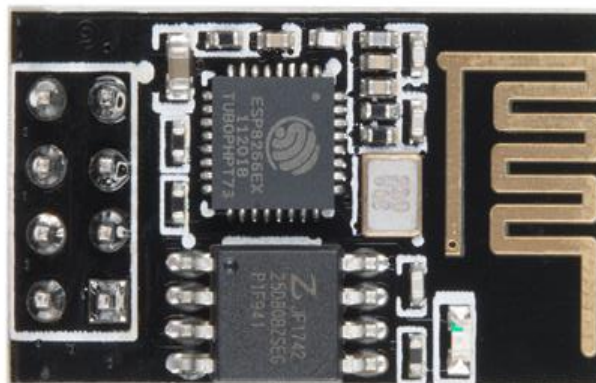


Figure 4.1

4.2 Features of ESP8266

1. IEEE 802.11 (or WLAN standard)
2. Backup and control utilization of power less than 1mW
3. Coordinated TCP/IP stack
4. Direct Wi-Fi (Point-to-Point)
5. Incorporated PLL's, micro-controllers and power the board units
6. +19.5 dBm control yield in IEEE 802.11 mode
7. Shut down current less than 10uA
8. Flash Memory of 1MB
9. Incorporated low-power 32-bit CPU can be used as Application Processor
10. SDIO 1.1 and 2.0, UART and SPI
11. STBC, 2×1 MIMO, 1×1 MIMO
12. Wake up and transmit bundles in time less than 2ms
14. Coordinated TR switch, LNA, control identifier and coordinating system

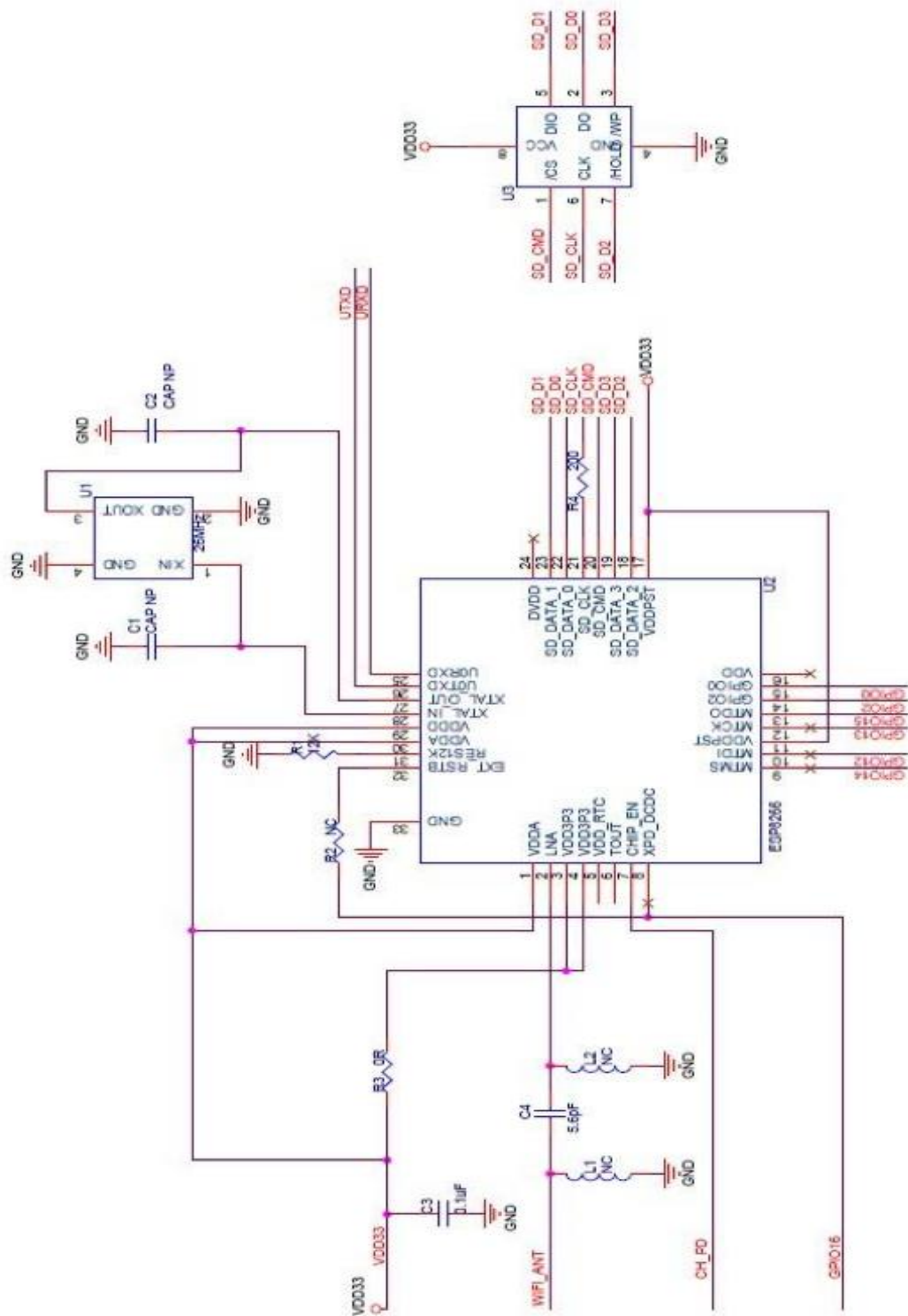


Figure 4.2 (Schematic of ESP8266)

4.3 CPU and Memory

4.3.1 Interfacing of CPU

The integrated chip that is installed in a ultralow 32bit very minute CPU, with 16 smaller modes can be considered with the CPU by means of the accompanying interfaces:

- associating storage microcontrollers may similarly be used to get to outer code memory ROM/RAM interface (Bus)
- Additionally joined microcapacity controller information RAM interface (dBus)
- Accessing the register of AHB interface
- Investigate the JTAG interface

4.3.2 Storage controller

Storagecontroller contains static RAM and ROM. CPU have the d-Bus, i-Bus and AHB interface to get to the control over the storage controller. Any of these user interfaces can give access to ROM or the RAM units, and allow the memory to decide the running request in the request of landing.

4.3.3 General Purpose I/O

Average of about 16-GPIO pins are there. The structure can allot them different storages. Each GPIO pins can be arranged by either pullup or pulldown resistors by programming registers at the input, activating edge or at CPU level on consideration on information, triggering the wake up interfere with information, open channel or corresponding push pull output drivers, programming output register source or sigma-delta PWM DAC. These pins are multi-plexed with different storages, for example consider, the fundamental interface, SI, UART, Bluetooth, etc.

4.3.4 Digital pins I/O

Advanced I/O are in two ways and three states. It includes a three state control info and output supports. Like the similar for low control task, I/O can be set to static state. For instance, when we decrease the chip's storage utilization, all the output empower sign can be set to keep up a low control state. Static storage can specifically be embedded I/O on requirement. At that point when the I/O help inside and outside circuit driving, static storage can be utilized to hold the final state. Static storage can stick to present positive criticism. Thus, the outer drive must stick to be more grounded than the

positive input. It might be as, the required main thrust estimate is still very low, in the 5uA of current.

All programmed I/O pins must include an over-voltage insurance circuit (snap back circuit) between the power and ground. Normally skip voltage is about 6V, while keeping up the voltage is 5.8V. This removes creating ESD and safeguards from extreme voltage. Diodes additionally dodge turn around voltage output devices.

CHAPTER 5

BUCK CONVERTER

5.1 INTRODUCTION

A buck converter is DC-to-DC control converter which ventures down its voltage from its supply to its load. It is a class of exchanged mode control supply (SMPS) normally containing at any rate two semiconductors (a transistor and a diode, current buck converters every now and again supplant the diode with a second transistor utilized for synchronous amendment) and at any rate one vitality stockpiling component, a capacitor, inductor, or the two in mix. To decrease voltage swell, channels made of capacitors (once in a while in blend with inductors) are ordinarily added to such a converter's load-side channel and supply-side channel.

Buck converters can be exceedingly proficient (frequently higher than 90%), making them valuable for undertakings, for example, changing over a PC's principle (mass) supply voltage (regularly 12 V) down to bring down voltages required by USB, DRAM and the CPU (1.8 V or less).

5.2 OPERATION

The important role associated with buck converter is the current that is stored in an inductor and is constrained by two switches (most part a transistor and a diode). In the converter, every one of the segments are viewed as different. In general, the diode and the switch corresponds to 0 drop in when ON while 0 current stream when OFF, and the inductor component has 0 arrangement obstruction. Further, it is accepted that the information and voltages of output do not change through the life-span over a certain frequency (this would suggest the output capacitance as being boundless).

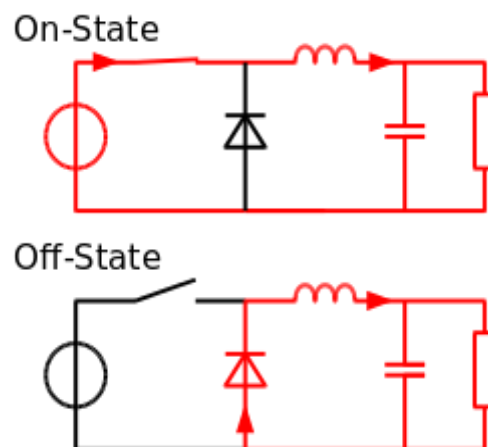


Figure 5.1

5.3 Working

The practical model associated with buck converter is best realized with the help of connection among current and voltages of the inductor. Let's begin with the open switch that is OFF state, the current in the circuit is zero. As soon as the switch is first shut, condition for closed circuit that is ON state, the current will start to increment, and the inductor will create a voltage over its terminals in presence of the evolving current. This voltage is further responsible for drop in the voltage that corresponds to source and along these lies the inclination of the net voltage over the stack. After few moments, with the increase in the value of current, the voltage across the inductor first rises to a certain peak and then declines, expanding the voltage related to the overall circuit. The inductor stores energy as an attractive field during the same moment of time. On the OFF situation the switch is opened circuited i.e. while the current is a changing yet (change in current), at that particular point there will be a drop in the voltage across the inductor, so the net voltage of the circuit will not be as exactly as the information voltage source. At that instant when the switch is opened once more ,i.e., condition for open circuit (OFF), the voltage source will be expelled from the circuit, and the current will diminish. The diminishing current will deliver a voltage drop across the inductor again (opposite to the drop at ON state), and now the inductor behaves as a Current Source. The put away vitality in the inductor's attractive field bolsters the present move through the whole circuit. This current, streaming while the information voltage source is made to separate, when linked along present streaming ON state, sums to the result that current more than the normal power supply (being 0 at same moment OFF situation). The increase in normal current compensates for the decrease in voltage, and in a perfectly gives power to the circuit. Amid the OFF state, the inductor is declining its put away vitality into the remainder of the circuit. In the event that the switch is shut again, (i.e closed circuit condition) before the inductor completely releases (ON situation), the voltage at the circuit will dependably be more similar than 0.

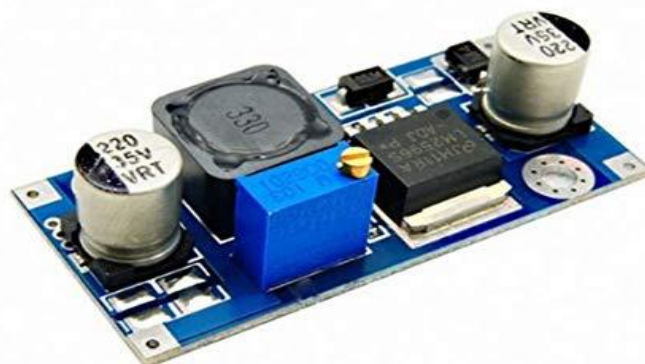


Figure 5.2

CHAPTER 6

INTEGRATED CIRCUIT

6.1 Introduction

An integrated circuit or IC is small chip-board that can function as an oscillator, timer, amplifier, micro-processor or even computer storage. An Integrated Circuit is a small wafer or small board usually made of silicon, that can have from hundreds to millions of transistors, resistors(current controlling elements) and capacitors(energy storage elements). These micro to nano scaled small electronic components can perform simple to complex calculations and store data using either digital or analog technology.

Digital Integrated Circuits use logical gates, which work only with two values that is in form of 1s and 0s. A small value in signal (i.e. low state) is sent to a component on a Digital IC that will result in a value of 0, while a exceeding voltage value of signal creates a value of 1. Digital ICs are the types you will generally find in networking equipment, computers and most consumer electronics.

Linear or Analog IC work according to continuous values. This results a component on a linear Integrated Circuit might have a value of any kind of output value with respect to other. The term 'linear' is used when the resulted value is a linear-function of the value that is supplied. For example, consider a component on a linear IC may multiple incoming value by a factor of 2.5 and output as the result. Linear IC are typically used in radio and audio frequency amplification.

6.2 ULN2803

The ULN2803A is an IC that has 50 V, 500 mA Darlington's transistor cluster. The gadget or the IC chip comprises of 8 NPN Darlington's transistors that high-voltage yields with regular cathode clamp diodes for exchanging inductive burdens. The authorized current-rating associated with each Darlington pair is 500 mA. The Darlington's transistors may be associated in parallel for high current capacity.

Applications involve transfer and hammer drivers, light drivers, show drivers, line drivers, and rational supports. The ULN2803 IC has a 2.7-k Ω arrangement base resistor for each Darlington pair for task legitimately with TTL or 5-V CMOS gadgets.

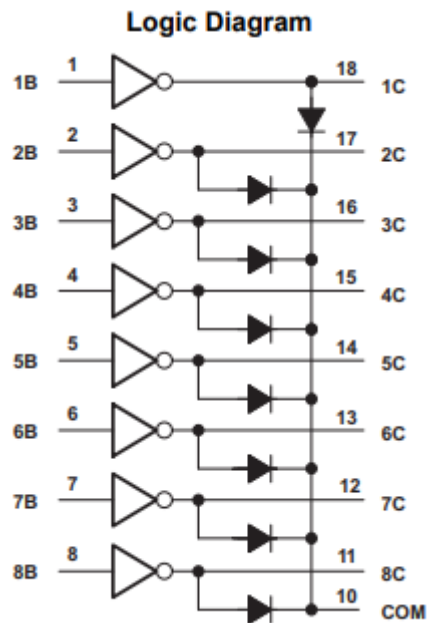


Figure 6.1

6.3 ULN2803-Features

- 500mA Single Output related Collector Current..
- High-Voltage, i.e., 50 Volts Output.
- Compatible Inputs with various logics.
- Output Clamp Diodes.

6.3.1 Feature Description

Each channel of ULN2803A comprises of Darlington's transistor associated NPN group of transistors. This association makes the impact of a only transistor with an extremely abrupt increase of the current . The high β takes into consideration high yield current that drive with a low info current, basically likening to operate with low GPIO voltages.

The GPIO voltages are changed over to current of the base through the $2.7k\omega$ (power defined with it) resistor associated between the base and information of the predriver Darlington NPN transistor.

The diodes that are associated between the yield and the common stick are utilised to stifle the kick back voltage from an inductive burden that is energized when the NPN drivers are killed (quit sink) and the put away vitality in the loops makes a turn around current stream into the curl supply through the kick-back diode.

In a normal activity, the diodes on base and gatherer pins to maker will be pivot uneven. In case these diode are forward uneven, internal parasitic NPN transistors will draw (an about proportional) current from other (near to) device pins.

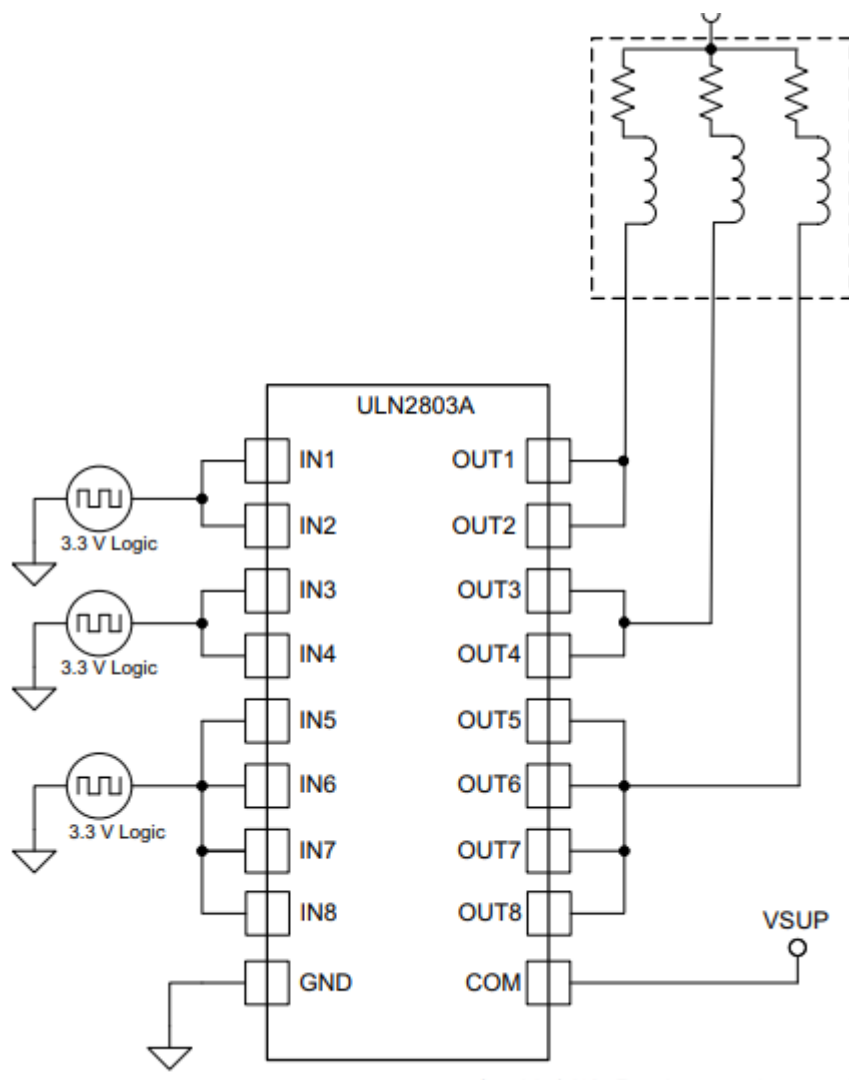


Figure 6.2 ULN2803 as an inductive load driver

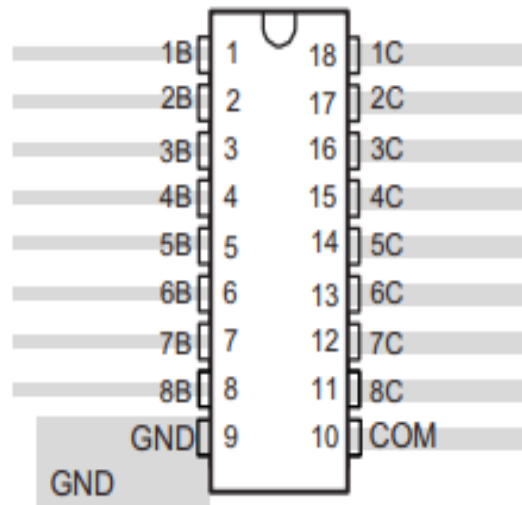


Figure 6.3

6.4 Applications

- Relay-Drivers
- Hammer-Drivers
- Lamp-Drivers
- Stepper Motors
- Line-Drivers
- HVAC Valve and LED Dot Matrix
- LED and Discharge of Gas: Display Drivers
- IP Cameras
- Logical Gates or Buffers (transistor and switch technology)

CHAPTER 8

IoT ENABLED WATER HEATING SYSTEM

7.1 INTRODUCTION

The On/Off operation of the IOT based water heating system can be done using the Android device.

As the Android device sends signal, the IC ULN2803 behaves in such a manner such that it switches the buck converter to step up and step down the voltage accordingly and as a result of which the water heating system functions accordingly.

Other features can be added by sending various inputs accordingly to obtain the desired outcomes. The timing control (e.g. if one wants the water heating system to be 'On' for a certain duration, this can be achieved).

In this way, using the concept of IoT we can build a water heating system that can be controlled from anywhere easing work of humans and depending on machines that can do task much faster requiring minimal amount of time.

The concept is helpful to all the people to comfort them and provide a luxurious taste just by a touch of a finger on their mobile phone and directly controlling the whole system.

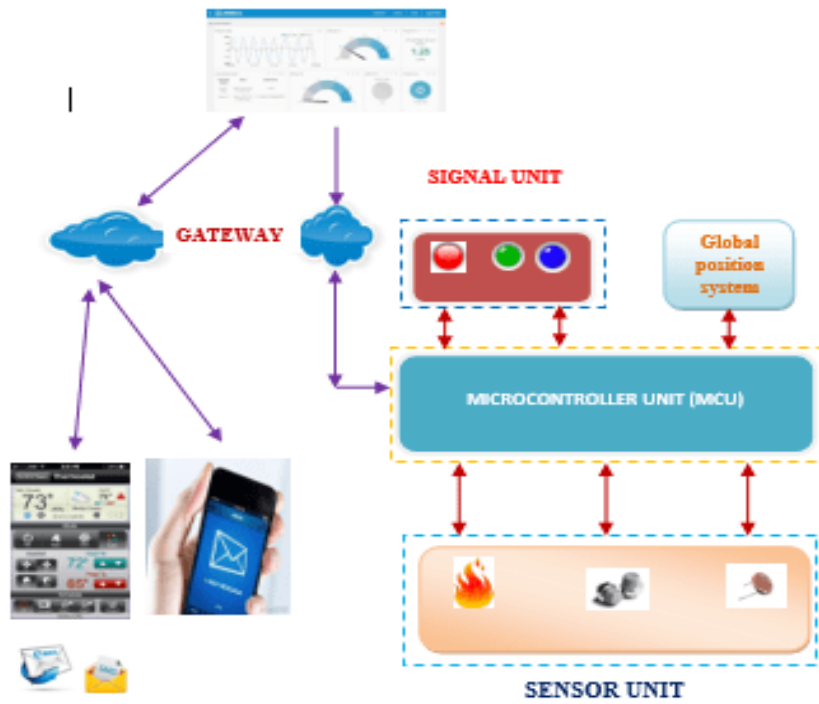


Figure 7.1

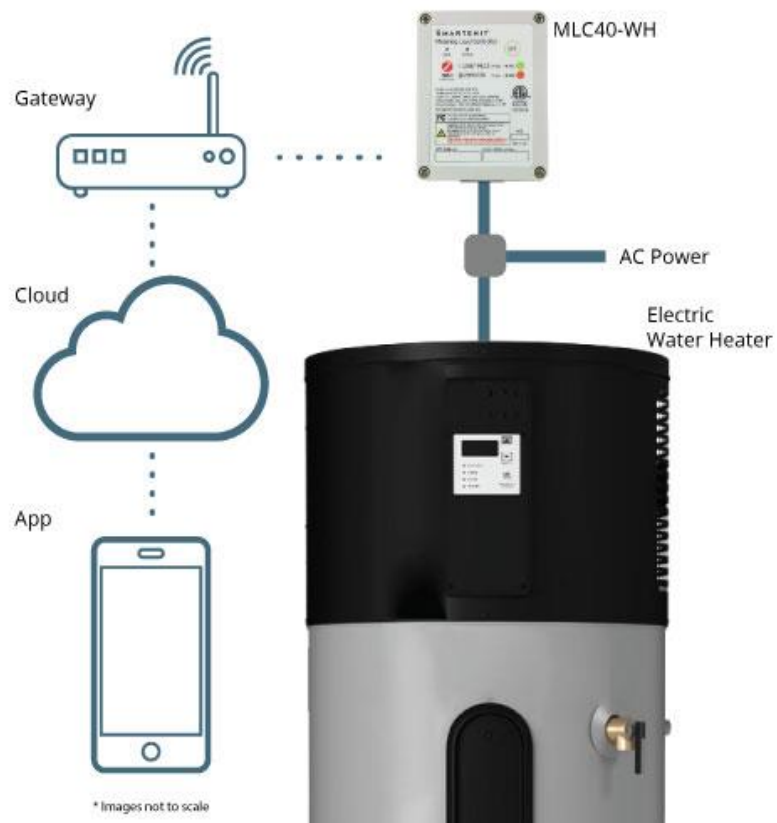


Figure 7.2

7.2 Working

Since the technology is growing day by day. It has become an essential task to monitor everything just by relying on the machines by providing them our brains. The water heating system is a device used to heat water for various purposes. Water is heated on a metallic container fitted and supported by an insulating plastic body.

An indoor regulator referred to as thermostat is a sensor device which is used to detect the temperature of a physical environment and performs certain activities on the basis of results with the goal that the environment's temperature is kept up near to an ideal setpoint.

Indoor regulators (thermostats) are used in any gadget (may be a water geyser or air conditioners) that is responsible for warming or cooling to a set-point temperature, models structure warming, focal warming, air systems, HVAC structure, water radiator, just as hardware including stoves, iceboxes, therapeutic and logical hatcheries that are used in kitchen.

An indoor regulator(thermostat) works as a control gadget, as it tries to diminish the results between the ideal and estimated temperatures. Some of the time an indoor regulator consolidates both the detection and control exercise of components of a controlled structure, for example, in a car indoor regulator.

Indoor regulators(thermostat) utilize various sorts of sensors to gauge the temperature. In one structure, the mechanical indoor regulator, a bimetallic strip as a loop legitimately works electrical contacts that control the warming or cooling source. Electronic indoor regulators, rather, utilize a thermistor or other semiconductor sensor that requires enhancement and preparing to control the warming or cooling hardware. An indoor regulator is a case of a "blast controller" as the warming or cooling gear yield isn't corresponding to the contrast between real temperature and the temperature setpoint. Rather, the warming or cooling gear keeps running at full limit until the set temperature is achieved, at that point stop. Expanding the distinction between the indoor regulator setting and the ideal temperature in this way does not change an opportunity to accomplish the ideal temperature. The rate at which the objective framework temperature can change is resolved both by the limit of the warming or cooling gear to individually add or expel warmth to or from an objective framework and the limit of the objective framework to store heat.

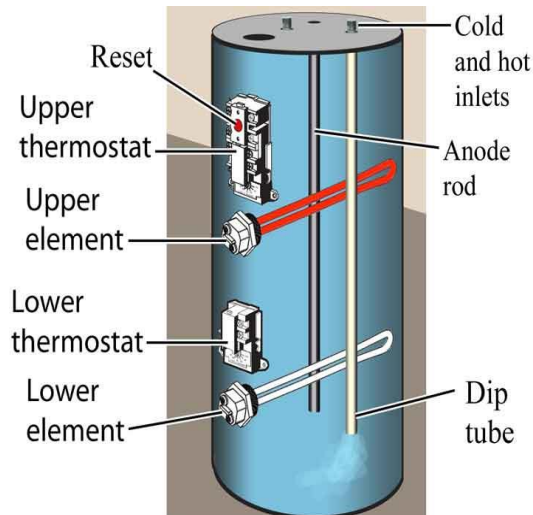


Figure 7.3

When a user selects a option in his android device to turn the water heating device ‘ON’, the communication that takes place is between the android device and the Wifi module at that instance of time.

The message further is circulated from the module to the chip (here ULN2803) and certain adjustments in connection are made such that high voltage is obtained at the output of the chip.

The buck converter is a device which is used to step up the voltage or step down the voltage accordingly to the process that takes place. In short, the buck converter behaves as a switch in our process.

In this way the projects function accordingly to our requirement.

Furthermore, other processes can also be managed like controlling the system just by commanding through android device within fraction of seconds.

This includes suppose if a user wants a temperature to be 80 degrees and the current room temperature at which the water is assumed to be 40 degrees. Now as soon as he passes a command of 'ON' the device turns to On state as mentioned by the above process.

As soon as the desired temperature is obtained the sensor sends a user a signal that you have obtained the temperature you wanted. Now, the heating system shuts Off automatically.

7.3 Block Diagram

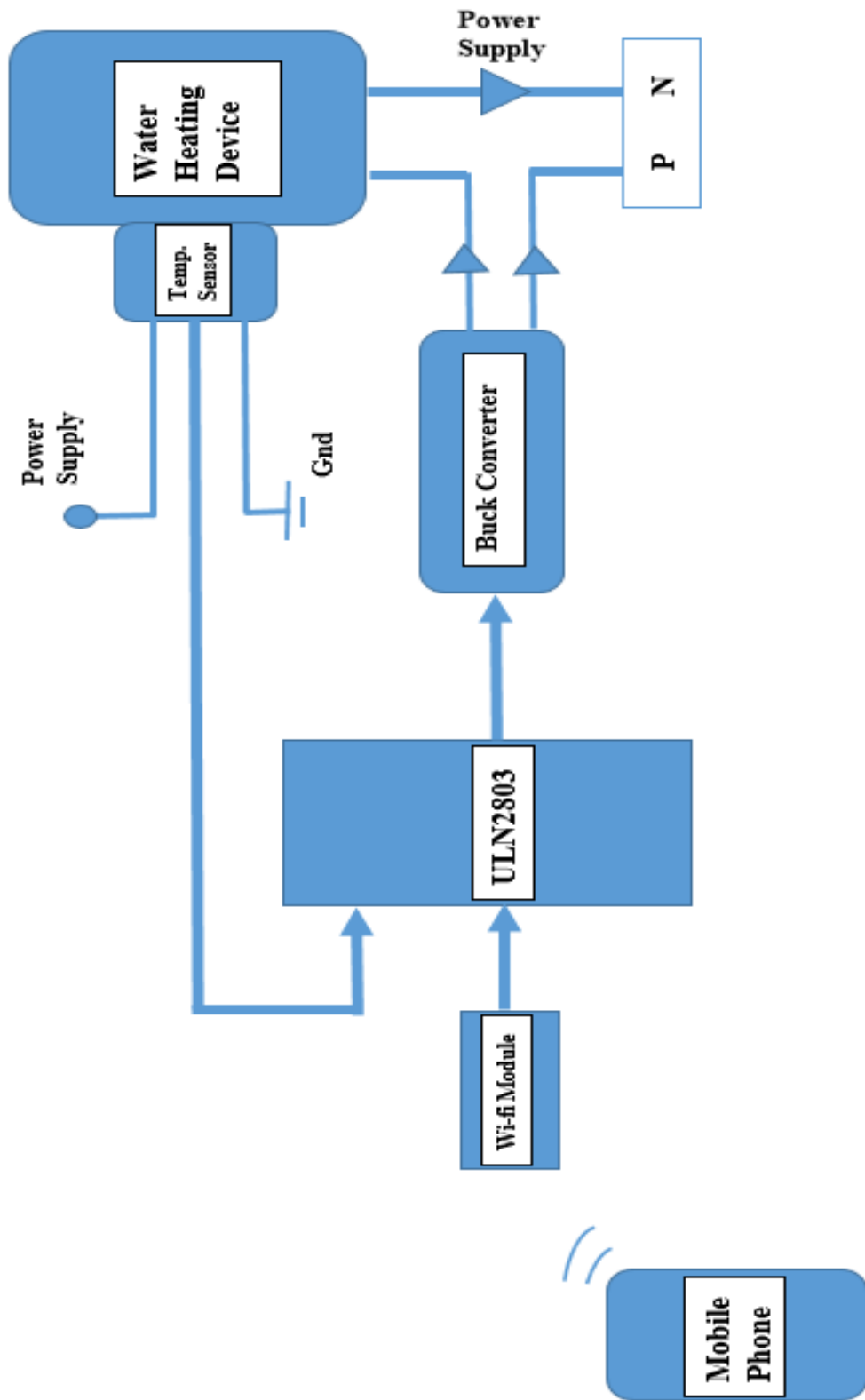


Figure 7.4

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