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Raspberry Pi-GPIO Basics with LED Light

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Abstract- These days computer is the basic need for every people in every field across the world. Raspberry pi is small size or credit card sized computer. The Raspberry Pi is a small computer that can do lots of things. You plug it into a monitor and attach a keyboard and mouse. There is a Broadcom BCM2835 SOC to integrate major functional element into single chip. We can control any hardware equipment through Raspberry Pi by using GPIO pins. Python programming languages are preferred to program the Raspberry Pi. It allows monitoring and controlling of hardware equipment. There are three series of Raspberry Pi, and several generations of each have been released. Raspberry Pi SBCs feature a Broadcom system on a chip (SoC) with an integrated ARM-compatible central processing unit (CPU) And on-chip graphics processing unit (GPU), while Raspberry PI Pico has a RP2040 system on chip with an integrated ARM-compatible central processing unit (CPU)). Raspberry pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi foundation in association with Broadcom. The Raspberry pi project originally learned towards the promotion of teaching basic computer in schools and in developing countries. This paper explains the Raspberry Pi with the explanation of GPIO pins, and through it showing the working or blinking of LED light. The main task of doing it is that through it we can make home automation project, by which home smart gadgets can be controlled from anywhere with the help of relay. The paper mainly emphasis on the home automation project with the help of LED light and the coding is used to accomplish the task. The Raspberry Pi has two zones of GPIO pins, which are the connections between the Raspberry Pi, and the real world. Output pins are like switches that the Raspberry Pi can turn on and off. It can also send a signal to another device.

Keywords- Raspberry Pi, Home automation, LED, GPIO pins, Processor.

I. INTRODUCTION

The raspberry Pi Foundation is a British charity and company founded in 2009 to promote the study of basic computer science in schools and is responsible for developing the Raspberry Pi singe-board computers.

The Raspberry Pi is a tiny and affordable computer that you can use to learn programming through fun, practical project. The Raspberry Pi is a credit-card sized computer It can be plugged into your TV and a keyboard and can be used for many of the things that your average desktop does - spreadsheets, word-processing, games and it also plays high-definition video. The Raspberry Pi is a fully featured microcomputer squashed onto a circuit board measuring approximately 9cm x 5.5cm.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor •It has Video Core IV GPU • originally shipped with 256 megabytes of RAM, later

upgraded to 512MB. • It does not include a built-in hard disk but uses an SD card for booting and long-term storage.

It has 10/100 Base T Ethernet socket, HDMI socket, USB 2.0 socket, RCA video socket, SD card socket, Powered from microUSB socket • 3.5mm audio out jack • Header footprint for camera connection is there in Raspberry Pi

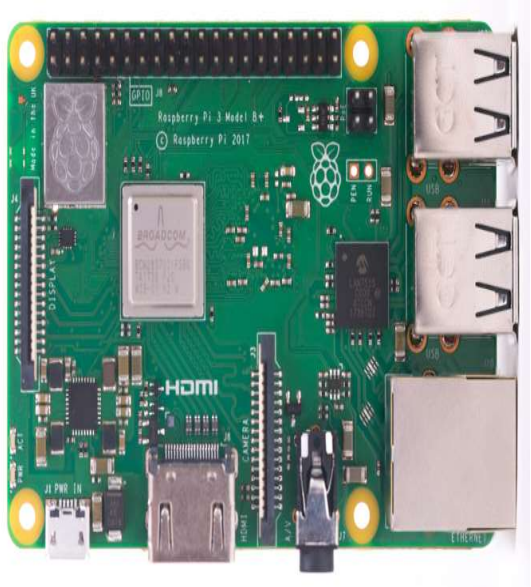

Fig 1. Raspberry Pi.

All over the world, people use the Raspberry Pi to learn programming skills, build hardware projects, do home automation, implement Kubernetes, and edge computing, and even use them in industrial applications.

The Raspberry Pi Foundation works to put the power of computing and digital making into the hands of people all over the world. It does this by providing low-cost, high-performance computers that people use to learn, solve problems, and have fun. It provides outreach and education to help more people access computing and digital making—it develops free resources to help people learn about computing and making things with computers Code Club and CoderDojo are part of the Raspberry Pi Foundation, although these programs are platform-independent (they're not tied to Raspberry Pi hardware).

The Raspberry Pi Foundation promotes these clubs and helps grow the network around the world to ensure every child has access to learning about computing. Similarly, Raspberry Jams are Raspberry Pi-focused events for people of all ages to come together to learn about Raspberry Pi and share ideas and projects and trains educators who can guide other people to learn.

What Raspberry Pi models have been released?
There have been many generations of the Raspberry Pi line: from Pi 1 to 4, and even a Pi 400. There has generally been a Model A and a Model B of most generations. Model A has been a less expensive variant and tends to have reduced RAM and fewer ports (such as USB and Ethernet). The Pi Zero is a spinoff of the original (Pi 1) generation, made even smaller and cheaper.

Here's the lineup so far:

- Pi 1 Model B (2012)
- Pi 1 Model A (2013)
- Pi 1 Model B+ (2014)
- Pi 1 Model A+ (2014)
- Pi 2 Model B (2015)
- Pi Zero (2015)
- Pi 3 Model B (2016)
- Pi Zero W (2017)
- Pi 3 Model B+ (2018)
- Pi 3 Model A+ (2019)
- Pi 4 Model A (2019)
- Pi 4 Model B (2020)
- Pi 400 (2021)

II. RASPBERRY PI OPEN SOURCE

The Raspberry Pi operates in the open-source ecosystem: it runs Linux (a variety of distributions), and its main supported operating system, Pi OS, is open source and runs a suite of open-source software. The Raspberry Pi Foundation contributes to the Linux kernel and various other open-source projects as well as releasing much of its own software as open source.

Some people buy a Raspberry Pi to learn to code, and people who can already code use the Pi to learn to code electronics for physical projects. The Raspberry Pi can open opportunities for you to create your own home automation projects, which is popular among people in the open-source community because it puts you in control, rather than using a proprietary closed system.

III. WHAT RASPBERRY PI WORKS

Fig 2. Connections with Raspberry Pi.

IV. APPLICATIONS:

1. Can be used for making supercomputer.

Fig 3. Raspberry Pi in Supercomputer.

2. Raspberry Pi Medical Device Input Shield.

Fig 4. Solar Raspberry Pi Power Pack.

Fig 5. Voice-Activated Coffee Machine

Fig 6. Raspberry Pi Dynamic Bike Headlight Prototype.

V. GENERATIONS OF RASPBERRY PI

The first generation (Raspberry Pi 1 Model B) was released in February 2012. It was followed by a simpler and inexpensive model Model A.

- In 2014, the foundation released a board with an improved design in Raspberry Pi 1 Model B+. These boards are approximately credit-card sized and represent the standard mainline form-factor.
- Improved A+ and B+ models were released a year later. A "compute module" was released in April 2014 for embedded applications, and a Raspberry Pi Zero with smaller size and reduced input/output (I/O) and general-purpose input/output (GPIO) capabilities was released in November 2015 for US$5.

1. The Timeline:

- The Raspberry Pi 2 which added more RAM was released in February 2015.
- Raspberry Pi 3 Model B released in February 2016, is bundled with on-board WiFi, Bluetooth and USB boot capabilities.

- As of January 2017, Raspberry Pi 3 Model B is the newest mainline Raspberry Pi.
- Raspberry Pi boards are priced between US$5–35.
- As of 28 February 2017, the Raspberry Pi Zero W was launched, which is identical to the Raspberry Pi Zero, but has the Wi-Fi and Bluetooth functionality of the Raspberry Pi 3 for US$10.

2. Features:

- All models feature a Broadcom system on a chip (SoC), which includes an ARM compatible central processing unit (CPU) and an on-chip graphics processing unit (GPU, a Video Core IV).
- CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM.
- Secure Digital (SD) cards are used to store the operating system and program memory in either the SDHC or Micro SDHC sizes.
- Most boards have between one and four USB slots, HDMI, and composite video output, and a 3.5 mm phono jack for audio.
- Lower-level output is provided by a number of GPIO pins which support common protocols like I^2C.
- The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on board Wi-Fi 802.11n and Bluetooth.

3. Operating System:

The Foundation provides Raspbian, a Debian based Linux distribution for download, as well as third party Ubuntu, Windows 10 IOT Core, RISC OS, and specialized media centre distributions.

- It promotes Python and Scratch as the main programming language, with support for many other languages.
- The default firmware is closed source, while an unofficial open source is available.

VI. GPIO PINS IN RASPBERRY PI

A standard interface for connecting a single-board computer or microprocessor to other components is through General-Purpose Input/Output (GPIO) pins. GPIO stands for General-Purpose Input/Output.

These pins are a physical interface between the Raspberry Pi and the outside world. At the simplest level, you can think of them as switches that you can turn on or off (input) or that the Pi can turn on or off (output).

One powerful feature of the Raspberry Pi is the row of GPIO pins along the top edge of the board. GPIO stands for General-Purpose Input/Output. These pins are a physical interface between the Raspberry Pi and the outside world. At the simplest level, you can think of them as switches that you can turn on or off (input) or that the Pi can turn on or off (output).

The GPIO pins allow the Raspberry Pi to control and monitor the outside world by being connected to electronic circuits. The Pi is able to control LEDs, turning them on or off, run motors, and many other things. It's also able to detect whether a switch has been pressed, the temperature, and light. We refer to this as physical computing.

There are 40 pins on the Raspberry Pi (26 pins on early models), and they provide various different functions.

If you have a RasPiO pin label, it can help to identify what each pin is used for. Make sure your pin label is placed with the keyring hole facing the USB ports, pointed outwards.

Fig 7. GPIO pin numbering.

When programming the GPIO pins, there are two different ways to refer to them: GPIO numbering and physical numbering. Throughout this course (and in all our resources) we will refer to the pins using the GPIO numbering scheme. These are the GPIO pins as the computer sees them.

The numbering of the GPIO pins is not in numerical order, instead relating to the numbering on the CPU of the Raspberry Pi, so there is no easy way to remember them. However, you can use a reference board that fits over the pins, a printed reference (like

the image above), or a website guide to the GPIO pins to help you.

1. Voltages:
The voltage of a pin is labeled on the reference guide. There are two 5V pins and two 3V3 pins, as well as a number of ground pins (0V), which are unconfigurable. The remaining pins are all general-purpose 3V3 pins, meaning that the outputs are set to 3.3 volts and the inputs are tolerant of 3.3 volts.

A GPIO pin designated as an output pin can be set to high (3.3V) or low (0V). Components are usually attached so that setting the output to high will allow current to flow to them, while setting the output to low won't.

A GPIO pin that is designated as an input will allow a signal to be received by the Raspberry Pi. The threshold between a high and a low signal is around 1.8V. A voltage between 1.8V and 3.3V will be read by the Raspberry Pi as high; anything lower than 1.8V will be read as low. Do not allow an input voltage above 3.3V, or else you will fry your Pi!

The GPIO header provides the following power and interface options:
- 3.3V (on 2 pins)
- 5V (on 2 pins)
- Ground (on 8 pins)
- General purpose input and output
- PWM (pulse width modulation)
- I2C
- I2S
- SPI

2. Serial
These allow a massive range of sensors, motors, LEDs and accessories to be connected to the Pi. Some of the standard GPIO pins are used for communication purposes. Here's a quick overview of these communication protocols!

- **SPI pins –** The Serial Peripheral Interface (SPI) is a communication protocol used to transfer data between micro-computers like the Raspberry Pi and peripheral devices. The MISO pin receives data, and the MOSI pin sends data from the Raspberry Pi. Furthermore, the serial clock pin sends pulses at a regular frequency between the Raspberry Pi and the SPI device at the same speed in which the devices to transfer data to each other.
- **UART pins –** UART stands for universal asynchronous receiver-transmitter, which is a physical circuit designed to send and receive data.
- **PWM pins –** PWM means "pulse width modulation," which is a communication protocol best used with stuff that moves and lights up: motors, LEDs, and so on.
- **I2C pins –** I2C is short for inter-integrated circuit (two "inters" or Squared). It works similarly to SPI, but it doesn't force you to use nearly so many pins.

GPIO are your standard pins that simply be used to turn devices on and off. For example, a LED.
- I2C (Inter-Integrated Circuit) pins allow you to connect and talk to hardware modules that support this protocol (I2C Protocol). This will typically take up 2 pins.
- SPI (Serial Peripheral Interface Bus) pins can be used to connect and talk to SPI devices. Pretty much the same as I2C but makes use of a different protocol.
- UART (Universal asynchronous receiver/ transmitter) are the serial pins used to communicate with other devices.
- DNC stands for do not connect, this is self-explanatory.
- The power pins pull power directly from the Raspberry Pi.
- GPID are the pins you use to ground your devices. It doesn't matter which pin you use as they are all connected to the same line.

VII. HOW TO NAVIGATE YOUR RASPEBERRY PI 3 MODEL B

If you build it, they will program. The genesis of the Raspberry Pi came from a few college students concerned about the dwindling number and skills of students applying to study Computer Science.

Newer computers and game consoles have replaced the old machines where most of us learned to program. The creators capitalized on the powerful and affordable processors designed for the booming mobile device arena, and they were able to create an economical, programmable computer with attractive

graphics that could boot into the programming environment and not break the bank.

The Raspberry Pi is a credit card sized single-board computer with an open-source platform that has a thriving community of its own, similar to that of the Arduino. It can be used in various types of projects from beginners learning how to code to hobbyists designing home automation systems.

There are a few versions of the Raspberry Pi, but the latest version, has improved upon its predecessor in terms of both form and functionality.

The Raspberry Pi Model B features:
- More GPIO
- More USB
- Micro SD
- Lower power consumption
- Better audio
- Neater form factor

This higher-spec variant increases the Raspberry pi GPIO pin count from 26 to 40 pins. There are now four USB 2.0 ports compared to two on the Model B. The SD card slot has been replaced with a more modern push-push type micro SD slot. It consumes slightly less power, provides better audio quality and has a cleaner form factor.

To get started you need a Raspberry Pi 3 Model B, a 5V USB power supply of at least 2 amps with a micro-USB cable, any standard USB keyboard and mouse, an HDMI cable and monitor/TV for display, and a micro SD card with the operating system pre-installed. The NOOBS (New Out Of the Box Software) OS is recommended for beginners, and you may choose one of several from the download page.

This pin out diagram will help you get familiar with the layout of the board and get started in immersing yourself into your own passion projects.

One of the most exciting starter activities to do with a Raspberry Pi is something you can't do on your regular PC or laptop—make something happen in the real world, such as flash an LED or control a motor. If you've done anything like this before, you probably did it with Python using the RPi.GPIO library, which has been used in countless projects. There's now an even simpler way to interact with physical components: a new friendly Python API called GPIO Zero.

The RPi. GPIO library is bare bones and provides all the essential functionality to do simple things with the Pi's GPIO pins—set up pins as inputs or outputs, read inputs, set outputs high or low, and so on. GPIO Zero is built on top of this and provides a collection of simple interfaces to everyday components, so rather than setting pin 2 high to turn on an LED, you have an LED object and you turn it on.

VIII. PROGRAMMING LED WITH GPIO

GPIO are your standard pins that simply be used to turn devices on and off. For example, a LED.

Fig 8. LED (Light Emitting doide).

I2C (Inter-Integrated Circuit) pins allow you to connect and talk to hardware modules that support this protocol (I2C Protocol). This will typically take up 2 pins.

SPI (Serial Peripheral Interface Bus) pins can be used to connect and talk to SPI devices. Pretty much the same as I2C but makes use of a different protocol.

UART (Universal asynchronous receiver/transmitter) are the serial pins used to communicate with other devices.
- DNC stands for do not connect, this is self-explanatory.
- The power pins pull power directly from the Raspberry Pi.
- GND are the pins you use to ground your devices. It doesn't matter which pin you use as they are all connected to the same line.

1. The Breadboard:

The breadboard is a way of connecting electronic components to each other without having to solder them together. They are often used to test a circuit design before creating a Printed Circuit Board (PCB).

The holes on the breadboard are connected in a pattern.

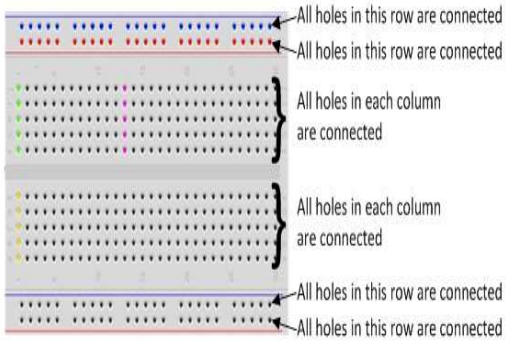

Fig 9. Breadboard.

With the breadboard in the CamJam EduKit, the top row of holes are all connected together – marked with red dots? And so is the second row of holes – marked with blue dots. The same goes for the two rows of holes at the bottom of the breadboard.

In the middle, the columns of wires are connected together with a break in the middle. So, for example, all the green holes marked are connected, but they are not connected to the yellow holes, or the purple ones. Therefore, any wire you poke into the green holes will be connected to other wires poked into the other green LED.

A Red LED When you pick up the LED, you will notice that one leg is longer than the other. The longer leg (known as the 'anode') is always connected to the positive supply of the circuit. The shorter leg (known as the 'cathode') is connected to the negative side of the power supply, known as 'ground'. LED stands for Light Emitting Diode, and glows when electricity is passed through it.

LEDs will only work if power is supplied the correct way round (i.e. if the 'polarity' is correct). You will not break the LEDs if you connect them the wrong way round – they will just not light. If you find that they do not light in your circuit, it may be because they have been connected the wrong way round holes.

2. The Resistor:

330 Ohm Resistor. You must ALWAYS use resistors to connect LEDs up to the GPIO pins of the Raspberry Pi. The Raspberry Pi can only supply a small current (about 60mA). The LEDs will want to draw more, and if allowed to them will burn out the Raspberry Pi. Therefore, putting the resistors in the circuit will ensure that only this small current will flow, and the Raspberry Pi will not be damaged.

Resistors are a way of limiting the amount of electricity going through a circuit; specifically, they limit the amount of 'current' that is allowed to flow. The measure of resistance is called the Ohm (Ω), and the larger the resistance, the more it limits the current. The value of a resistor is marked with colored bands along the length of the resistor body.

You will be using a 330Ω resistor. You can identify the 330Ω resistors by the colour bands along the body. The colour coding will depend on how many bands are on the resistors supplied:

- If there are four colour bands, they will be Orange, Orange, Brown, and then Gold.
- If there are five bands, then the colours will be Orange, Orange, Black, Black, and Brown.
- It does not matter which way round you connect the resistors. Current flows in both ways through them.

3. Jumper Wires:

Jumper Wires are used on breadboards to 'jump' from one connection to another. The ones you will be using in this circuit have different connectors on each end. The end with the 'pin' will go into the Breadboard. The end with the piece of plastic with a hole in it will go onto the Raspberry Pi's GPIO pins.

4. The Raspberry Pi's GPIO Pins

GPIO stands for General Purpose Input Output. It is a way the Raspberry Pi can control and monitor the outside world by being connected to electronic circuits. The Raspberry Pi can control LEDs, turning them on or off, or motors, or many other things. It is also able to detect whether a switch has been pressed, or temperature, or light.

In the CamJam EduKit you will learn to control LEDs and a buzzer, and detect when a button has been pressed. The diagram below left shows the pin layout for a Raspberry Pi Models A and B (Rev 2 - the

original Rev 1 Pi is slightly different), looking at the Raspberry Pi with the pins in the top right corner. The new 40 pin Raspberry Pi's shares exactly the same layout of pins for the top 13 rows of GPIO pins.

IX. BUILDING THE CIRCUIT

- The circuit consists of a power supply (the Raspberry Pi), an LED that lights when the power is applied, and a resistor to limit the current that can flow through the circuit.
- You will be using one of the 'ground' (GND) pins to act like the 'negative' or 0 volt ends of a battery. The 'positive' end of the battery will be provided by a GPIO pin. Here we will be using pin 18. When they are 'taken high', which means it outputs 3.3 volts, the LED will light. Now take a look at the circuit diagram below.

1. A Single LED:

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.[6]

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared (IR) light.[7] Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays.

Recent developments have produced LEDs available in visible, ultraviolet (UV), and infrared wavelengths, with high, low, or intermediate light output, for instance white LEDs suitable for room and outdoor area lighting. LEDs have also given rise to new types of displays and sensors, while their high switching rates are useful in advanced communications technology with applications as diverse as aviation lighting, fairy lights, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.[8]

LEDs have many advantages over incandescent light sources, including lower power consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. In exchange for these generally favorable attributes, disadvantages of LEDs include electrical limitations to low voltage and generally to DC (not AC) power, inability to provide steady illumination from a pulsing DC or an AC electrical supply source, and lesser maximum operating temperature and storage temperature.

In contrast to LEDs, incandescent lamps can be made to intrinsically run at virtually any supply voltage, can utilize either AC or DC current interchangeably, and will provide steady illumination when powered by AC or pulsing DC even at a frequency as low as 50 Hz. LEDs usually need electronic support components to function, while an incandescent bulb can and usually does operate directly from an unregulated DC or AC power source.

LEDs are made in different packages for different applications. A single or a few LED junctions may be packed in one miniature device for use as an indicator or pilot lamp. An LED array may include controlling circuits within the same package, which may range from a simple resistor, blinking or color changing control, or an addressable controller for RGB devices. Higher-powered white-emitting devices will be mounted on heat sinks and will be used for illumination. Alphanumeric displays in dot matrix or bar formats are widely available. Special packages permit connection of LEDs to optical fibers for high-speed data communication links.

The circuit consists of a power supply (the Raspberry Pi), an LED that lights when the power is applied, and a resistor to limit the current that can flow through the circuit.

- **Efficiency:** LEDs emit more lumens per watt than incandescent light bulbs.[138] The efficiency of LED lighting fixtures is not affected by shape and size, unlike fluorescent light bulbs or tubes.
- **Color:** LEDs can emit light of an intended color without using any color filters as traditional lighting methods need. This is more efficient and can lower initial costs.
- **Size:** LEDs can be very small (smaller than 2 mm2 [139]) and are easily attached to printed circuit boards.
- **Warmup time:** LEDs light up very quickly. A typical red indicator LED achieves full brightness

in under a microsecond.[140] LEDs used in communications devices can have even faster response times.

- **Cycling:** LEDs are ideal for uses subject to frequent on-off cycling, unlike incandescent and fluorescent lamps that fail faster when cycled often, or high-intensity discharge lamps (HID lamps) that require a long time before restarting.
- **Dimming:** LEDs can very easily be dimmed either by pulse-width modulation or lowering the forward current. [141] this pulse-width modulation is why LED lights, particularly headlights on cars, when viewed on camera or by some people, seem to flash or flicker. This is a type of stroboscopic effect.
- **Cool light:** In contrast to most light sources, LEDs radiate very little heat in the form of IR that can cause damage to sensitive objects or fabrics. Wasted energy is dispersed as heat through the base of the LED.
- **Slow failure:** LEDs mainly fail by dimming over time, rather than the abrupt failure of incandescent bulbs.[142]
- **Lifetime:** LEDs can have a relatively long useful life. One report estimates 35,000 to 50,000 hours of useful life, though time to complete failure may be shorter or longer.[143] Fluorescent tubes typically are rated at about 10,000 to 25,000 hours, depending partly on the conditions of use, and incandescent light bulbs at 1,000 to 2,000 hours. Several DOE demonstrations have shown that reduced maintenance costs from this extended lifetime, rather than energy savings, is the primary factor in determining the payback period for an LED product.[144]
- **Shock resistance:** LEDs, being solid-state components, are difficult to damage with external shock, unlike fluorescent and incandescent bulbs, which are fragile.[145]
- **Focus:** The solid package of the LED can be designed to focus its light. Incandescent and fluorescent sources often require an external reflector to collect light and direct it in a usable manner. For larger LED packages total internal reflection (TIR) lenses are often used to the same effect.

However, when large quantities of light are needed many light sources are usually deployed, which are difficult to focus or collimate towards the same target.

- You should turn your Raspberry Pi off for the next bit just in case you accidentally short something out.
- Use one of the jumper wires to connect a ground pin to the rail, marked with blue, on the breadboard. The female end goes on the Raspberry Pi's pin, and the male end goes into a hole on the breadboard.
- Then connect the resistor from the same row on the breadboard to a column on the breadboard, as shown above.
- Next, push the LEDs legs into the breadboard, with the long leg (with the kink) on the right.
- Lastly, complete the circuit by connecting pin 18 to the right-hand leg of the LED. This is shown here with the orange wire.

2. The Code:

You are now ready to write some code to switch the LED on. Turn on your Raspberry Pi and open the terminal window.

Create a new text file "LED.py" by typing the following:

- nano LED.py
- Type in the following code:
- import RPi.GP IO as GPIO
- import time
- GPIO.setmode(GPIO.BCM)
- GPIO.setwarnings(False)
- GPIO.setup(18,GPIO.OUT)
- print "LED on"
- GPIO.output(18,GPIO.HIGH)
- time.sleep(1)
- print "LED off"
- GPIO.output(18,GPIO.LOW)

Once you have typed all the code and checked it, save and exit the text editor with "Ctrl + x" then "y" then "enter".

3. Running the Code:

To run this code type:

sudo python LED.py

You will see the LED turn on for a second and then turn off.

Explanation

So, what is happening in the code? Let's go through it a line at a time:

import RPi. GPIO as GPIO:
The first line tells the Python interpreter (the thing that runs the Python code) that it will be using a 'library' that will tell it how to work with the Raspberry Pi's GPIO pins. A 'library' gives a programming language extra commands that can be used to do something different that it previously did not know how to do. This is like adding a new channel to your TV so you can watch something different.

import time:
Imports the Time library so that we can pause the script later on.

GPIO.setmode(GPIO.BCM)
Each pin on the Raspberry Pi has several different names, so you need to tell the program which naming convention is to be used.

print "LED on"
This line prints some information to the terminal.

GPIO.output(18, GPIO.HIGH)
This turns the GPIO pin 'on'. What this means is that the pin is made to provide power of 3.3volts. This is enough to turn the LED in our circuit on.

time. sleep (1)
Pauses the Python program for 1 second

print "LED off"
This line prints some information to the terminal.

GPIO.output(18, GPIO.LOW)
This turns the GPIO pin 'off', meaning that the pin is no longer supplying any power.

And that's it! You are now able to turn an LED on and off.

X. CONCLUSIONS

LED light is blinked when we programmed it the help of whiteboard if we are not having female to female jumper wires. if we are having female to male jumper wire, then whiteboard is required. We have used resistors, led, with the help of python programming.

LED innovations across various sectors including hospitality, retail and entertainment among others. A longer life, brighter illumination and less electricity consumption are some of the reasons why LED is being chosen above others.

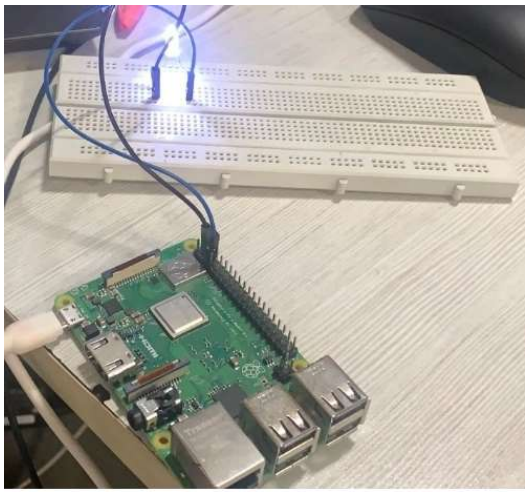

Fig 10. LED Demonstration.

Entertainment and furnishing markets are also trying to make the most out of the latest LED innovations as well. Use of LED technology is on a rise in these sectors and many LED manufacturing companies have started designing and manufacturing their products exclusively for entertainment and decorative sectors.

Superbright blue, green, and white InGaN SQW LEDs have been discussed in this book. By combining high-power, high-brightness blue InGaN SQW LEDs, green InGaN SQW LEDs, and red GaAlAs LEDs, many kinds of applications, such as LED full-color displays and LED white lamps for use in place of light bulbs or fluorescent lamps, are now possible with characteristics of high reliability, high durability, and low energy consumption. Also, a white LED made by combining a blue InGaN SQW LED and YAG phosphor, which was less expensive than a white LED composed of three primary color LEDs, has been developed. The luminous efficiencies of the blue, green, and white LEDs are 3, 10, and 5 lm/W, which are much higher than that of conventional light bulbs (1 lm/W).

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XI. FUTURE ENHANCEMENT

In future, the focus would be to develop own LED with Raspberry Pi Embedded Systems project using Raspberry Pi B/B+/Zero model.

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