# **Process Modeling and Implementation with Python, Node-RED and Raspberry Pi**

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ADLS 22: Project Work 1

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## Introduction

The market of robotic process automation is predicted to grow up to US$ 3.97 billion by 2025, with an annual growth rate around 31%. While robotic process automation is designed to work 24 hours per day and faster and more accurate than humans it is not intended to fully compensate human labor. Rather its usage is supposed to free humans from repetitive, routine and tedious tasks and allow them to focus to the work that demands creativity and innovation. The automation of processes brings various benefits such as optimization of resources through a reduction in staff, higher security, safety and reliability or faster response and result, since there is no human intervention required, the staff does not come in direct contact with the plant and the chances of human error are reduced. (Axmann & Harmoko, 2020)

An important tool in the field of process automation is the Raspberry Pi. RPi is a Linux based single board computer equipped with GPIO ports for connecting sensors and actuators. RPi are used in various industries like Engineering, Computer Science, Biochemistry, Genetics, Environmental Science, Robotics, Business, Management and Accounting and many more. In the field of Robotics there are numerous applications reaching from surveillance and military to crop disease detection or multi-utility robots. (Mathe et al., 2022)

The cloud technology is evolving towards multi-cloud environments integrating various devices leading to the development of edge cloud and so-called fog computing. This combination of cloud and IoT (Internet of Things) technologies requires the merging of data center technologies with smaller, more constrained devices. To build such an edge cluster architecture RPis can be used as edge nodes (local computation and data storage next to the source of the data). (Pahl et al., 2016)

Text about Dobot

In this project the goal is the investigate the application of RPi in combination with the Dobot Magician robot in process automation and robotics. In our setting the RPi will serve as an edge cluster while communication between robots will be secured by utilizing the no-code environment Node-RED. The usability of both RPi as edge cluster an Node-RED as a no-code environment will be explored. Finally, the aim is to identify potential real-world applications for deploying similar systems to the one developed in this project.

## Theoretical Background

In this part of the project work different the technologies that were introduced in chapter Introduction will be further discussed.

In edge clouds the computing application and data management services are moved to the edge of the network – next to the source of the data. In such a setting the core cloud provides a globalized view, while the edges of the cloud (also referred to as edge cloud nodes) provide localized views. This principle is shown in Figure 1: Principle of edge cloud computing. (Pahl et al., 2016)

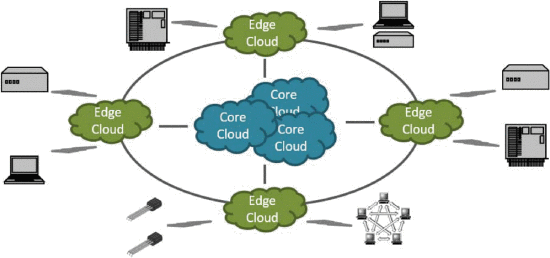


Figure 1: Principle of edge cloud computing

This is your introduction and thesis paragraph. The introduction should be about five or six sentences and provide some background or context for your topic. Limit the use of “I” and “you” in academic writing, though they are both used in this directions / template document. When appropriate, include recent events relating to the topic. For example, if you are writing about cyber warfare, you might mention Russia using cyber-attacks to influence the 2016 US presidential election. Your thesis should be one sentence and outline the main points of the paper. Readers should know from your thesis exactly what to expect from your paper. If you need help writing a thesis, check out [Kibin’s Thesis Generator](https://www.kibin.com/thesis-builder/type) for argumentative or compare and contrast essays.

## Literature Review or Background (This is a Level 1 Heading)

Summarize and quote the important research on this topic that has gone before you. Define subject-specific vocabulary or related theory. Usually, you want to look at books for background. You might want to use your textbook or an encyclopedia to find the names of researchers or theories that are important to the topic, then, search for those names on [UWW Library’s homepage search tool, Research@UWW](http://library.uww.edu/). Search Research@UWW for keywords of your topic (example: cyber warfare or cyber attack) to find related articles and books. Need help? [Ask a Librarian](http://library.uww.edu/get-help/ask-a-librarian).

**This is a Level 2 Heading if Needed**

Let’s talk about in-text citation. Anytime you summarize what someone else has said, you must always include the author’s last name and year either in the text narration (see next paragraph) or in parentheses at the end. Most in-text citations should look something like this, with the period after the parentheses (Ramirez, 2017). If you include any direct quotes from someone else, include the author’s last name, year, and page number in parentheses at the end. “Here is an example” (Ramirez, 2017, p. 26). If a work has three or more authors, the in-text citation includes only the first author’s last name and then “et al,” like this: (Stein et al., 2019).

If you would rather not have so many parentheses breaking up the flow of your text, you can also work the in-text citation into what you are writing. For example, you can explain in your narration how Pavlov et al. (2019, p. 5) are known for their research into classical conditioning with animals, while Skinner & Ferster (1957) studied reinforcement of behavior in children.

The purpose of in-text citations is so your reader can find the correct source in your References, so if you include any authors or titles in-text, they absolutely must match up with a corresponding citation in your References. No “orphan” in-text citations! Find out more about in-text citation on the [UWW Library’s APA in-text citation page](http://libguides.uww.edu/apa/intext).

Business sources are not standard APA citations. See [UWW Library’s APA business sources citation page](http://libguides.uww.edu/apa/business).

## Discussion

The discussion should be the largest part of your paper and include your argument, research, and experiences (for example, through Service-Learning). Each main point of your paper should start its own paragraph with a strong first sentence. Again, limit the use of “I” and “you” in academic writing.

Remember to introduce quotations with who said it and/or why it’s important. Make sure quotes fit seamlessly in your paper. Include short quotations (40 words or less) in-text with quotation marks. Use ellipsis (...) when omitting sections from a quote and use four periods (....) (i.e., an ellipsis plus the period) if omitting the end section of a quote.

This is a longer quote, which is 40 or more words. Indent the quote a half-inch from the left margin and double-space it with no quotation marks. To get the right format, just click on “Quote” in the Styles area on the Word frame above. In parentheses, include the author’s last name, year, and page number at the end, but no period (Smith, 2017, p. 45)

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## Conclusion

The conclusion restates the thesis and summarizes the main arguments or points of the article, so that your reader could just read the conclusion to generally understand the paper. What is important to learn from reading your paper? If you know of areas in this topic that need further study, mention them. After this paragraph, there is a page break that forces References onto its own page: You will want to keep it there.

## References

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