Experiment No._03

Title: Sensor and actuator interfacing with Raspberry Pi

Batch: **B2** **Roll No.:** **16010421059** **Experiment No.:03**

Aim: and actuator interfacing with Raspberry Pi

Resources needed: Internet, Raspberry Pi module, Sensors and Actuators

Theory:

Pre Lab/ Prior Concepts:

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enable these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

Role of Sensor in IoT:

Sensors are now found in a wide variety of applications, such as smart mobile devices, automotive systems, industrial control, healthcare, oil exploration and climate monitoring. Sensors are used almost everywhere, and now sensor technology is beginning to closely mimic the ultimate sensing machine the human being. The technology that allows this to happen is sensor fusion, which leverages a microcontroller to fuse the individual data collected from multiple sensors to get a more accurate and reliable view of the data than one would get by using the data from each discrete sensor on its own. Sensor fusion creates a situation in which the whole is much greater than the sum of its parts.

Role of Actuator in IoT:

An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system, for example by opening a valve. In simple terms, it is a "mover".

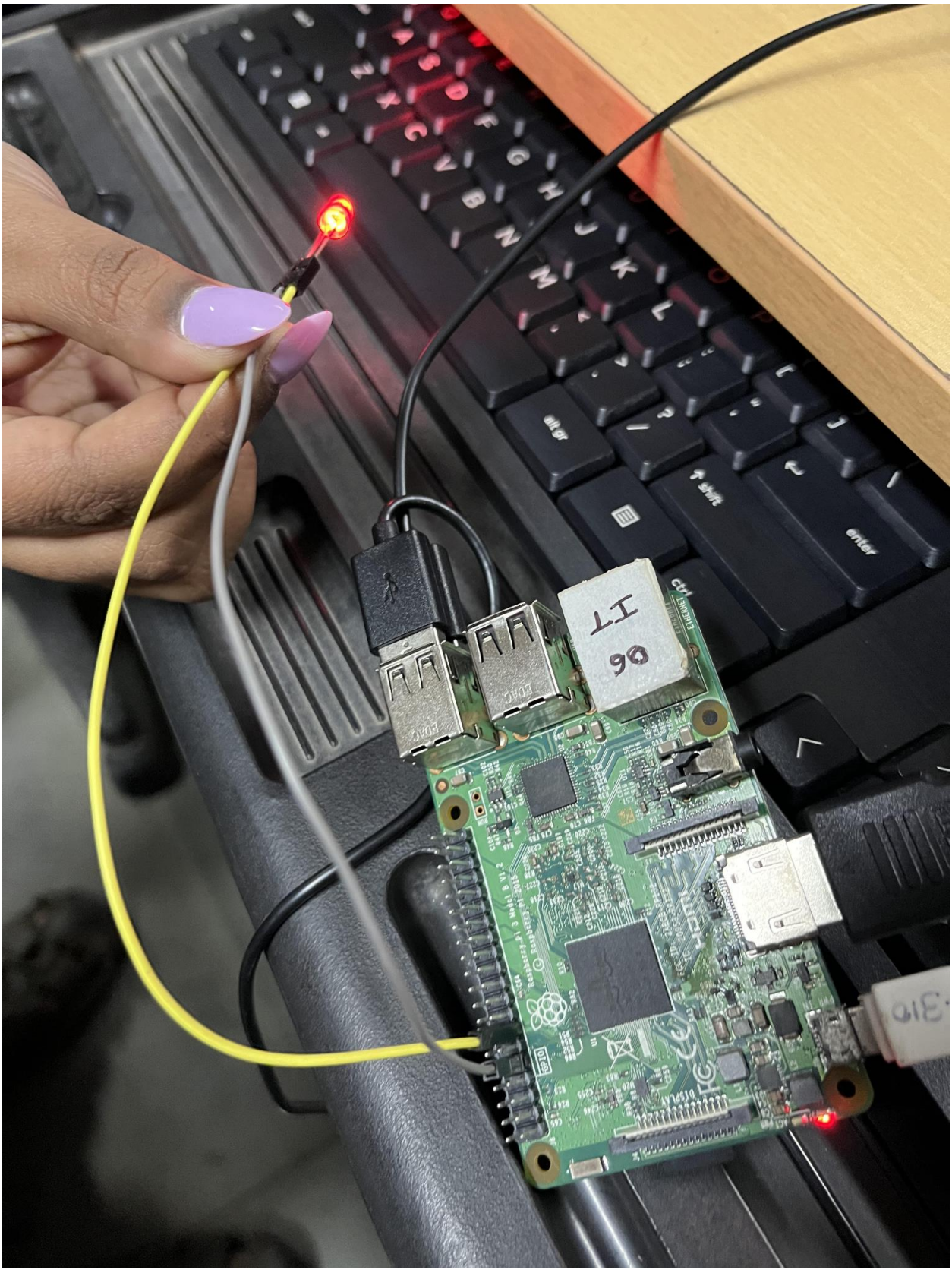
An actuator requires a control device (controlled by control signal) and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic, or hydraulic fluid pressure, or even human power. Its main energy source may be an electric current, hydraulic pressure, or pneumatic pressure. The control device is usually a valve. When it receives a control signal, an actuator responds by converting the source's energy into mechanical motion. In the electric, hydraulic, and pneumatic sense, it is a form of automation or automatic control.

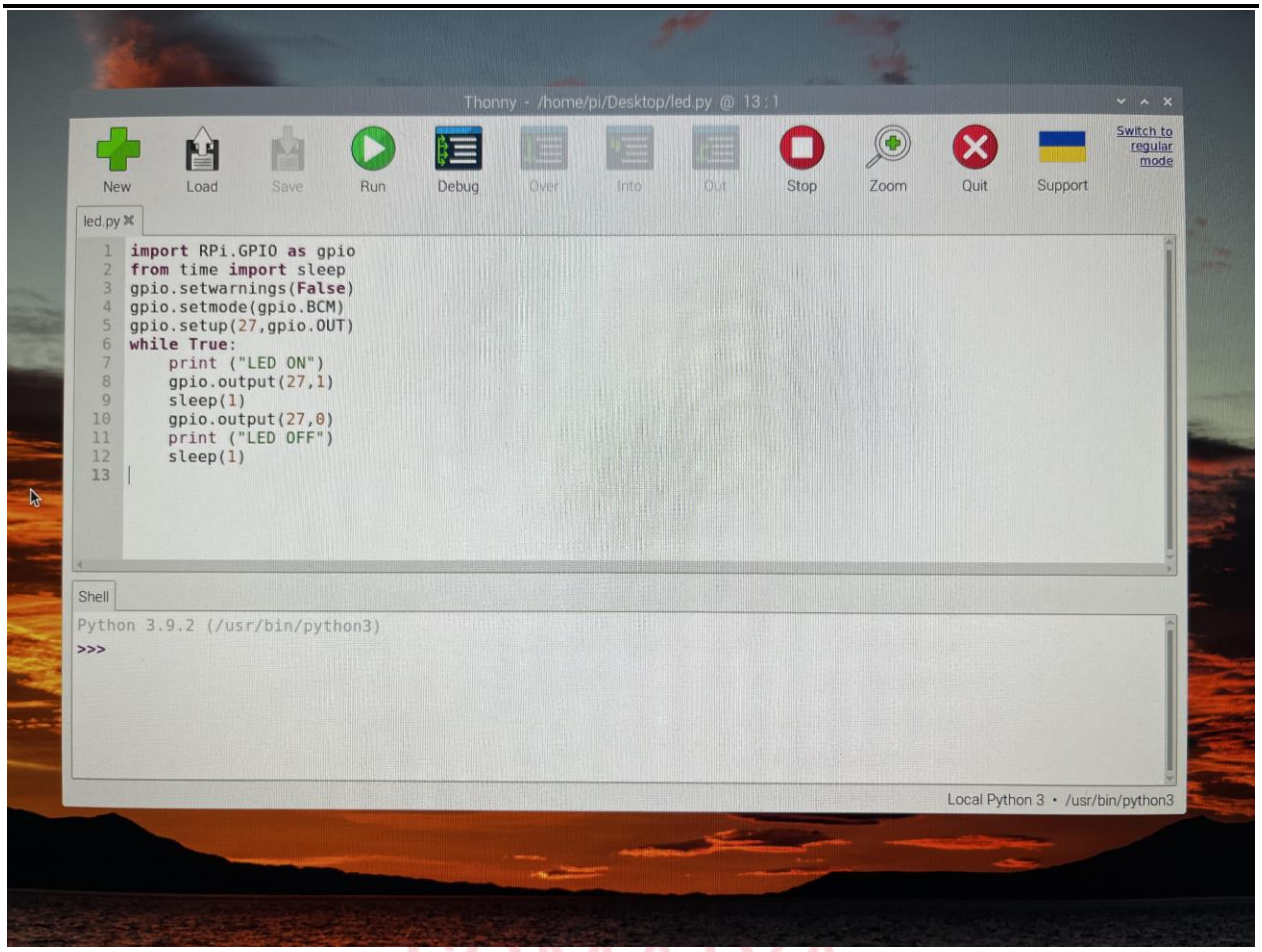
The displacement achieved is commonly linear or rotational, as exemplified by linear motors and rotary motors, respectively. Rotary motion is more natural for small machines making large displacements. By means of a leadscrew, rotary motion can be adapted to function as a linear actuator (a linear motion, but not a linear motor).

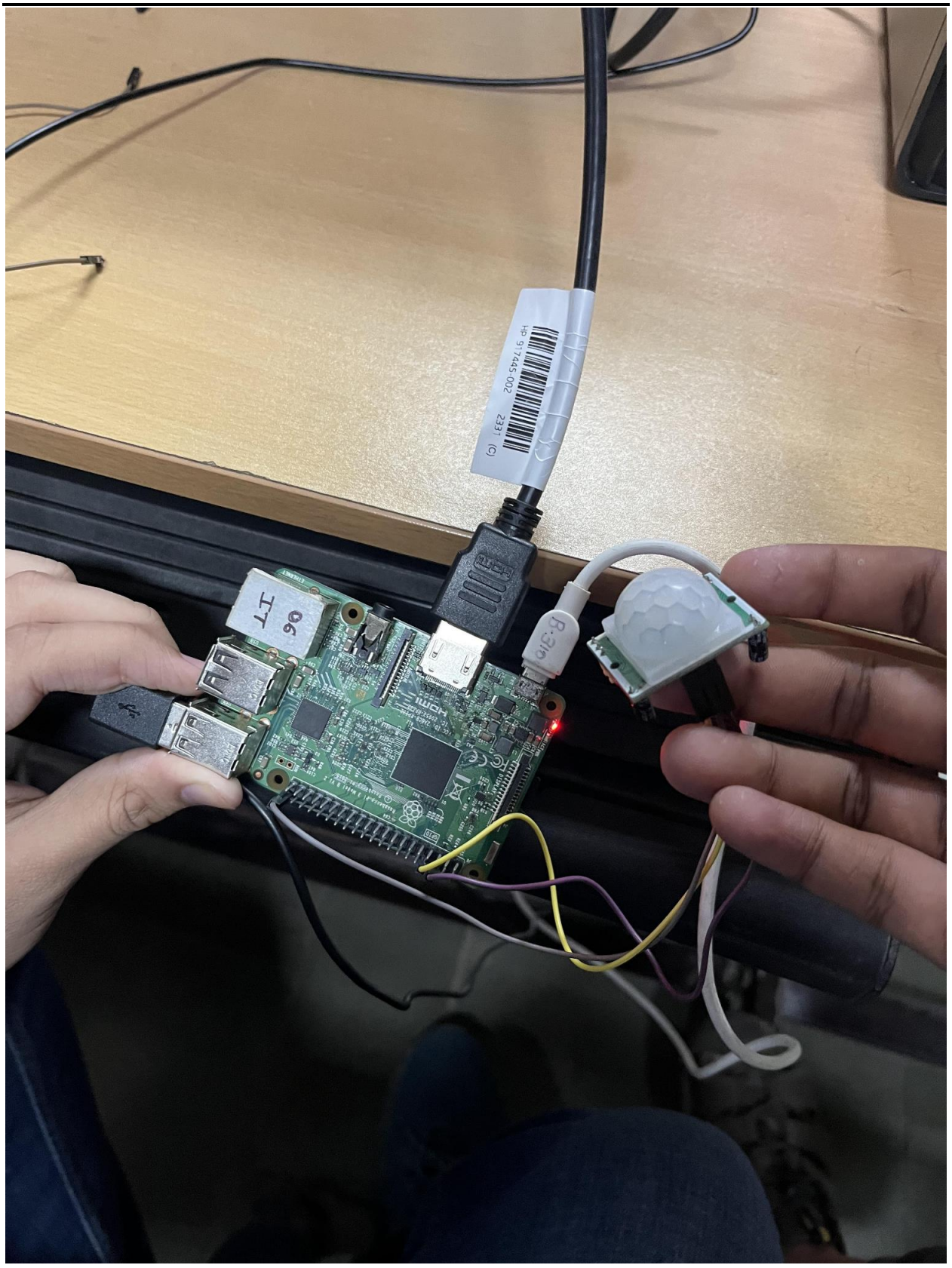
Activity:

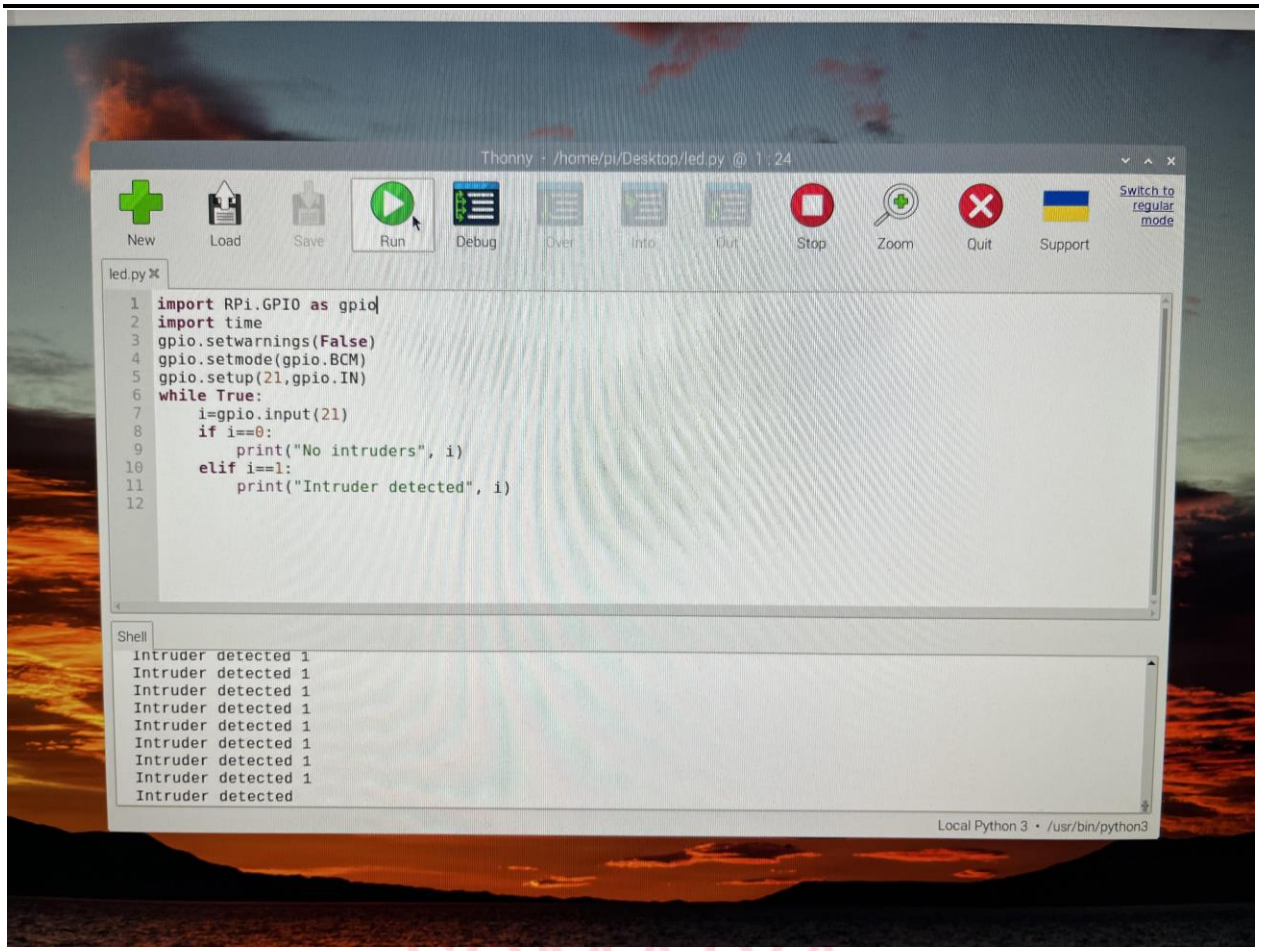
1. List out sensors which can be use with Raspberry Pi.
2. Integrate verity of available sensor in lab with Raspberry Pi, list out step performed, circuit, code, output and components used.

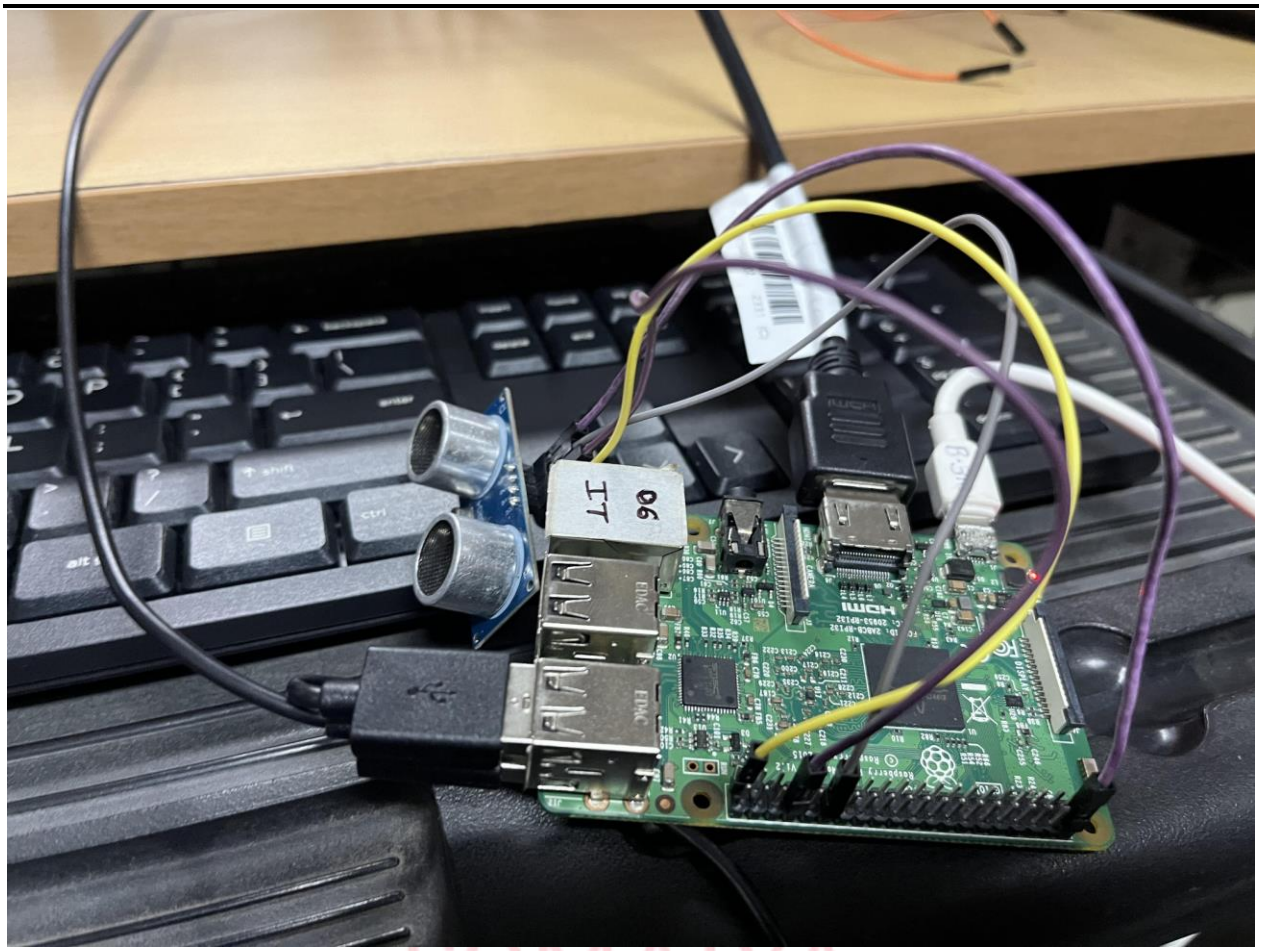
Results:

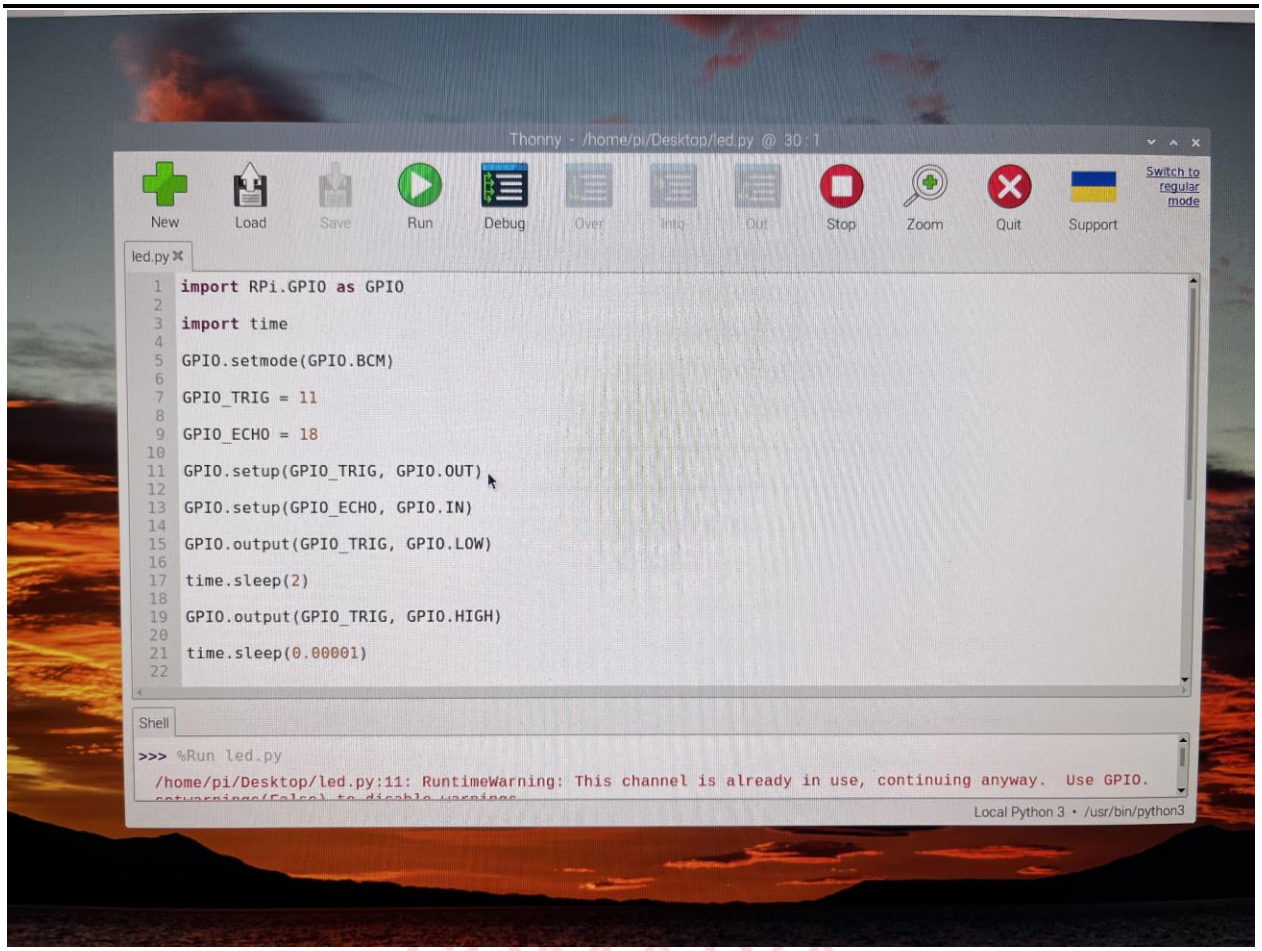












Questions:

1. How R-Pi can use for data analytics?

Ans:

Raspberry Pi (R-Pi) can be used for data analytics in various ways, although it's important to note that due to its limited resources compared to more powerful servers or desktop computers, it may be better suited for smaller-scale analytics tasks. Here are several ways you can use Raspberry Pi for data analytics:

1. Python and Jupyter Notebooks:

- Raspberry Pi supports Python, a popular programming language for data analytics. You can use libraries like NumPy, Pandas, and Matplotlib for data manipulation, analysis, and visualization.

- Install Jupyter Notebooks on your Raspberry Pi to create interactive documents that combine live code, equations, visualizations, and narrative text.

2. Data Collection and IoT:

- Raspberry Pi can be used for collecting data from various sensors and devices, making it suitable for IoT (Internet of Things) applications. You can analyze the data locally or send it to a central server for further analysis.

3. Data Visualization:

- Use tools like Matplotlib, Seaborn, or Plotly to create visualizations directly on your Raspberry Pi. These libraries allow you to generate charts, graphs, and dashboards to better understand your data.

4. Machine Learning:

- Train and deploy small machine learning models on Raspberry Pi for tasks like image recognition, classification, or regression. Tools like TensorFlow Lite or PyTorch can be used for this purpose.

5. Databases:

- Store and query data using lightweight databases like SQLite on your Raspberry Pi. This is useful for managing and retrieving data locally.

6. Web Scraping:

- Use Python libraries such as Beautiful Soup or Scrapy to scrape data from websites. Raspberry Pi can be programmed to automate the collection of data from online sources.

7. Real-Time Analytics:

- Process and analyze real-time data streams using tools like Apache Kafka or MQTT. This is particularly useful for applications that require continuous monitoring and analysis of incoming data.

8. Distributed Computing:

- Create small-scale distributed computing setups using multiple Raspberry Pi devices. Tools like Apache Spark or Hadoop can be installed to distribute data processing tasks across the network.

9. Data Storage:

- Use external storage devices or cloud services to store larger datasets that may not fit within the limited storage capacity of the Raspberry Pi itself.

Remember that the Raspberry Pi has resource constraints, so complex or resource-intensive analytics tasks may be better suited for more powerful hardware. However, for learning, prototyping, and small-scale projects, Raspberry Pi can serve as a cost-effective and energy-efficient platform for data analytics.

Outcomes:

CO2 Comprehend IoT architecture, enabling technologies and protocols

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Conclusion: Thus we have learnt to configure raspberry pi 3 and we have successfully interfaced it with sensors.

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:

https://en.wikipedia.org/wiki/Internet_of_things

Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.

2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1stEdition, VPT, 2014.

3. Dr. Ovidiu Vermesan, Dr. Peter Friess, “Internet of Things - From Research and Innovation to Market Deployment”, River Publisher, 2014