โครงงานสะเต็มศึกษาและกล่องสมองกล

เรื่อง ระบบแสดงสถานะโต๊ะกินข้าวในโรงอาหาร

(Food Count System IoT)

โดย

1. นายทัศน์พล เหมมั่น
2. นายนจรุจ อุ่นธง
3. นายวิทยา อ้นสุวรรณ

รายงานนี้เป็นส่วนประกอบของการแข่งขันโครงงานสะเต็มศึกษาและกล่องสมองกล

ระดับชั้นมัธยมศึกษาตอนปลาย นำเสนอภาษาอังกฤษ

เนื่องในงานการแข่งขันมหกรรมวิชาการระดับชาติ กลุ่มโรงเรียนผู้นำ 46 ICT โรงเรียนในฝันและโรงเรียนเครือข่าย

ระหว่างวันที่ 16 – 18 สิงหาคม 2566

ณ มหาวิทยาลัยอุบลราชธานี และโรงเรียนวารินชำราบ อำเภอวารินชำราบ จังหวัดอุบลราชธานี

Project name Food Count System IoT (Food Court + Count system + IoT)

Students name

1. Mr. Tasphol Hemmat
2. Mr .Nopparoot Aunthong
3. Mr. Wittaya Ounsuwan

Advisor Mr. Khanit Chanoksrithornkirati

School Yothinburana school

Address 1313 Pracha Rat Sai 1 Road Bang Su, Bangkok 10800

Abstract

The “Food Count System IoT” project is a dynamic solution aimed at tackling the challenges posed by bustling food courts during peak hours. By harnessing the power of ESP32 microcontrollers, the project intends to enhance student experiences by providing real-time updates on table availability. This innovative system allows students to easily locate available lunch tables, streamlining their dining experience. The project’s cornerstone involves ESP32-based clients that utilize the MQTT protocol to broadcast table statuses, which are then processed by user clients created with Node-RED. The project is structured into two pivotal phases: the development of ESP32-based Box Clients and the implementation of ESP32 control logic for toggle button states, MQTT publishing, and Node-RED MQTT subscriptions for displaying table statuses. The project makes use of ESP32 modules, toggle switches, 3.7V Li-ion batteries, battery boxes, and the team’s adept programming skills.

While the Food Count System IoT offers an ingenious solution to assist students in locating available tables, there are certain challenges to be addressed. The implementation cost of deploying individual ESP32 Box Clients for each table can be substantial. Additionally, occasional operational hiccups may arise due to student unfamiliarity with the system or mischievous behavior that may disrupt the accurate functioning of the system.

Unit 1

Introduction

1.4 Rationale of the Project

The project “Food Count System IoT” originates from the need to address challenges faced by bustling food courts during peak hours. Leveraging the capabilities of ESP32 microcontrollers, the project aims to elevate student experiences by providing real-time updates on table availability. In an innovative approach, this system empowers students to effortlessly locate vacant lunch tables, streamlining their dining encounters.

The pivotal concept revolves around ESP32-based clients, utilizing the MQTT protocol to broadcast table statuses, subsequently processed by user clients implemented through Node-RED. The project’s execution unfolds in two key phases: the development of ESP32-based Box Clients, and the intricate implementation of ESP32 control logic encompassing toggle button state readings, MQTT publication, and Node-RED MQTT subscription for displaying table statuses.

The project harnesses components such as ESP32 modules, toggle switches, 3.7V Li-ion batteries, battery boxes, and the team’s proficient programming skills. While the Food Count System IoT introduces an ingenious solution to aid students in locating available tables, certain challenges warrant attention. Notably, the cost implications of deploying individual ESP32 Box Clients for each table, and occasional operational anomalies stemming from student unfamiliarity or mischievous behavior, require strategic handling.

In essence, the “Food Count System IoT” project resonates as a pioneering endeavor with the potential to enhance student convenience and optimize food court management. As the deployment of IoT technology in everyday scenarios gains momentum, this project serves as a testament to the transformative power of innovation.

1.2 Project Objectives

1. Develop an IoT-based table counting system utilizing ESP32 microcontrollers.

2. Enhance student convenience by facilitating swift identification of available lunch tables.

3. Showcase the applicability of IoT technology in addressing real-world challenges.

1.3 Scope of Study:

The “Food Count System IoT” project encompasses the following details:

1. Project Commencement Date: The project will initiate on July 20, 2566.
2. Location: The study and development of the project will take place at Yothinburana School. This real-world setting will allow the creation and testing of the system within the school’s cafeteria environment.
3. Development Phases:
    - Design and fabrication of ESP32 client boxes to be installed on dining tables.
    - Programming ESP32 control logic to transmit table status data via MQTT.
    - Creation and deployment of a Node-RED system to receive MQTT data and display table statuses to users.
    - Testing and refinement of the system in the actual cafeteria setting.
4. Study Duration: The project will encompass the period from July 20 to July 30, 2566, during which development and testing activities will take place.

1.5 Anticipated Benefits

2. Efficient Table Management: Implementing the IoT-based system streamlines table allocation in busy food courts, optimizing resource utilization and enhancing operational efficiency.
3. Student Convenience: Real-time updates enable students to quickly find available tables, minimizing wait times and enhancing their dining experience.
4. Resource Allocation: Accurate data on table occupancy facilitates effective staff and resource allocation, reducing wastage and improving cost-effectiveness.
5. Showcasing IoT: The project serves as a tangible example of IoT's practical application, inspiring similar innovations and highlighting its transformative potential.

Unit 3

Equipments and Methods

3.1 Equipment

1. ESP32 Modules: Microcontrollers for creating the IoT clients.
2. Toggle Switches: Input devices for indicating table occupancy.
3. Li-ion Batteries (3.7V) and Battery Boxes: Power sources for ESP32 client boxes.
4. Enclosures: 3D-printed or fabricated cases to house the ESP32, toggle switch, and battery.
5. CAD Software (e.g., SolidWorks): For designing the enclosure.
6. Programming Environment: Arduino IDE for writing ESP32 control logic.
7. MQTT Broker: To facilitate communication between ESP32 clients and Node-RED.
8. Node-RED: Flow-based development tool for creating user interfaces and handling MQTT data.
9. Testing Equipment: Tools for connectivity testing, such as laptops, smartphones, and MQTT clients.