Robot Control Learning Platform for Automation Engineers
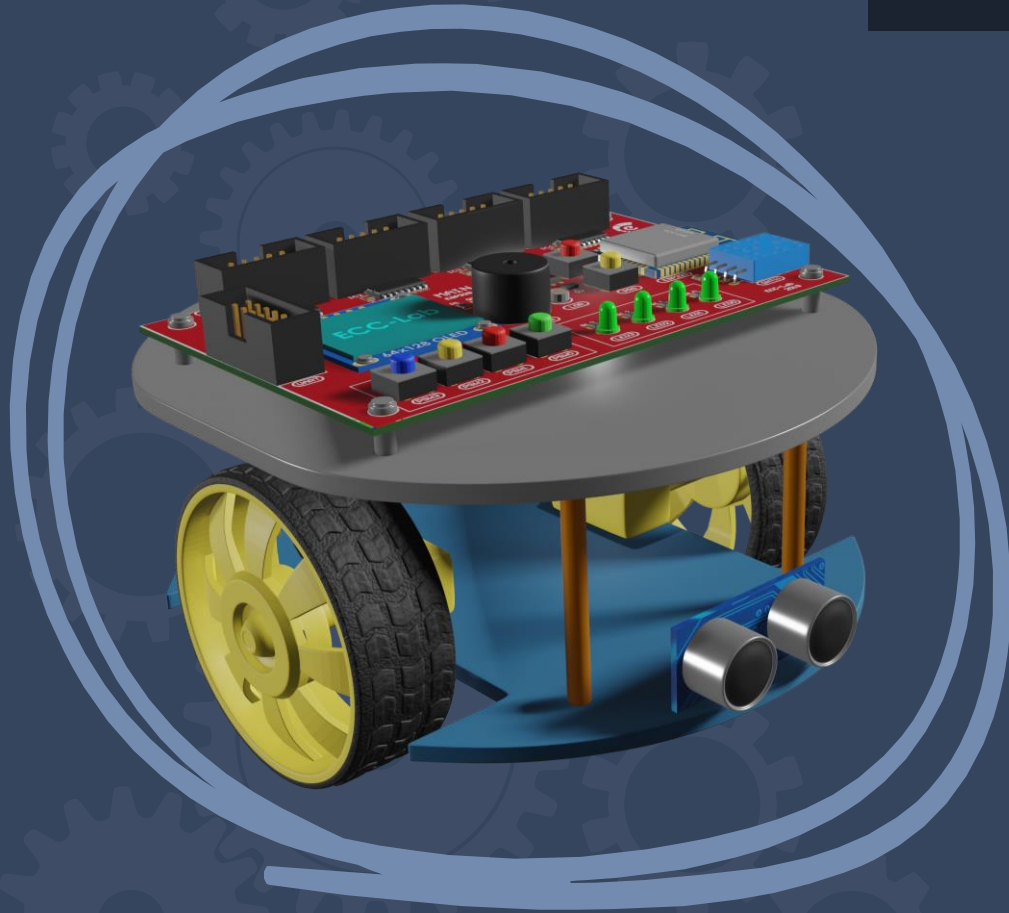
01 Overview

02 Robot Microcontroller Design
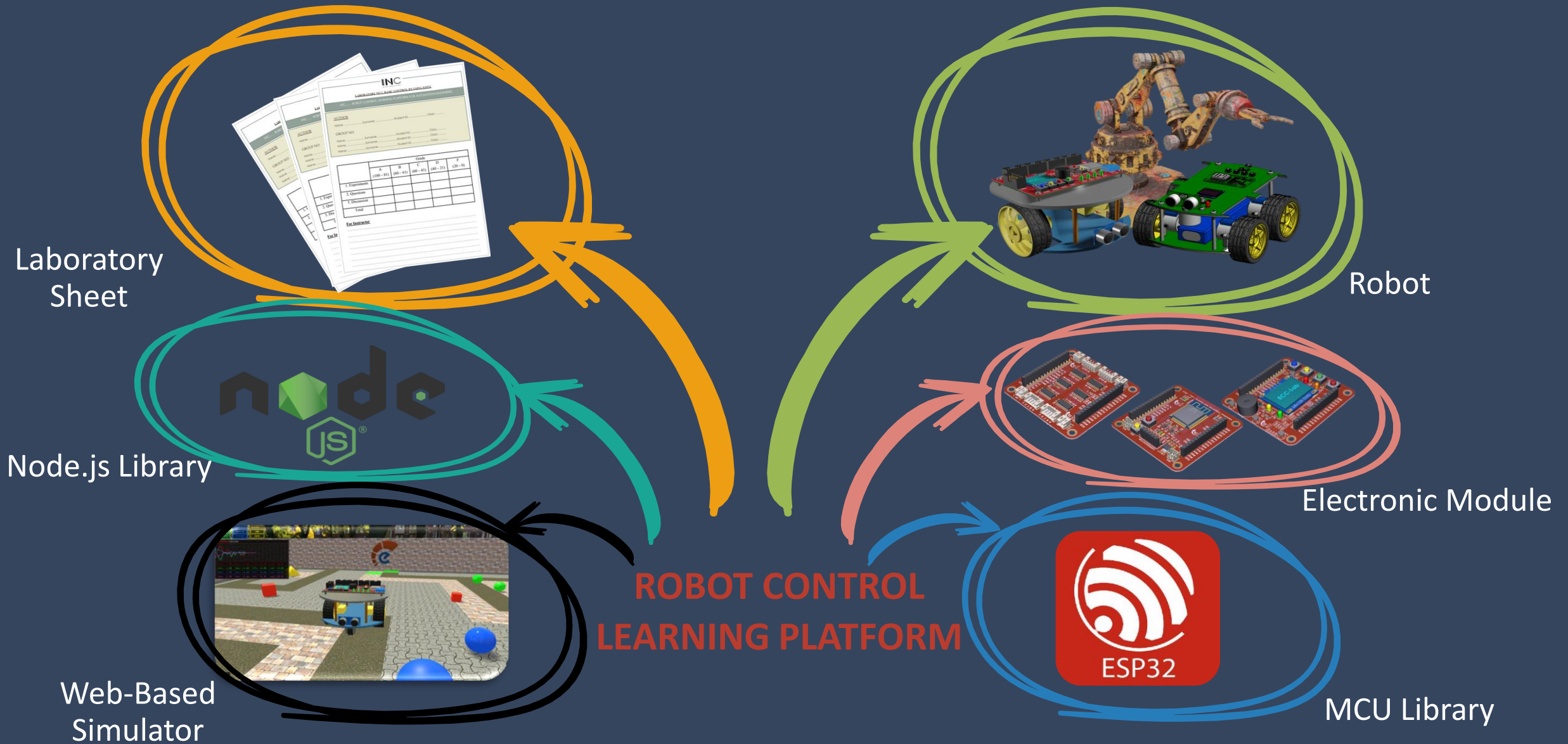
03 Laboratory

01
Overview

Laboratory Sheet

Robot

Node.js Library

Electronic Module

Web-Based Simulator

ROBOT CONTROL LEARNING PLATFORM

ESP32

MCU Library

Overview

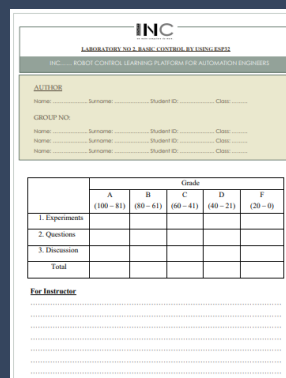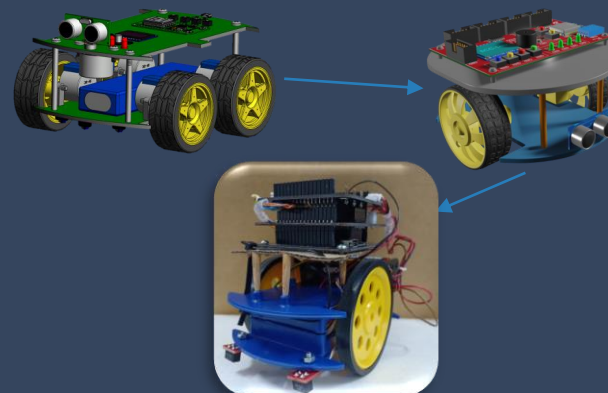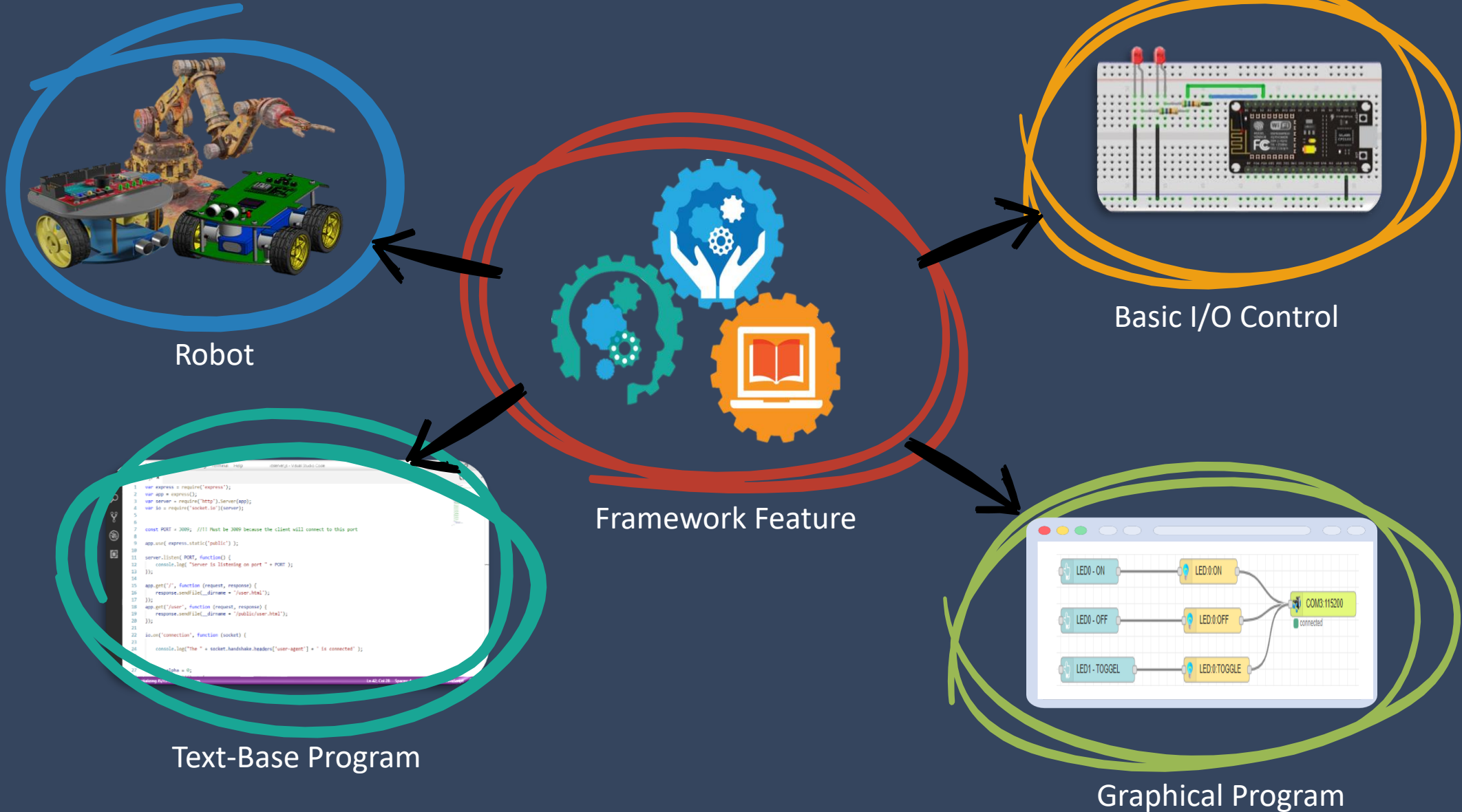|	Laboratories	Robot Design	Library Design (COM + MCU)
Version 1	Design first draft	Design Robot	Research + Design function
Version 2	Form + Content	- Hardware Design - Circuit Design - Testing	- Basic Control - Wi-Fi
Version 3	Complete Laboratory Sheets		- Simulation - Node.js

Robot

Basic I/O Control

Framework Feature

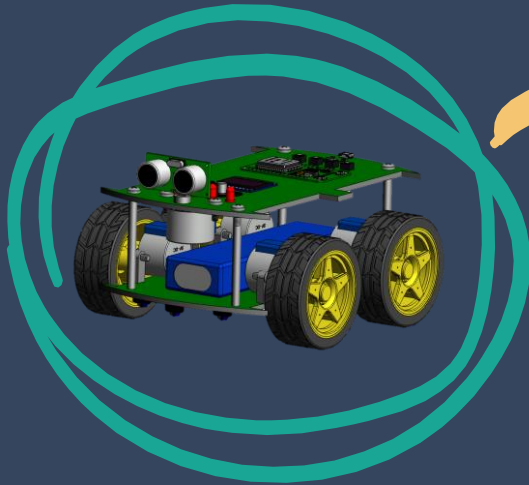Text-Base Program

Graphical Program
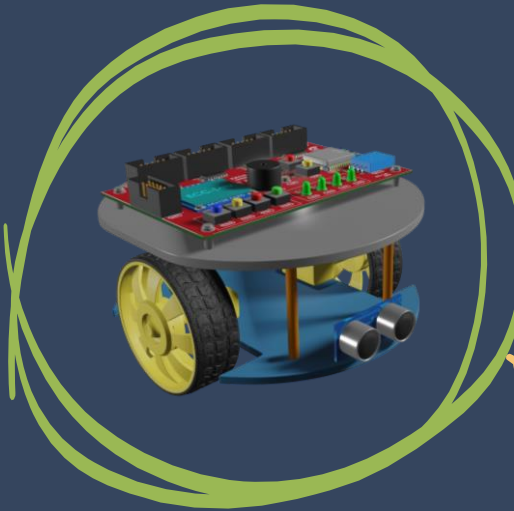
02
Robot Microcontroller Design

Robot Design
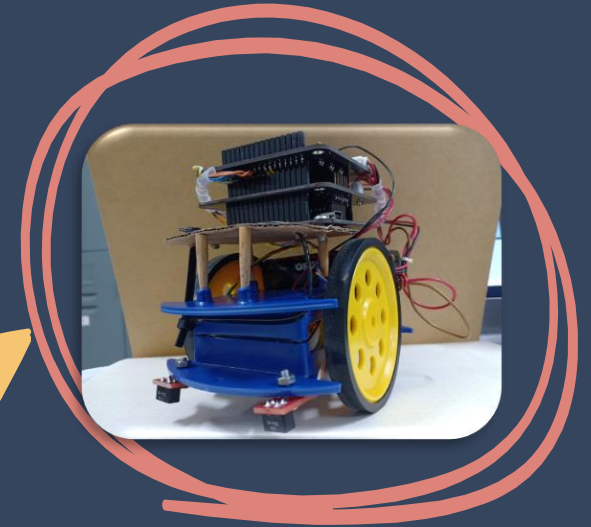
Design 1

Disadvantages
- Too big
- Fixed kind of robot
- Battery is too big and too much current
- Use a lot of motor
- Have specific function

Design 2

Disadvantages
- Not flexible to work
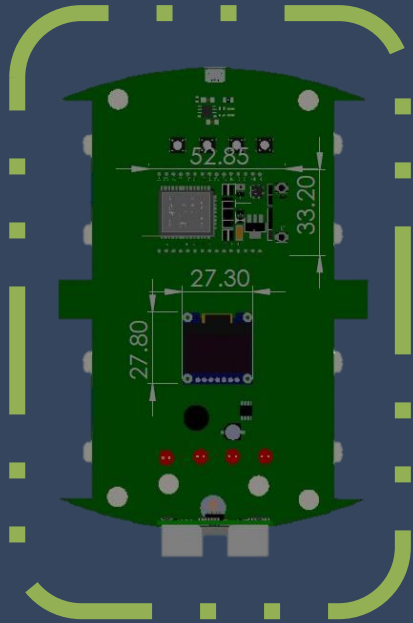- There are still specific function

Design 3

Advantages
- Any robot can be use
- Microcontroller board will support all type of robot

Microcontroller Design

PCB Design
Version 1
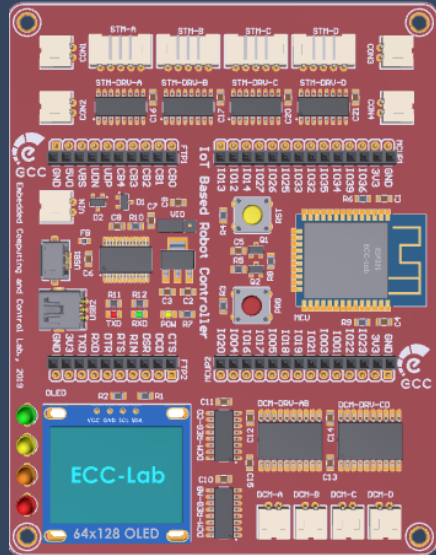
PCB Design
Version 2
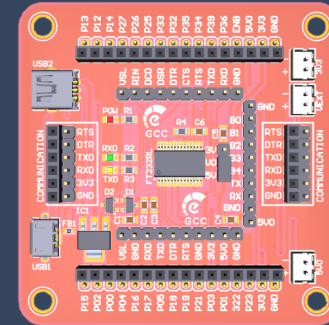
FT232
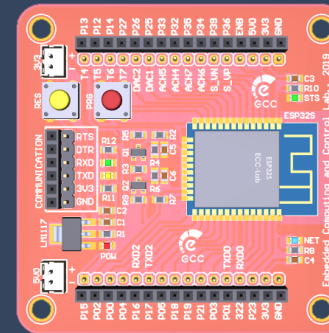
MCU ESP32
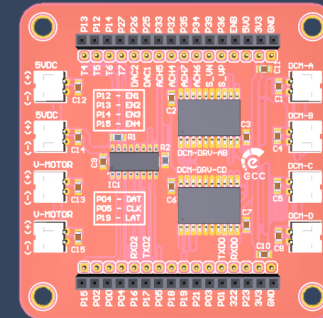
DC Driver
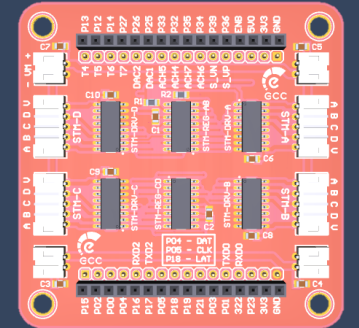
ST Driver
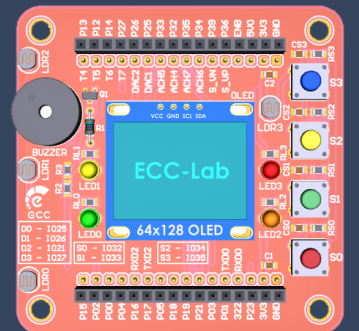
Panel

PCB Design
Version 3

MCU ESP32
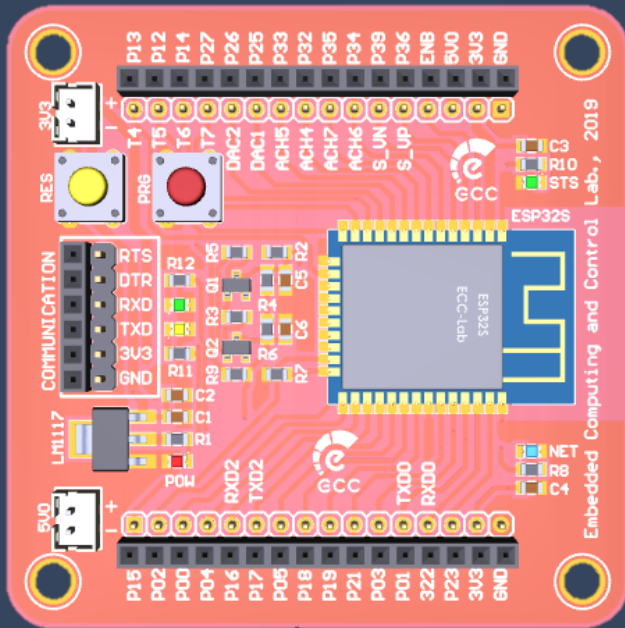
WIFI

Bluetooth

LED indicator
(Status green, Internet connection blue)
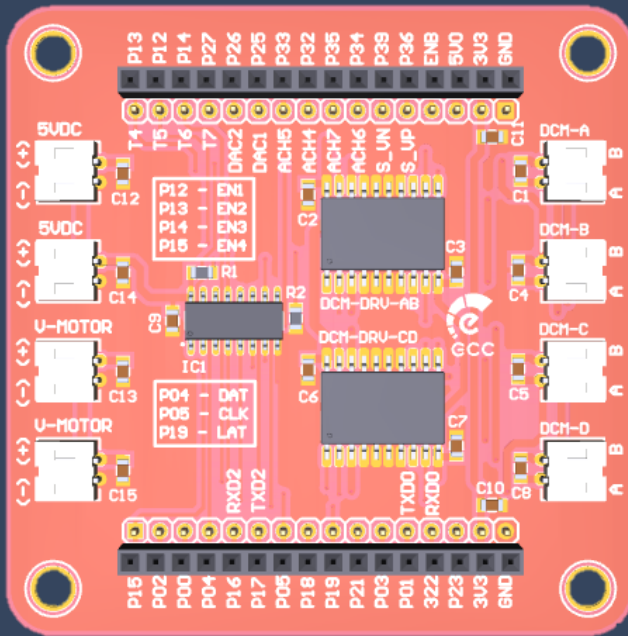
L293D

Pulse-Width Modulation (PWM)

Voltage range
4.5V – 36V

Current
600 mA/channel

Current
350 mA/channel

Bidirectional Stepper
Motor Drive

Voltage range
3.5V – 55V
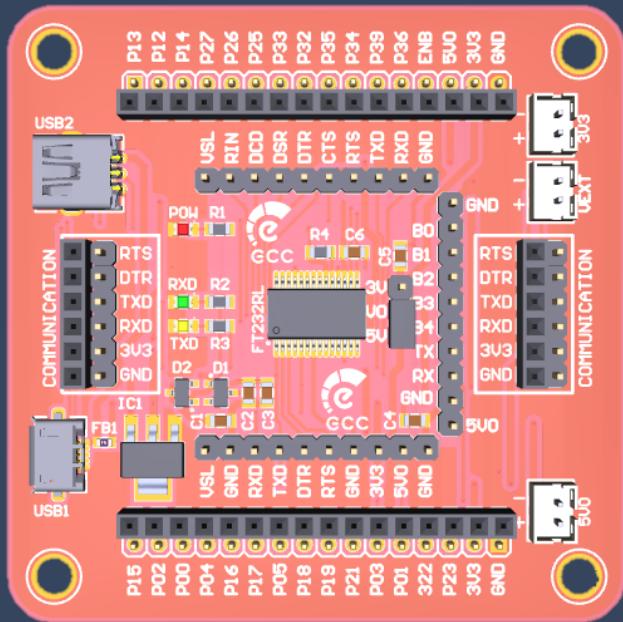
Build-in
power supply

LED indicator

Full speed USB 2.0
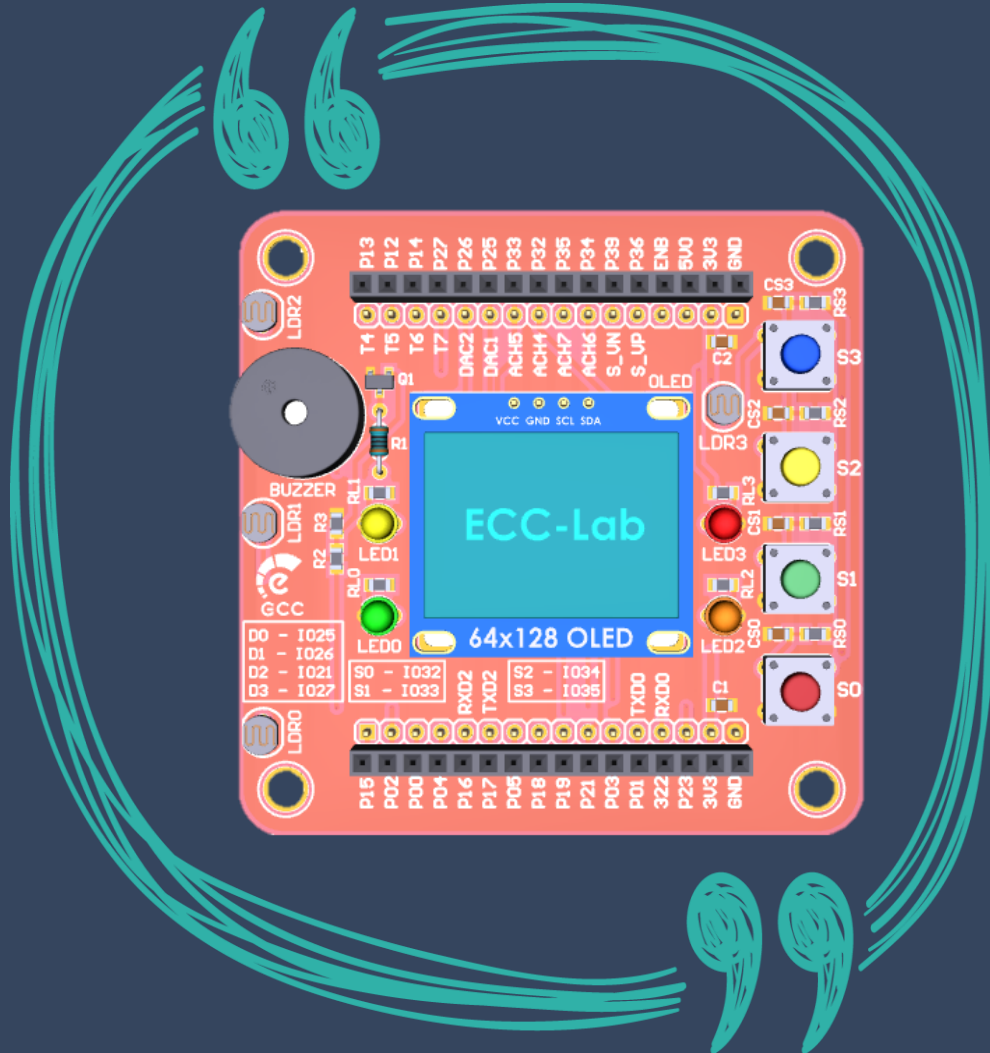
Buzzer

LCD

LED

Switch

03
Laboratory

WRITE CODE

GETINPUT.ESP32

UDP

WIFI NETWORK

UDP

WIFI ADAPTER

USB

GETINPUT.ESP32

SER1 TTL

12 Laboratories

SERIAL OVER USB
(TESTING AND BENCHMARKETING
PURPOSES ONLY)

SER2 TTL

Movement
(Run, Left, Right)

Using the Ultrasonic
Distance Sensor

Line Following

Simulation

Control Web-based
application and Bluetooth

Function of sensor
in Robot

Lab Simulation

User

WRITE CODE

Web Browser

Node.js application through the web browser.

Action Keyboard

NodeJS Server

Keyboard Control

Move
Forward
Backward

Turn
TurnLeft
TurnRight

Actions
Idle
Auto

Movement
(Run, Left, Right)

Control Web-based application

Node.js Application

SDK Library

Express is a minimalistic web framework based on Node.js

Robot Control Learning Platform for Automation Engineers

Members: Ms. Piyaporn Chairojsampan Ms. Raweenipha Jitaree Ms. Kanyawee Sadubjit
Advisor: Dr.Santi Nuratch

Abstract

Nowadays, automation system has become an important role in our life. Automation system has developed everyday which it is a very important thing for students who study in Engineering field. It is necessary for them to study before they are going to work as an engineer in the future.

For our project, we will focused on enhancing the automation engineering skills on software components by using microcontroller which we are going to create laboratories and experiments that will use the robot as a learning platform to help students to understand more about the fields that they are studying and also inspire them to use their knowledge that they get from our laboratories in the future engineering works.
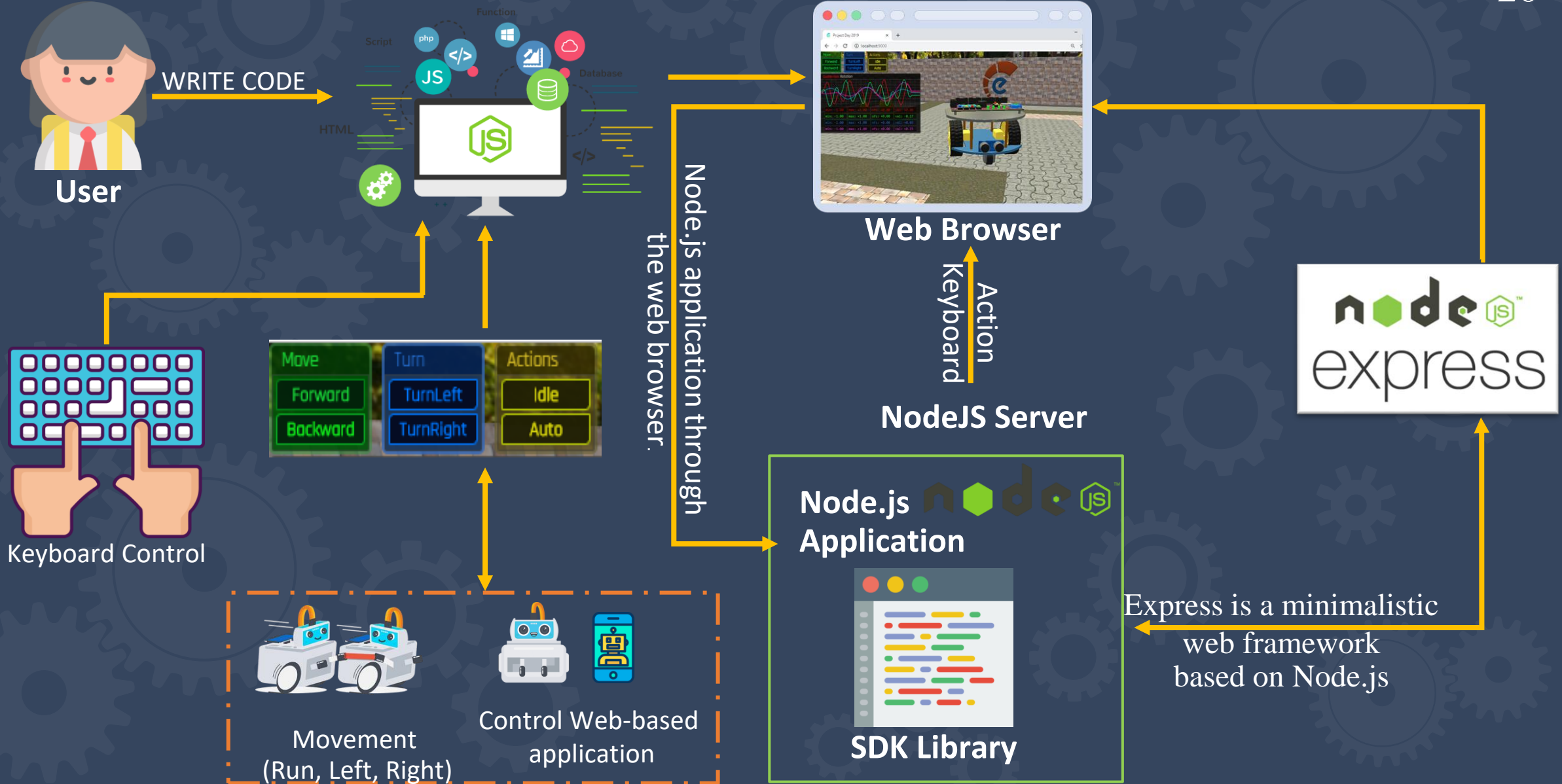
Background

Automation system has a big role in human life, and it is also a system that is likely to develop and become popular. The main duty is to facilitate the human life. It can control and reduce the damage from human and it is easier to operate. Therefore, we propose robot control learning platform for automation engineers. The platform provides both libraries and laboratory sheets for students to learn about how to control a robot. In this project we will design laboratories for 16 weeks, that will contain 12 laboratories such as collision avoidance, line tracking, etc.


Objectives

1. To make laboratories for the 3rd year students in the Department of Control System and Instrumentation Engineering, KMUTT
2. To build robot as a learning platform in each laboratory
3. To make libraries for robot control system
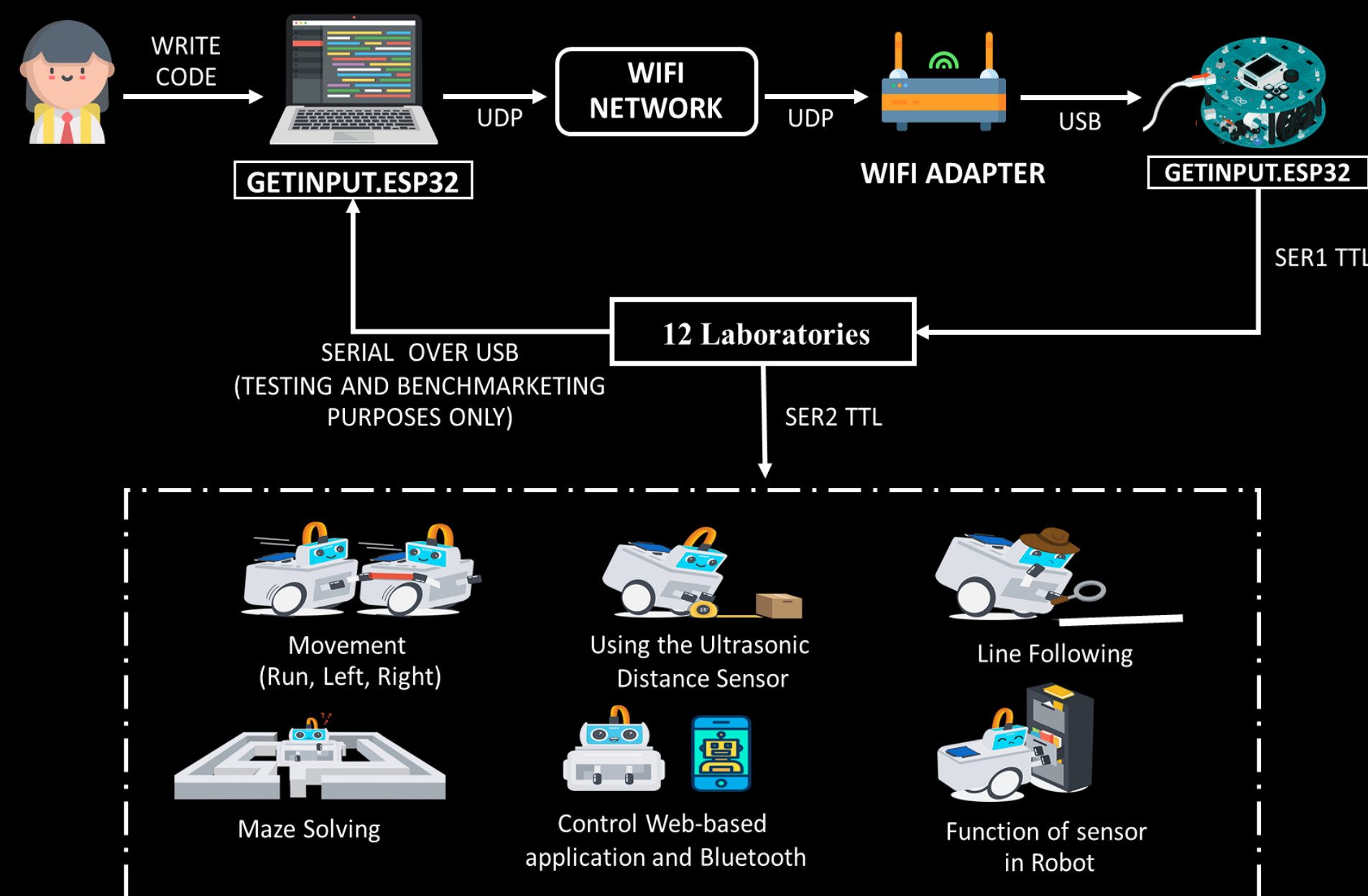4. Design IoT-based MCU board for robot control system

Methodology

1. To make laboratory sheets for the 3rd year students in INC

2. Bring advantages of research to adapt with project

3. Design laboratory sheets for learning robot control system

4. Create laboratory sheets for experiments

5. Write programming examples and complete all modules

Lecturer requirements → Design Laboratory & Robot → Design & Create Libraries → Electronics & Robot / Laboratory Sheet
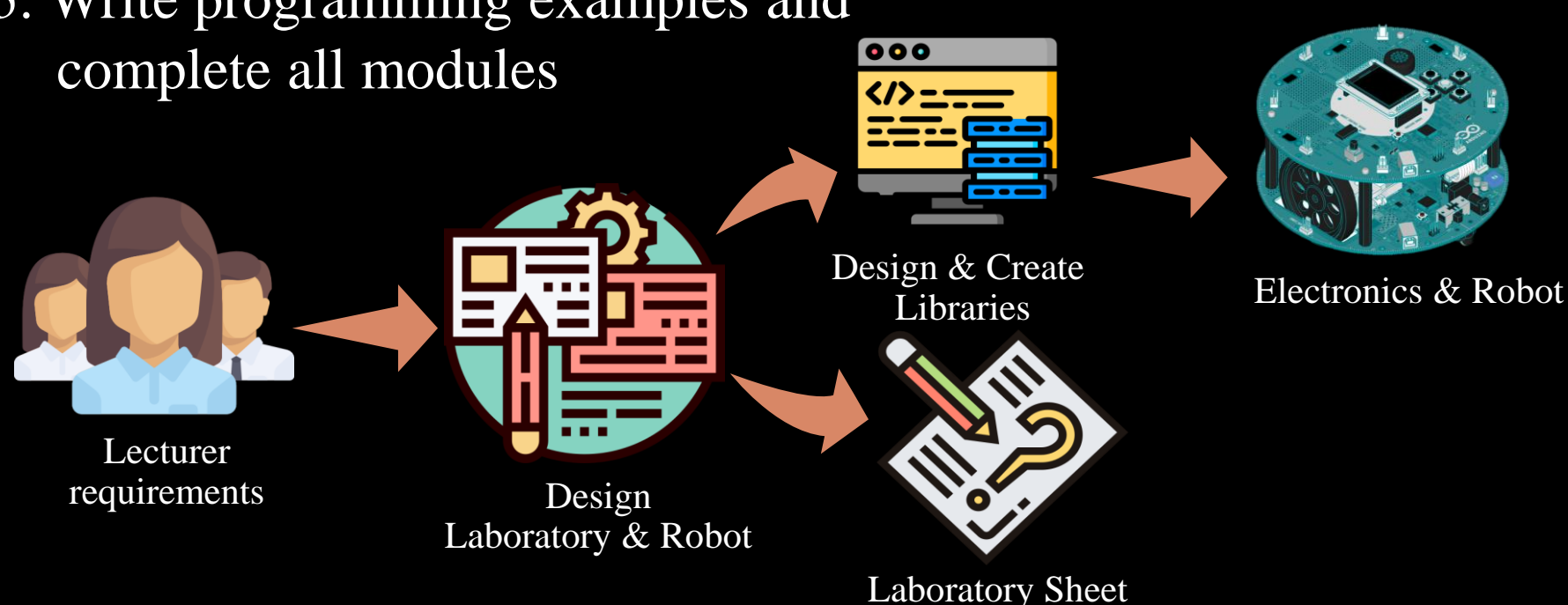
Experiment and Results

12 Laboratories

1. Software Installation
2. Basic I/O Control
3. Wi-Fi and Bluetooth
4. Web-based application
5. Robot Movement Control
6. LCD Display
7. Line Tracking and avoid define area
8. Collision Avoidance
9. Maze problem
10. Detect and follow the light
11. Avoid falling
12. Signaling/Marker

WRITE CODE — GETINPUT.ESP32 — UDP — WIFI NETWORK — UDP — WIFI ADAPTER — USB — GETINPUT.ESP32 — SER1 TTL

SERIAL OVER USB (TESTING AND BENCHMARKING PURPOSES ONLY) — 12 Laboratories — SER2 TTL

Movement (Run, Left, Right) — Using the Ultrasonic Distance Sensor — Line Following — Maze Solving — Control Web-based application and Bluetooth — Function of sensor in Robot

Conclusion

In this project, we propose the robot control learning platform for automation engineers (and other related fields). The system composes of hardware, software and laboratory sheets. These help students convenient to learn and understand more about the field that they are studying, and it also supports automation system. Students will enjoy laboratories. We will have efficiency robotic system learning lab kits and students can use their knowledge in the future engineering works about automation system which it is necessary for them before they are going to work as an engineer. In addition, these platforms can be applied to industrial robots and other automation systems.