# TPA-iPES

Thai-German Pre-engineering School
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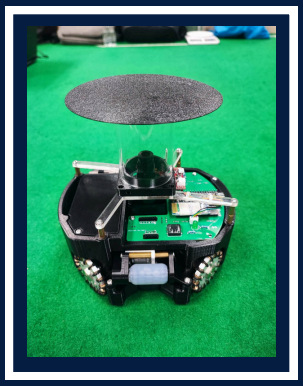
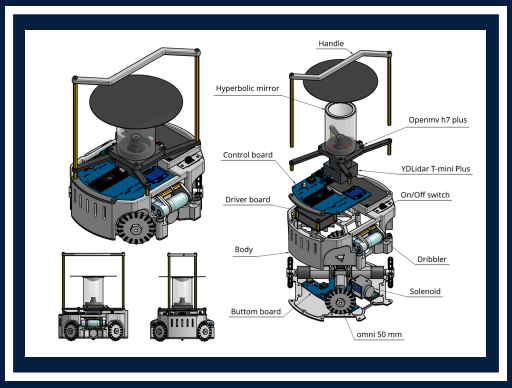
## Team member :

Mr. Watcharapong Thepnok : Vision system/software, sub control software
Mr. Sirapop Sudduen : Main Control software/ pcb schematic design/ component placement
Mr. Nikanti Chirasukon : Mechanical/structure design, PCB outline design

## Mentor:

Mr. Kathawut Uschin
Mr. Chainarin Chaochaipat






## Hardware :

"We use two LiPo batteries: 1500mAh for the main system and 300mAh for the solenoid. The dribbler uses a brushless motor for ball control, and the solenoid kicker is controlled by a MOSFET. The robot is designed in Onshape and main body is 3D printed."

## Software:

We use STM32CubeIDE for programming the STM32F411CEU6 due to its efficient peripheral and clock management. For vision tasks, we use OpenMV IDE with the H7 Plus, taking advantage of its built-in image processing libraries.

## Vision System:

Our vision system uses a 360-degree hyperbolic mirror setup combined with a camera to determine the ball's position relative to the robot. The hyperbolic mirror is specifically designed to cover a suitable range of the field by calculating its hyperbolic parameters. The camera applies a blob detection method to locate the ball in the image and converts this to real-world coordinates using experimentally derived formulas. To improve reliability, blob filtering uses the ball's unique features, like pixel size and angular size, to reduce false detections.

## Ball Chasing System:

Our ball chasing system keeps the robot facing one direction while moving translationally toward the ball. It uses two PID controllers—one for the X-axis and one for the Y-axis—to minimize distance to the ball.
When the PID output indicates the robot is moving in a direction that may result in hitting rather than dribbling the ball, we adjust its movement vector to a more effective angle. This angle is calculated based on the shortest path that allows the robot to reach and dribble the ball smoothly from its current position where we consider if the robot would move in a straight line at that moment.

## Movement System:

We use a 4-wheel X-cross omniwheel configuration with brushed motors and magnetic encoders, managed by PID control. Two levels of PID synchronization motor pair and vector ensure balanced speed and direction preventing unwanted rotation and improving movement accuracy.

## Localization System:

Our localization system uses a 360-degree 2D LiDAR to determine the robot's position on the field and IMU to determine robot orientation which is needed as a part of localization and also angle correction for movement system. Lidar find the longest distance in each quadrant, which typically indicates the field corners. These points are used to calculate the robot's X and Y coordinates.
The position data also helps the robot locate the goal for shooting and avoid going out of bounds during movement.

RoboCup JUNIOR