



RL4Eng-JO

Erasmus+ Project Report: Remote Labs Implementation in Mechatronics Course

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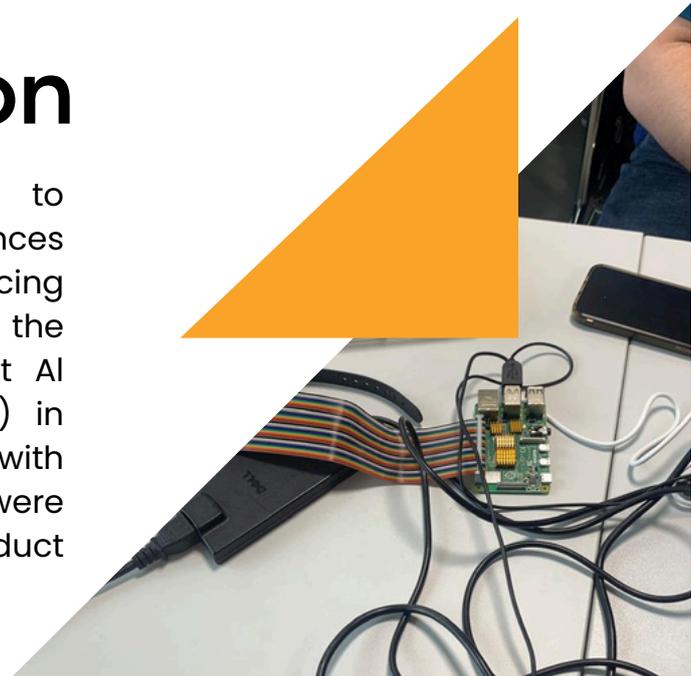
■ About RL4Eng



This report presents the outcomes of the Erasmus+ project on remote labs in mechatronics courses at Al Hussain Technical University in Jordan. The project aimed to enhance student learning experiences, especially during the COVID-19 pandemic, by implementing remote labs using Raspberry Pi kits. Despite challenges such as equipment setup and technical issues, all 19 students actively participated in the remote labs, leading to a significant improvement in their understanding of mechatronics concepts.

■ Introduction

The Erasmus+ project aimed to enhance student learning experiences in different courses by introducing remote labs. This report focuses on the implementation of remote labs at Al Hussain Technical University (HTU) in Jordan, where 20 Raspberry Pi kits with over 60 components each were acquired for students to conduct experiments at home.



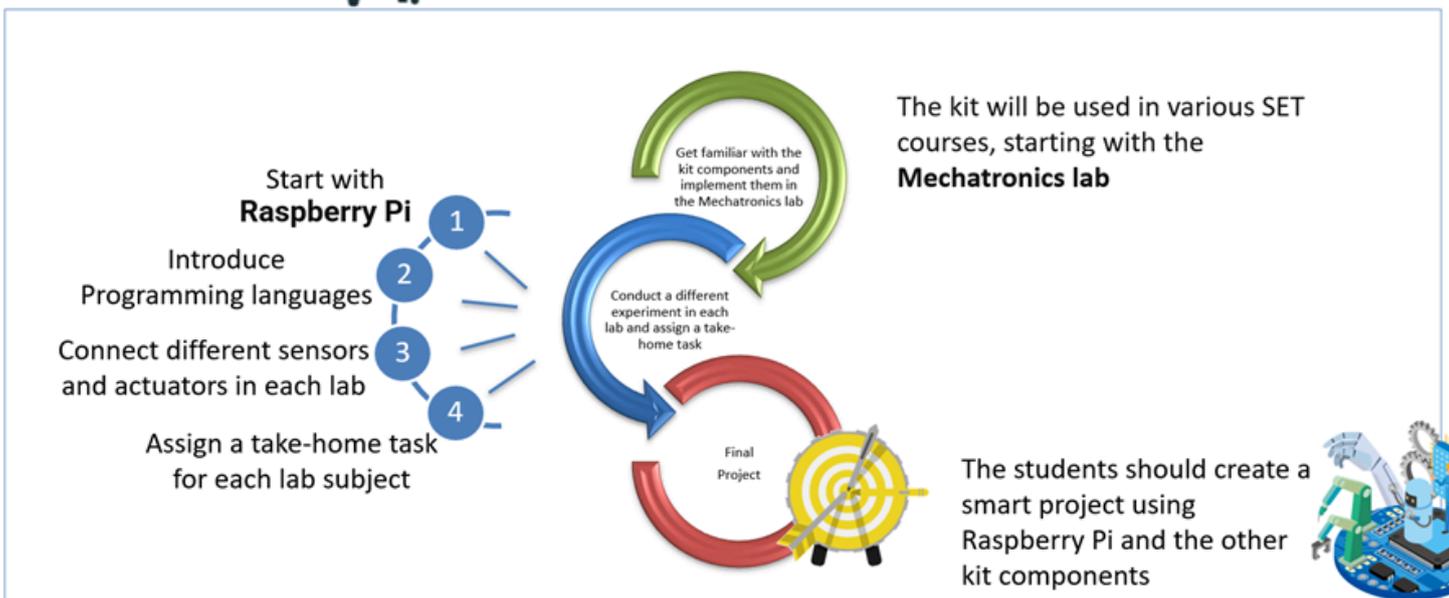
Implementation

The remote labs were integrated into the mechatronics course curriculum at HTU. Each week, one lab session was conducted in the university where students performed an experiment using the Raspberry Pi kits. Following the in-person session, students were given a different take-home task related to the experiment. Students took the Raspberry Pi kits home, where they performed weekly experiments. Following the experiment, students recorded a video demonstrating their work and submitted it for assessment using Microsoft Teams. This approach eliminated the need for an active internet connection during the experiment.



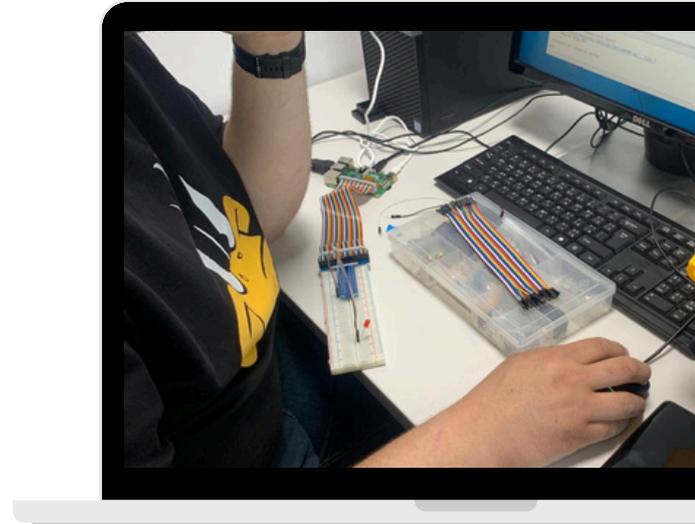
Project Implementation Plan

Mechatronics Lab



■ Experiments

After introducing the Raspberry Pi kits and familiarizing students with its components, a series of experiments were conducted to explore various aspects of digital and analog electronics. These experiments aimed to enhance students' understanding of mechatronics concepts and provide hands-on experience with real-world applications. The following is a summary of the experiments conducted by students:



01

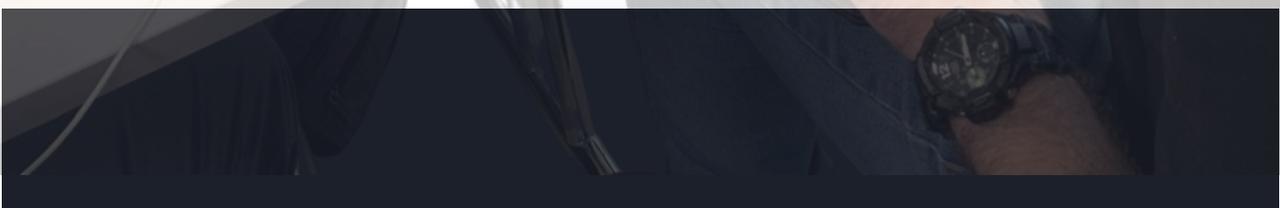
Configuring the Raspberry Pi and Introducing Kit Components: Students learned how to set up the Raspberry Pi and became familiar with the various components included in the kit, laying the foundation for further experiments.

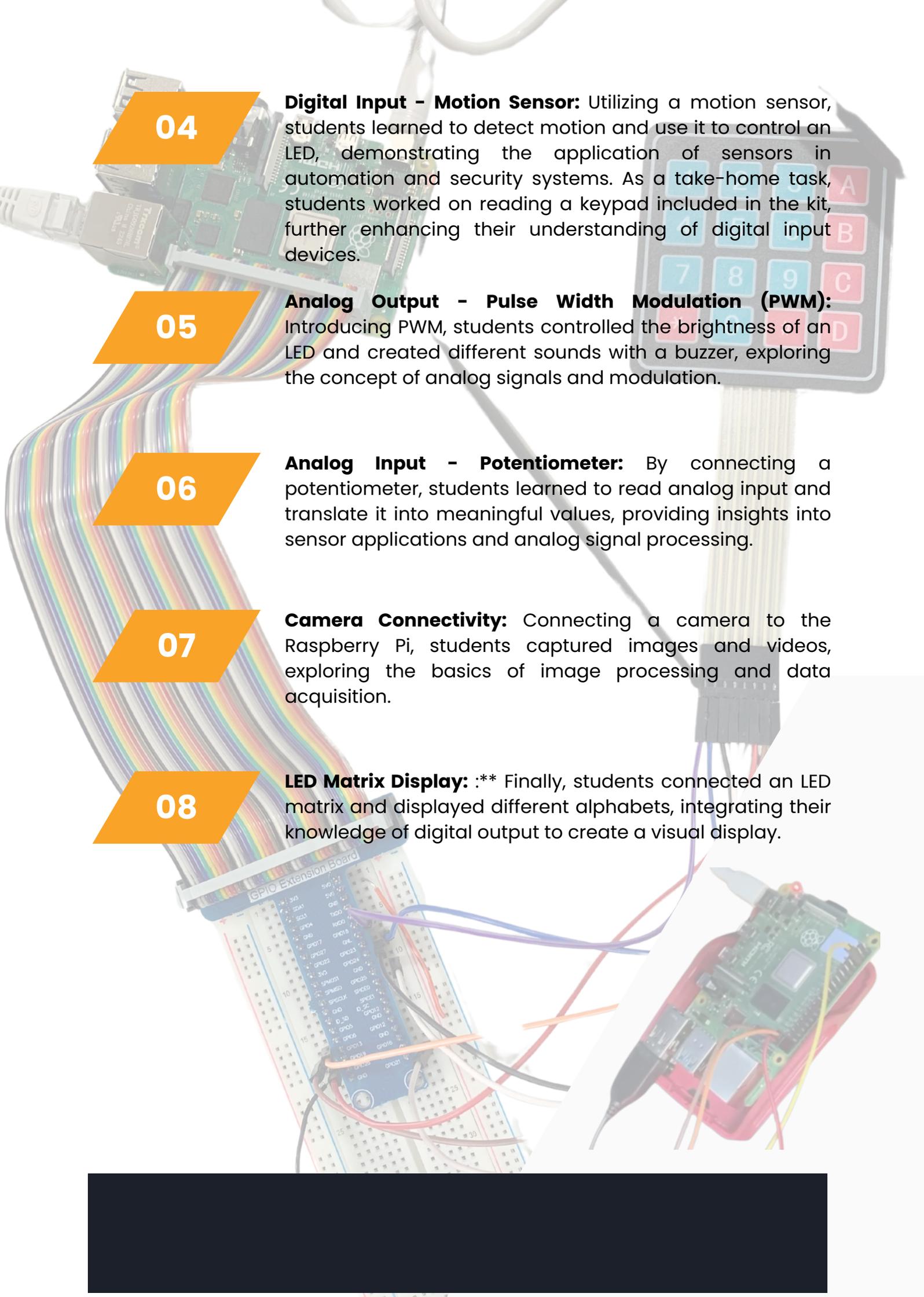
02

Digital Output - LED Control: Using the Raspberry Pi's GPIO pins, students learned to turn on and off an LED and then progressed to making it blink, gaining hands-on experience in digital signal control.

03

Digital Output - Relay Control with Push Button: Students advanced to controlling a relay, a switch that can control high-power circuits, using a push button. This experiment introduced them to interfacing physical inputs with digital outputs.



A background image showing a Raspberry Pi board with various sensors and a keypad connected to it. The board is green and has several components attached, including a motion sensor, a keypad, and a camera. The keypad is a 4x4 grid with buttons labeled A, B, C, D, 7, 8, 9, and 0. The motion sensor is a small black component. The camera is a small black component. The board is connected to a power source and a USB drive. The background is a light gray gradient.

04

Digital Input - Motion Sensor: Utilizing a motion sensor, students learned to detect motion and use it to control an LED, demonstrating the application of sensors in automation and security systems. As a take-home task, students worked on reading a keypad included in the kit, further enhancing their understanding of digital input devices.

05

Analog Output - Pulse Width Modulation (PWM): Introducing PWM, students controlled the brightness of an LED and created different sounds with a buzzer, exploring the concept of analog signals and modulation.

06

Analog Input - Potentiometer: By connecting a potentiometer, students learned to read analog input and translate it into meaningful values, providing insights into sensor applications and analog signal processing.

07

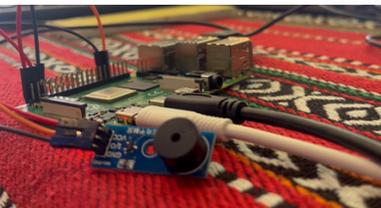
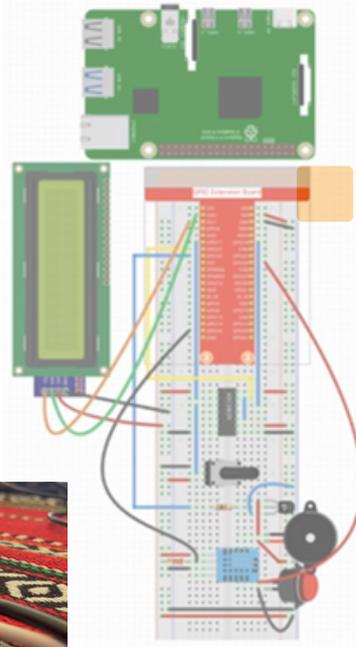
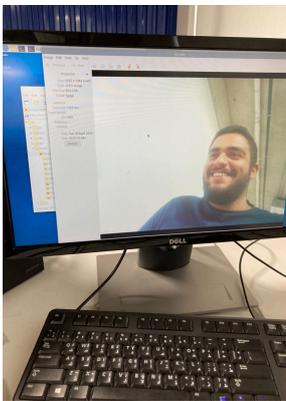
Camera Connectivity: Connecting a camera to the Raspberry Pi, students captured images and videos, exploring the basics of image processing and data acquisition.

08

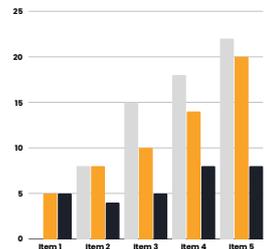
LED Matrix Display: Finally, students connected an LED matrix and displayed different alphabets, integrating their knowledge of digital output to create a visual display.

Future Experiments and Project-based Learning

In addition to the conducted experiments, the course had plans for further experiments during the semester. These additional experiments aimed to delve deeper into mechatronics concepts and provide students with a more comprehensive understanding of the subject. Furthermore, as a final step for the lab, each group of students was responsible for creating a project using the Raspberry Pi kits. This project-based learning approach not only reinforced the theoretical concepts learned in class but also allowed students to apply their knowledge to real-world scenarios. Through these projects, students developed critical thinking, problem-solving, and teamwork skills, preparing them for future challenges in the field of mechatronics.



Outcome



The implementation of remote labs was well-received by students. Despite challenges such as equipment setup and recording issues, all 19 students actively participated in the remote labs. The hands-on experience gained from working with the Raspberry Pi kits significantly improved their understanding of mechatronics concepts.

■ Challenges and Solutions

One of the main challenges faced was ensuring that students properly set up the Raspberry Pi kits at home. To address this, detailed setup instructions were provided, and technical support was available online. Additionally, to ensure fair assessment, guidelines for video submissions were established to standardize the demonstration process.

■ Future Steps

Building on the success of the remote labs, HTU plans to expand the use of Raspberry Pi kits to other engineering courses. The university also aims to create a repository of student-submitted videos for future reference and learning.

■ Conclusion

The implementation of remote labs using Raspberry Pi kits has been a successful endeavor at Al Hussain Technical University (HTU). The project aimed to enhance student learning experiences, and it has achieved its objectives. Despite challenges such as equipment setup and technical issues, all 19 students actively participated in the remote labs. The hands-on experience gained from working with the Raspberry Pi kits significantly improved their understanding of mechatronics concepts.

The remote labs were seamlessly integrated into the mechatronics course curriculum at HTU. Each student was provided with a Raspberry Pi kit to conduct experiments at home, following weekly in-person lab sessions at the university. The use of Microsoft Teams for video submissions facilitated easy assessment and feedback.

The success of this project not only demonstrates the effectiveness of remote labs in enhancing student learning experiences but also prepares students for future digital work environments. The project has set a precedent for innovative remote learning practices and has proven to be a valuable addition to the mechatronics curriculum at HTU.

