Міністерство освіти і науки України
Український державний університет науки і технологій

Комп'ютерних технологій і систем
(назва факультету)

Електронні обчислювальні машини
(повна назва кафедри)

Пояснювальна записка

до кваліфікаційної роботи
бакалавра
(ступінь вищої освіти)

на тему: Розробка електронного бейджа для конференцій

за освітньою програмою Комп'ютерна інженерія

зі спеціальності: 123 Комп'ютерна інженерія
(шифр і назва спеціальності)

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Засвідчую, що у цій роботі немає запозичень з праць інших авторів без відповідних посилань.

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Дніпро – 2025 рік

Ministry of Education and Science of Ukraine
Ukrainian State University of Science and Technologies

Computer Technologies and Systems
(faculty)

Electronic Computers
(department)

Explanatory Note

to Bachelor's Thesis
(higher education degree)

on the topic: Electronic conference badge development

according to educational curriculum Computer Engineering

in the Speciality: 123 Computer Engineering
(speciality and its code)

Done by the student of the group: КС2014 / Sarham SALIM /
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Dnipro 2024

Міністерство освіти і науки України
Український державний університет науки і технологій

Факультет: Комп'ютерні технології і системи
Кафедра: Електронні обчислювальні системи
Рівень вищої освіти: Перший (бакалаврський)
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(шифр та назва)

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Дата _____

ЗАВДАННЯ

на кваліфікаційну роботу бакалавра
(ступінь вищої освіти)

студенту Сархам Салім
(Прізвище, Ім'я По батькові)

1. Тема роботи: Розробка електронного бейджа для конференцій

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затверджені наказом від " " р. №

2. Строк подання студентом роботи: 17.01.2025 р.

3. Вихідні дані до роботи: Arduino documentation, ESP32 documentation

4. Зміст пояснювальної записки (перелік питань, які потрібно опрацювати):

4.1 Основна частина:

Порівняння електронних бейджей від різних компаній

Вибір технологічного стеку для розробки системи

Розробка електронного бейджа

КАЛЕНДАРНИЙ ПЛАН

№ з/п	Назва етапів кваліфікаційної роботи	Строк виконання етапів роботи	Примітка
1	Вступ	4.11.2024	5%
2	Порівняння електронних бейджей від різних компаній Comparison of electronic badges from different companies	8.11.2024	20%
3	Вибір компонентів для побудови пристрою Selecting components for the device development	25.11.2024	20%
4	Розробка електронного бейджа Development of an electronic badge	13.12.2024	50%
5	Висновки	10.01.2025	5%
6	Подання кваліфікаційної роботи до кафедри	17.01.2025	
7	Захист кваліфікаційної роботи на засіданні Екзаменаційної комісії	24.01.2025	

Студент _____ Сархам САЛІМ
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Керівник роботи _____ Володимир ДЗЮБА
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кваліфікаційної роботи бакалавра
(ступінь вищої освіти)

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Тема випускної роботи: Розробка електронного бейджа для конференцій

1. Якісні відмінності кваліфікаційної роботи: Випускна робота студента є актуальною. Відмінністю роботи є низьке споживання енергії та тривалий час роботи розробленого електронного бейджа для конференцій. Електронний бейдж завантажує інформацію через Wi-Fi мережу, і має функції перегляду програми конференції та відправлення контактної інформації користувача іншому учаснику конференції. У роботі: здійснено огляд подібних бейджів, обрано компоненти пристрою, розроблено схему та програмне забезпечення пристрою. Робота програми перевірена на сучасному симуляторі плат розробки.

2. Зауваження: Невеликі недбалості оформлення не знижують якості роботи

3. Висновок щодо дотримання академічної доброчесності: перевірка роботи на антіплагіат підтвердила дотриманість здобувачем академічної доброчесності

Комплексна оцінка кваліфікаційної роботи: Кваліфікаційна робота заслуговує відмінної оцінки, а здобувач Салім Сархам Мустафа, присудження йому кваліфікації бакалавра за спеціальністю 123 Комп'ютерна інженерія

Керівник: ст. викл. кафедри ЕОМ Дзюба В. В.
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Дата: 21.01.2025 (підпис)

РЕФЕРАТ

Пояснювальна записка до кваліфікаційної роботи бакалавру:

52 с, 21 рис., 1 табл., 10 джерел.

Об’єкт розробки – електронний бейдж для конференцій.

Мета роботи – розробка інтелектуального бейджа для конференцій на базі мікроконтролеру.

Методи дослідження – аналіз аналогічних розробок.

Одержані результати – виконано огляд аналогічних розробок, та аналіз загальних вимог до подібних пристроїв. Обрано апаратні компоненти для пристрою. Розглянуті основні завдання і функції пристрою, побудовано функційну схему пристрою. Побудовано рисунок зовнішнього вигляду пристрою. Розроблено програмне забезпечення та інструкція з користування.

Ключові слова: БЕЙДЖ, КОНФЕРЕНЦІЯ, ARDUINO, MICROCONTROLLER.

ABSTRACT

Explanatory note to the bachelor's qualification thesis:

52 p, 21 fig., 1 table, 10 sources.

The research subject is development of an electronic conference badge.

The goal of the work is to design a user friendly electronic conference badge in order to enhance attendee experience through interactive technology.

The project presents design, development and implementation of an electronic conference badge, aiming to revolutionize the traditional conference experience by integrating advanced technologies such as WiFi, Bluetooth and LED displays. The proposed badge enable attendees to engage with each other, access event information and participate in interactive activities.

A review of similar developments and an analysis of the general requirements for such devices were performed.

The hardware components for the device have been selected. The work examined the main tasks and functions of the device. A functional diagram of the device and a drawing of the appearance of the device were developed. Software and instructions for use were also developed.

Keywords: CONFERENCE, BADGE, ARDUINO, MICROCONTROLLER.

CONTENTS

INTRODUCTION

An Electronic conference badge is a wearable electronic device typically designed for attendees of conferences, festivals, or events. It serves as their identity and is a replacement for a traditional paper-based badge or pass issued at public events.

In the modern era of technology-driven interactions, electronic conference badges have emerged as essential tools for enhancing communication and engagement at events such as conferences, exhibitions, and trade fairs. These smart badges combine the principles of wearable technology and real-time data processing to facilitate seamless networking, personalized experiences, and event analytics. The development of electronic conference badges marks a significant advancement over traditional paper-based badges, offering versatility and functionality that cater to the needs of organizers, attendees, and exhibitors alike.

The history of conference badges can be traced back to simple name tags that served the sole purpose of identifying attendees. These basic identifiers, though functional, were limited in scope and offered no interaction beyond visual recognition. As conferences grew in size and complexity, the need for better attendee management and enhanced networking capabilities became evident. By the late 20th century, advancements in technology such as barcodes and QR codes introduced a new era of semi-automated badges, enabling quick registration and data capture. However, these solutions were largely static and lacked the ability to adapt to dynamic conference environments.

Use of Wi-Fi's radio bands networks and flash storage technologies will allow badges to store and transmit data wirelessly, facilitating applications such as access control, session tracking, and contact exchange. The integration of IoT (Internet of Things) principles further expanded the potential of electronic badges, transforming them into interactive tools capable of real-time updates and analytics.

The goal of our work is to create a typical electronic conference badge which can be used to show identity and exchange information seamlessly between attendees.

1 COMPARISON OF ELECTRONIC BADGES

We will overview some of the previous works on the development of electronic conference badge and compare their functionality.

1.1 White SmartBadge

Mark Alexander White (2006) designed the SmartBadge [1] which is an electronic replacement for the standard paper name badge worn at conferences and similar events. The SmartBadge communicates with other badges by using the infrared transceiver.

Hardware components of the SmartBadge

The SmartBadge was developed using the following hardware components:

- CC1010 microcontroller;
- RF transceiver IC;
- LCD display;
- Four bi-color LEDs;
- Two buttons;
- Piezoelectric buzzer.

Functions of the SmartBadge

The SmartBadge has a number of functionalities which include the following:

- It can be used to display information of users;
- It can be used to greet users;
- It can be used to exchange information through infrared connection;
- It can be used to connect persons with same interest;
- It can log how long you stay with a person.

Figure 1.1 – Picture of The SmartBadge

Pros and Cons of White SmartBadge

The pros and cons of White SmartBadge are as follows:

Pros:

- Enhance security and authentication.
- Improved efficiency in check-in and access control.

Cons:

- Technical issues and debugging challenges.
- Limited compatibility.

1.2 Liu SmartBadge

Yi Liu also a student of University of Canterbury designed an intelligent smart badge [2] system which can analyze wearers' interest by using Bayesian Network Algorithm. The smart badge can be used to collect information in real time through an infrared sensor; the system is designed in such a way that when two attendees with similar interests come in contact, the badges can send their IDs to the server which in turn gives back feedback to the attendees indicating the keywords they have in common.

Yi Liu did not give much emphasis about the hardware part as it is being designed by another student; therefore, his main concern is the design of the intelligent system.

Features of Liu smart badge

According to Liu, the intelligent smart badge system should have the following three functions:

- 'Attendees' Memes Inference': The function can analyze the wearer's interests by using a Bayesian Networking algorithm, rather than the wearer programming their interests by themselves;
- 'Seeking Friends': This is an introduction service which uses matchmaking algorithms to find people with similarities in their profiles.

'Social Relationship Inference': This function infers social relationships between people based on proximity and interaction behaviors. Being able to infer relationships in this way will augment a variety of existing services that currently require users to manually quantify existing relationships. When two people encounter each other, they cannot only know each other names (on the badge), but they can also know what the relationship between them is. By inferring the social relationships, the intelligent system can group the attendees according to their purposes for attending the conference and the memes they have.

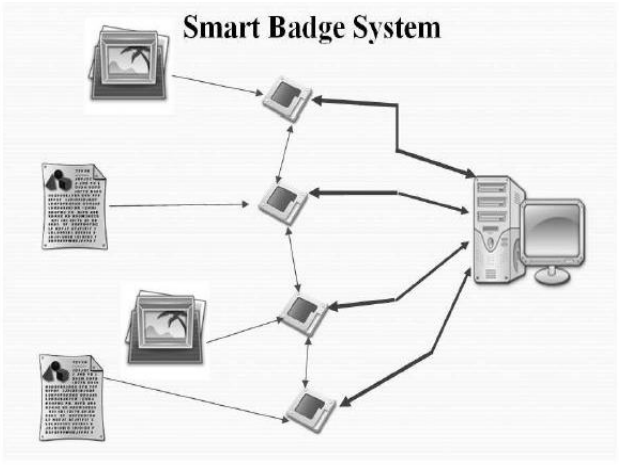

Figure 1.2 – The Smart Badge System

Pros and Cons of Liu SmartBadge

The following are pros and cons of Liu SmartBadge:

Pros:

- Using algorithm to analyze wearers' interest.
- Improved data accuracy and tracking.

Cons:

- Expensive to set up

1.3 Parallax Hackable Electronic Badge

Parallax Inc. a privately held company in Rocklin, California which designs, manufactures and sells Basic Stamp microcontrollers, Propeller microcontrollers, micro controller accessories (such as LCDs, sensors, RF modules, etc) and educational robot kits also produce its own type of Hackable Electronic Badge [3] .

A hackable electronic badge is a wearable electronic device desiged to be modified, extended, or exploited by users. The Parallax Hackable Electronic Badge can be used to store and distribute schedules, identify participants, share contact info, and play interactive games.

Hardware components of the hackable electronic badge

The Hackable Electronic Badge was developed using the following hardware components:

- Propeller 8-core microcontroller, 64 KB EEPROM and 5 MHz crystal oscillator, with two-way infrared communication;
- 128 x 64 OLED display;
- 3-axis accelerometer (±1.5 g) for orientation and motion detection;
- Two super-bright, tri-color RGB LEDs;
- Six passive touch-buttons with status LEDs, plus 1 special OSHW logo touch-button;
- Stereo audio and composite video out;
- USB port for programming and charging;
- Convenient on/off push switch;
- 3.6 V Li-ion battery;

Features of hackable electronic badge

- On-board battery charger, management, and charging disable functions;
- Two mini prototyping areas, with access to I2C, 11 I/O's, 3.3V, 5V-USB and battery voltage;
- Replaceable and user-customizable display covers;
- Six mounting points plus lanyard slots; lanyard included.

Application of parallax Hackable electronic badge

The Parallax Hackable Electronic Badge can be used in a number of ways which include:

- Interactive ID Badge for conferences, hackathons, and maker spaces;
- Interactive lessons in programming, cyber security, and information diffusion in the classroom;
- Research and experimentation with parallel processing and social communication;
- Robot control panel, using onboard multicore processor, OLED display, accelerometer and buttons;
- Develop portable games or interactive quizzes.

Figure 1.3 – The Hackable Electronic Badge

Below are some of the pros and cons of Hackable Electronic Badge:

Pros:

- Innovation and creativity: Hackable badges inspire innovation and creativity, allowing attendees to showcase their skills;
- Cost-Effective: Attendees can reuse and repurpose the badge.

Cons:

- Technical Challenges: Hackable badges can be technically challenging, requiring attendees to have some programming or electronic knowledge;
- Support and Maintenance: Hackable badges require ongoing support and maintenance which can be time-consuming and resource-intensive.

1.4 IntelliBadge

Donna Cox, Volodymyr Kindratenko and David Pointer presents a paper on IntelliBadge [5] which is a system that provide location aware value-added services to the participants of an academic conference with the goals to facilitate social interactions and foster social networks among the conference attendees through RFID technology.

The developed system tracks conference attendees, analyses the tracking data in real-time and provides various services to the attendees, such as a real-time snapshot of the conference events attendance, the ability to locate friends in the convention center, and the ability to search for events of interest.

1.5 Analysis of Electronic Badges

In order to come up with our unique electronic badge, we take a look at some of the existing electronic badges which are, White SmartBadge, Liu Smart Badge, Parallax Hackable Electronic Badge and IntelliBadge each with its distinctive features.

Analysis comparative table for electronic badges is shown in table 1.1. Plus sign (+) means the tool has the feature, while minus sign (-) means the tool doesn't have the feature.

All of the above electronic badges have sound alarms, but nevertheless, not all the devices provide the necessary information, so we take measure of some parameters approximately.

Table 1.1 – Analysis comparative table for electronic badges

Features	White SmartBadge	Liu SmartBadge	Parallax Hackable Electronic Badge
Information exchange			
Infrared	+	+	+
Bluetooth/ Wifi	-	-	-
Scheduling alarm	-	-	+
Greeting alarm	+	+	-
Width / Height	10x10cm	10x10cm	10.2x7cm
Weight (approximately)	100 grams	100 grams	900 gram
No. of buttons	2	2	8
Number of colors	4	4	8
Information screen	16X2 LCD Screen	16X2 LCD Screen	128x126 OLED Display
Cost of device (approximately)	Around 25$	Around 25$	40$
Time of work	3V U10004 thin cell battery (8hrs)	3V U10004 thin cell battery (8hrs)	3.6V Lion battery (12hrs)

From the table above, none of the electronic badges use Wi-Fi or Bluetooth for information exchange; so we will develop our own electronic conference badge using ESP32 Microcontroller that has Wi-Fi or Bluetooth connection.

1.6 Tasks solved with an electronic badge

After conducting analysis, the electronic conference badge should have the following key features:

- Serve as an identity
- Be able to make announcement for each session
- Exchange information seamlessly

1.7 Summary

After carefully studying the three different types of electronica badges namely White SmartBadge, Liu Smart Badge, Parallax Hackable Electronic badge and IntelliBadge, we can develop a next generation electronic conference badge that prioritizes user experience and creativity. Our proposed badge design will integrate advanced technologies like Wi-Fi, Bluetooth and LED displays while ensuring ease of use, durability and affordability.

2 ELECTRONIC BADGE COMPONENTS SELECTION

2.1 Requirements for components

Given that a bachelor's student will be responsible for developing the system, we have established key requirements for components selection to ensure the development process is student-friendly and achievable.

These requirements are:

- The components should be easy to understand and program;
- The components should be readily available and easy to procure;
- They should be of low-cost with good performance;
- They should meet safety standards and eco-friendly when possible;
- The components should be compatible with each other.

We will take a look at the different hardware components that will be used in the development process of the device.

2.2 Hardware components

2.2.1 ESP32 S3 development board

The ESP32 S3 Development Board is a powerful and versatile microcontroller board designed for IoT (Internet of Things) and embedded applications [4]. Based on the ESP32 microcontroller by Espressif Systems, it features integrated Wi-Fi and Bluetooth capabilities, making it ideal for a wide range of wireless communication projects. The ESP32 S3 Development Board is suitable for both beginners and experienced developers due to its rich feature set and extensive community support.

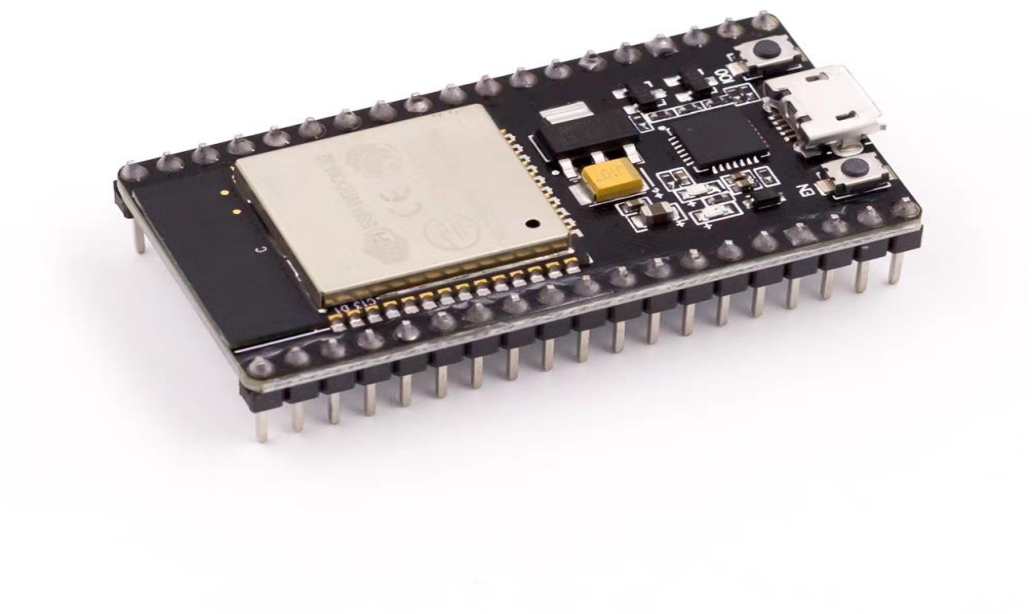

Figure 2.1 – ESP32-S3 Development Board

Features:

- Microcontroller: ESP32-S3
- Wireless Connectivity: Integrated Wi-Fi (802.11 b/g/n) and Bluetooth 5, BLE+ Mesh)
- 700Ma 3.3V LDO regulator
- Low power RGB LED
- LiPo battery charging
- USB-C
- Dimension: 35 x 18mm
- Interfaces: UART, SPI, I2C, I2S, PWM, ADC, DAC

Technical Specifications:

- Microcontroller: ESP32-S3
- Clock Speed: Up to 240 MHz
- Flash Memory: 8 MB
- SRAM: 520 KB
- GPIO Pins: 17
- UART:
- SPI:

- I2C:
- I2S:

2.2.2 4.2 inch E-ink display

Electronic paper display is a collective name for display technologies that offer a paper-like performance with high display clarity, sunlight readability and very low power consumption.

Figure 2.2 – 4.2 inch E-ink Display

The 4.2 inch E-ink raw display has the following features and specifications [5]:

Features:

- No backlight: keeps displaying last content for a long time even when power is down;
- Ultra low power consumption: basically power is only required for refreshing;
- Comes with development resources and manual.

Technical specifications:

- Operating voltage: 3.3V
- Interface: 3-wire SPI, 4-wire SPI

- Resolution: 400x300
- Displays size: 84.8mm x 63.6mm
- Dot pitch: 0.212 x 0.212
- Full refresh time: 15s
- Refresh power: 26.4Mw(typ)
- Standby power: <0.017Mw
- Viewing angle: >170°

2.2.3 3.7V LiPo battery

A lithium-ion polymer battery (LiPo) is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of liquid electrolyte.

Figure 2.3 – 3.7V LiPo Battery

The following are features and specifications of the 3.7V LiPo battery [6]:

Features:

- Stable performance;
- Long-lasting durability;
- Strong endurance;
- Explosion proof design using excellent materials, built-in high performance circuit protection board;
- Multiples intelligent self-protection components such as intelligent control IC and MOS to ensure that the lithium battery charge and discharge performance is stable, safe and reliable which can be used with confidence.

Technical Specifications:

- Real capacity: 700mAh
- Limit voltage: 4.2V
- Cut-off voltage: 2.75V
- Discharge temperature: -20¬+60°C
- Charging Temperature: 0¬45°C

2.2.4 Piezoelectric buzzer

A buzzer or beeper is an audio signaling device which may be mechanical, electromechanical or piezoelectric. It is used in alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.

Figure 2.4 – Piezoelectric buzzer

Technical Specifications [7]:

- Rated voltage: 3v
- Operation Voltage: 2¬5V
- Sound pressure level (SPL): Min 80db
- Average consumption current: Max 40
- Oscillation frequency: 2700Hz
- Response time: Max 50Ms
- Range of operation temperature: -20 ¬ +60°C

- Range of preservation temperature: -30 ¬ +80°C
- Coil resistance 16 ± 4Ω

2.2.5 Momentary push buttons

A momentary push button switch is a type of switch which is designed to form a connection only when pressed and break the connection as soon as it is released.

Figure 2.5 – Momentary Push Button

Technical Specifications [8]:

- Withstand voltage: AC250V
- Rated load: DC12V 50Ma
- Contact resistance: ≥ 0.03Ω
- Insulation Resistance: ≥ 100M Ω
- Temperature -30 ¬ +70°C

2.2.6 5mm LED

An LED (Light Emitting diode) is a semiconductor device that emits light when an electric current passes through it. LEDs can be used as indicators such as power-on lights, warning lights and signal lights.

Features:

- Short response time.

Technical Specifications [9]:

- Electric current: 20mA.
- Voltage: 3.2¬3.4V.
- Service life: 100,000hrs.

Figure 2.6 – 5 mm LED

2.3 Summary

In conclusion, the development of our electronic conference badge requires a thoughtful selection of hardware components. The ESP32 Microcontroller, E-ink display, LiPo battery, push button, piezoelectric buzzer and LEDs collectively provide a robust foundation for the development of the badge. By leveraging these components, the electronic conference badge can effectively facilitate networking, communication and information sharing among conference attendees; while also ensuring a compact, interactive and energy-efficient design.

3 DEVELOPMENT OF AN ELECTRONIC CONFERENCE BADGE

3.1 Development of a device diagram

Below is a detailed explanation on the functions of the components carefully selected for the development of the electronic conference badge which are; ESP32-S3 development board, 4.4 inch E-ink screen, 3.7V LiPo battery, piezoelectric buzzer, momentary push button and LEDs.

The ESP32-S3 Development board has a number of essential roles in the development of the electronic conference badge which are:

- Processing and Control: The ESP32 is the brain of the badge, responsible for executing instructions, managing data, and controlling the various components.
- Wireless Connectivity: The ESP32-S3 provides Wi-Fi and Bluetooth capabilities, enabling the badge to connect to the internet, communicate with other devices, and receive updates.
- Data Storage: The ESP32-S3 has built-in flash memory, allowing it to store data, such as conference schedules, attendee information, and badge settings.

The 4.2 inch E-ink display is also a critical part of the electronic conference badge. The screen provides a user-friendly interface for attendees to navigate and interact with the badge.

It will display relevant information to the wearer which includes:

- Attendee information and networking opportunities.
- Conference schedule and timings.
- Speaker profiles and session details.
- Notifications and updates.

The 3.7V LiPo Battery has the sole responsibility of powering the electronic conference badge. The battery provides the necessary power to the ESP32 development board, display, and other components, ensuring the badge functions continuously throughout the conference. The battery's charging circuitry and power management system ensure safe and efficient charging, as well as optimal power

distribution to the badge's components. The battery's capacity and efficiency determine the badge's overall power consumption.

Piezoelectric buzzer has the following number of functions on the electronic conference badge:

– Alerts and Notifications: The piezoelectric buzzer produces a distinct sound to alert the attendee of important events, such as; schedule reminders (e.g., upcoming sessions or meetings), message notifications (e.g., new messages from other attendees) and event announcements (e.g., keynote speaker introductions).

– Feedback and Confirmation: The buzzer provides audible feedback to confirm user interactions, such as; button presses (e.g., navigating through menus), successful data transmission (e.g., sending contact information) and Error notifications (e.g., failed data transmission).

– Attention-Grabbing: The buzzer can be used to grab the attendee's attention in situations like: emergency alerts (e.g., important announcements or warnings) and special events (e.g., prize giveaways or contests).

The Electronic Conference Badge features four pushbuttons each serving distinct purposes which are; menu function selection, menu function confirmation, cancel function and power function.

Below is a detailed explanation of how each button works.

1) Menu Function Navigation (Navigation Button)

The menu function navigation button allows users to navigate through the menu options. It enables users to browse and select the desired menu option.

Behavior: When pressed, the button scrolls through the available menu options, such as "User Profile", "Conference Program", "Exchange contacts".

2) Menu Function Selection (Select Button)

Menu function selection button scrolls through the available users, to select user for exchange contacts. It provides a clear and intentional way for users to sending a contact (email) to a selected conference participant.

Behavior: When pressed, the button scrolls through users list.

3) Send Function (Send Button)

Send function button sends contact information to a selected user.

Behavior: When pressed, the button sends the contact information of the sender.

4) Power Function (Power Button)

The power function button turns the device on or off. It provides a simple and straightforward way for users to control the device's power.

We have selected four different types of LEDs (blue, red, green and yellow); and each LED indicate different state of the badge. We will explain the function, behavior and purpose of each LED.

1) Red LED (Error/Malfunction Indicator)

Red LED indicates a device malfunction or inability to connect to Wi-Fi or send contact information. It alerts the user to a potential issue with the device, prompting them to take corrective action.

Behavior: Turns on when the device encounters an error, such as a hardware malfunction or software issue, turns on when the device fails to connect to a Wi-Fi network and also remains on until the error is resolved or the device is restarted.

2) Green LED (Navigation Indicator)

Green LED indicates the status of pressing navigation button. It provides visual feedback to the user that the screen information must change.

Behavior: Turns on when the user press navigation button.

3) Blue LED (User Selection Indicator)

The blue LED indicates the process of user selection. It provides visual feedback to the user that the device is charging, helping them monitor the battery level.

Behavior: Turns on when the device is connected to a power source and the battery is charging, remains on until the battery is fully charged and it turns off when the device is fully charged or disconnected from the power source.

4) Yellow LED (Messaging Indicator)

Yellow LED indicates the status of sending contacts to another user. It provides visual feedback to the user that the contact sharing process is in progress.

Behavior: Turns on when the user initiates the contact sharing process, remains on until the contact information is successfully transmitted and it turns off when the transmission is complete or fails.

Additional ESP32 charge LED (Charge Indicator)

ESP32 board has own charge indicator. It provides visual feedback to the user that the device is charging, helping them monitor the battery level.

Behavior: Turns on when the device is connected to a power source and the battery is charging, remains on until the battery is fully charged and it turns off when the device is fully charged or disconnected from the power source.

Using the above components to perform the designated tasks, the following functional diagram of the device was built, shown in Figure 3.1.

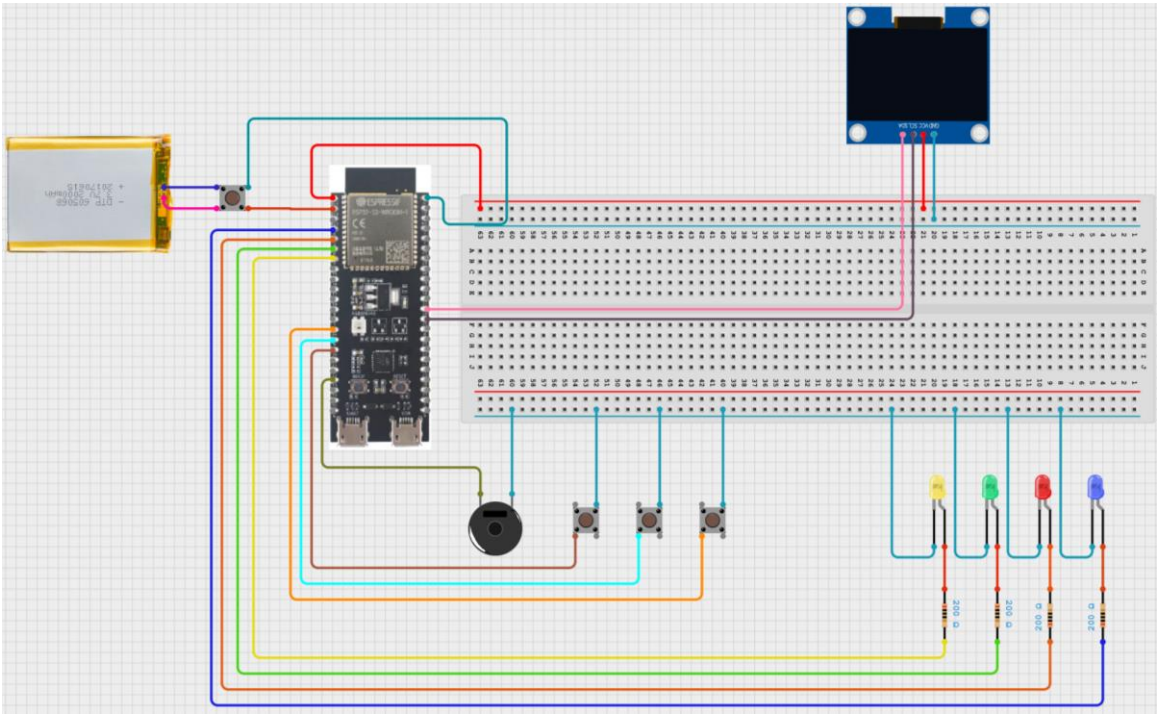

Figure 3.1 – Functional diagram of an electronic badge

Next, we need to consider the location of the main hardware components on the device.

3.2 Visual design of the device, placement of components

Electronic conference badges come in various shapes and sizes to suit different conference themes, attendee preferences and functional requirements. The shapes can be in vertical or horizontal form, it can be rectangular, square or even circular. Below are examples of some of the shapes of electronic badges.

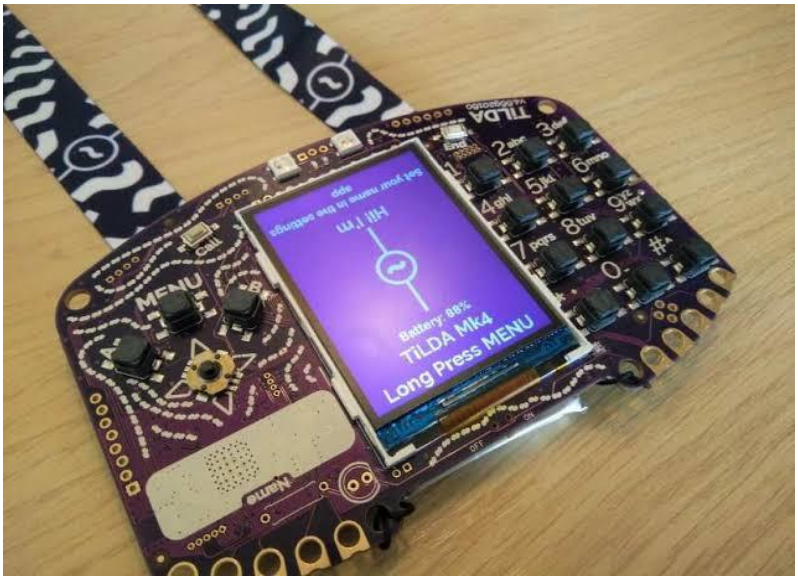

Fig. 3.2.1 EMF Camp Badge

Fig. 3.2.2 Pybadge

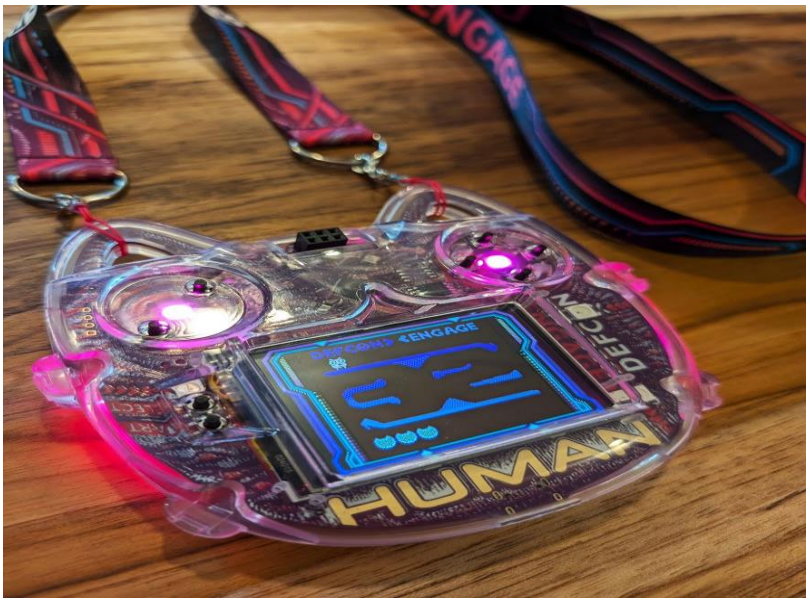

Fig. 3.2.3 Defcon Badge

Our electronic conference badge will have a vertical layout, and below is a 3D visual representation of it.

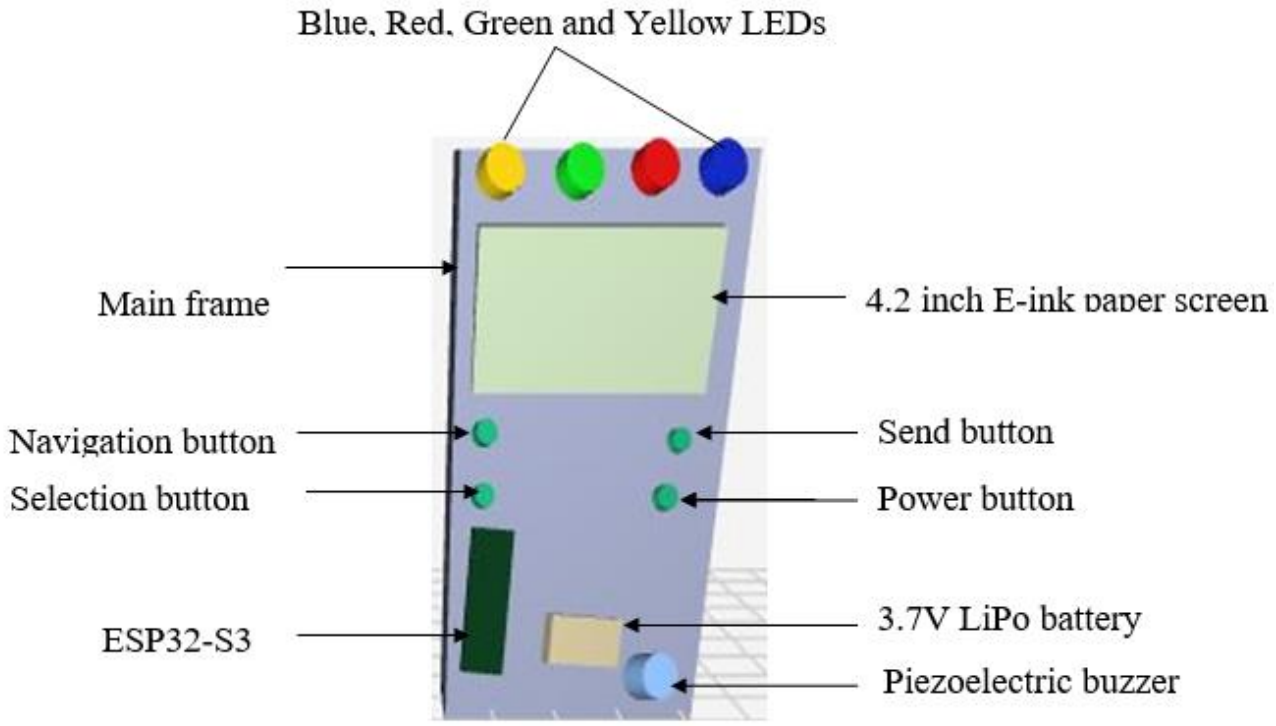

Fig. 3.2.4 3D representation of badge

This arrangement of components will allow you to conveniently use the device. All main indicators are located at the top. The buttons are divided into individual functions.

3.3 Working principles of the Electronic Conference Badge

Below is an explanation about how the electronic conference badge will work; how it will receive conference information, how it will select and transfer a contact and how it will be configured.

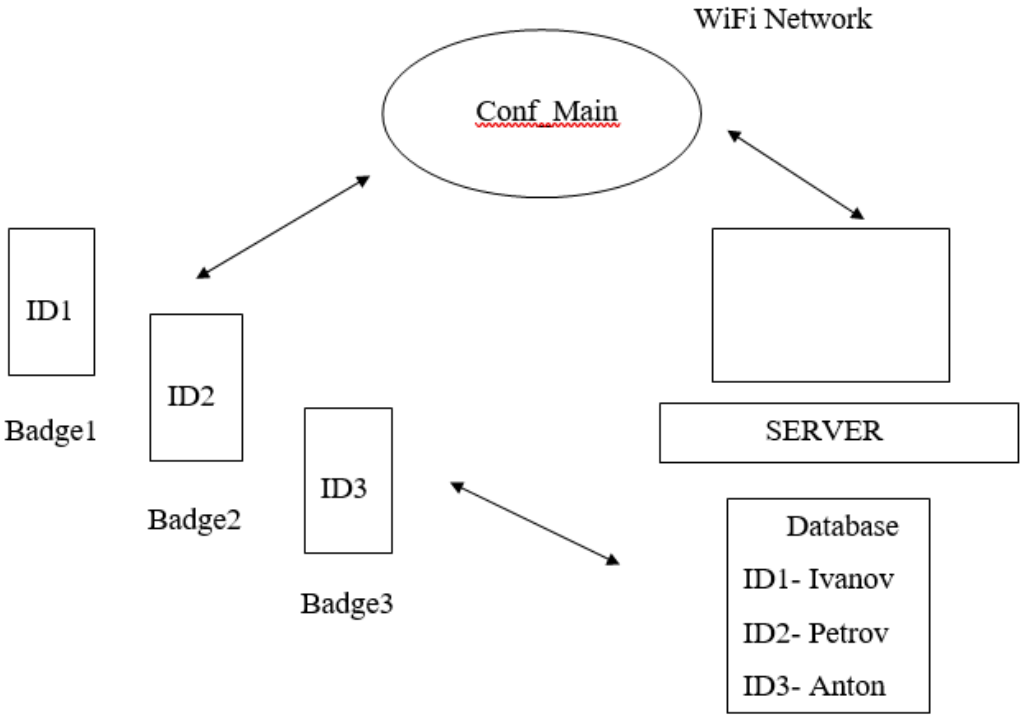

Fig 3.2.1 The Electronic Conference Badge System

The electronic conference badges will connect to a conference server WiFi network enabling them to download conference information and access a database of attendee profiles for networking.

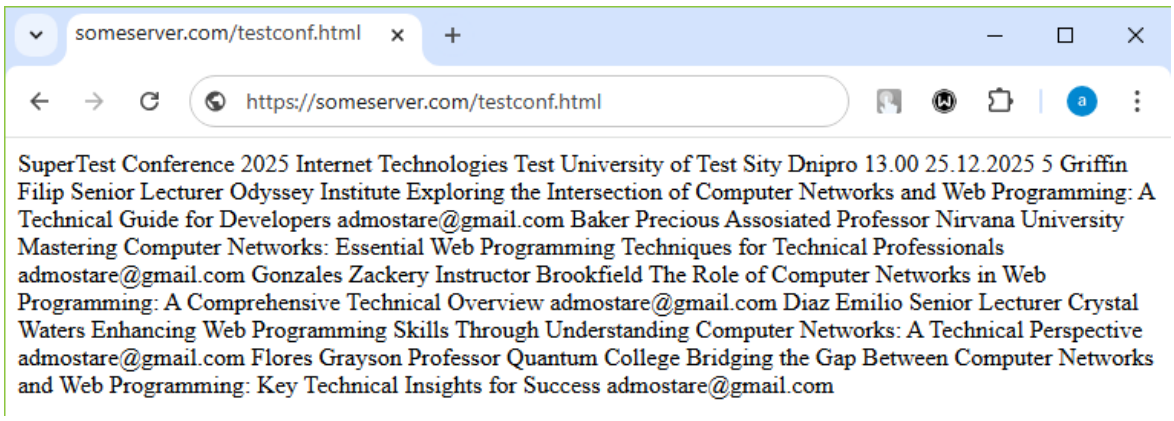

Fig. 3.3.1 Conference Server

For the convenience of working with the badge, it is enough to place an online text file with certain information. An example of such a file is shown in Figure 3.3.1

The file should be split into separate lines containing certain information, such as:

- Conference title;
- Section title;
- Name of the university where the conference is held;
- Place;
- Section start time;
- Section start date;
- Number of participants;
- Information about all participants (Names, Job positions, University, Article, contact emails)

The detailed contents of the file are shown in the figure 3.3.2

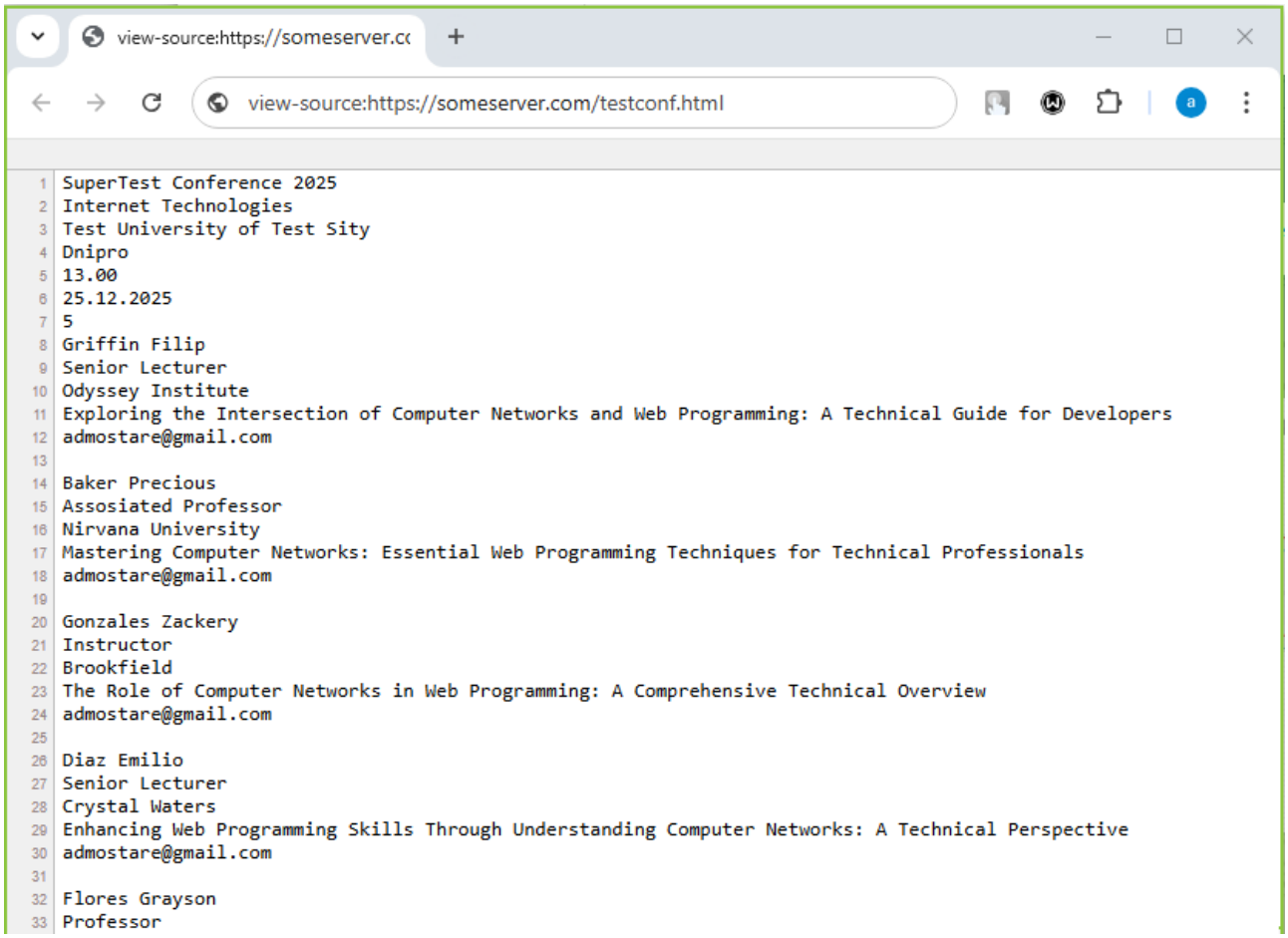

Fig. 3.3.2 Detailed contents of the file with conference information

How the electronic conference badge receives conference information

- The badge connects to the conference Wi-Fi network which provides internet access and enables communication with the conference server.
- The conference server pushes conference information such as session schedules and attendee profiles to the badge.
- The badge communicates with the server using APIs over Wi-Fi to fetch updated information.
- The badge software processes and displayed the received conference information on the screen.

Selecting and transferring contacts

- The badge is loaded with the attendee's profile including their names, organization and contact information.
- Attendees select the contacts they want to exchange information with using the badge's interface.
- The badge sends contact information to the selected user through email.

Configuration

- The badge is configured with the attendee's profile information and conference settings during the initial setup.
- The badge is configured to connect to the conference Wi-Fi network which provides internet access and enables communication with the conference server.

3.4 Conference Badge software development

To develop the Conference Badge control program, the Arduino C programming language was used, which is a C++ language with the Wiring framework.

Since all hardware components were not available, Wokwi - World's most advanced ESP32 Simulator was used for development.

The figure 3.4.1 shows the appearance of the simulator with the program being developed.

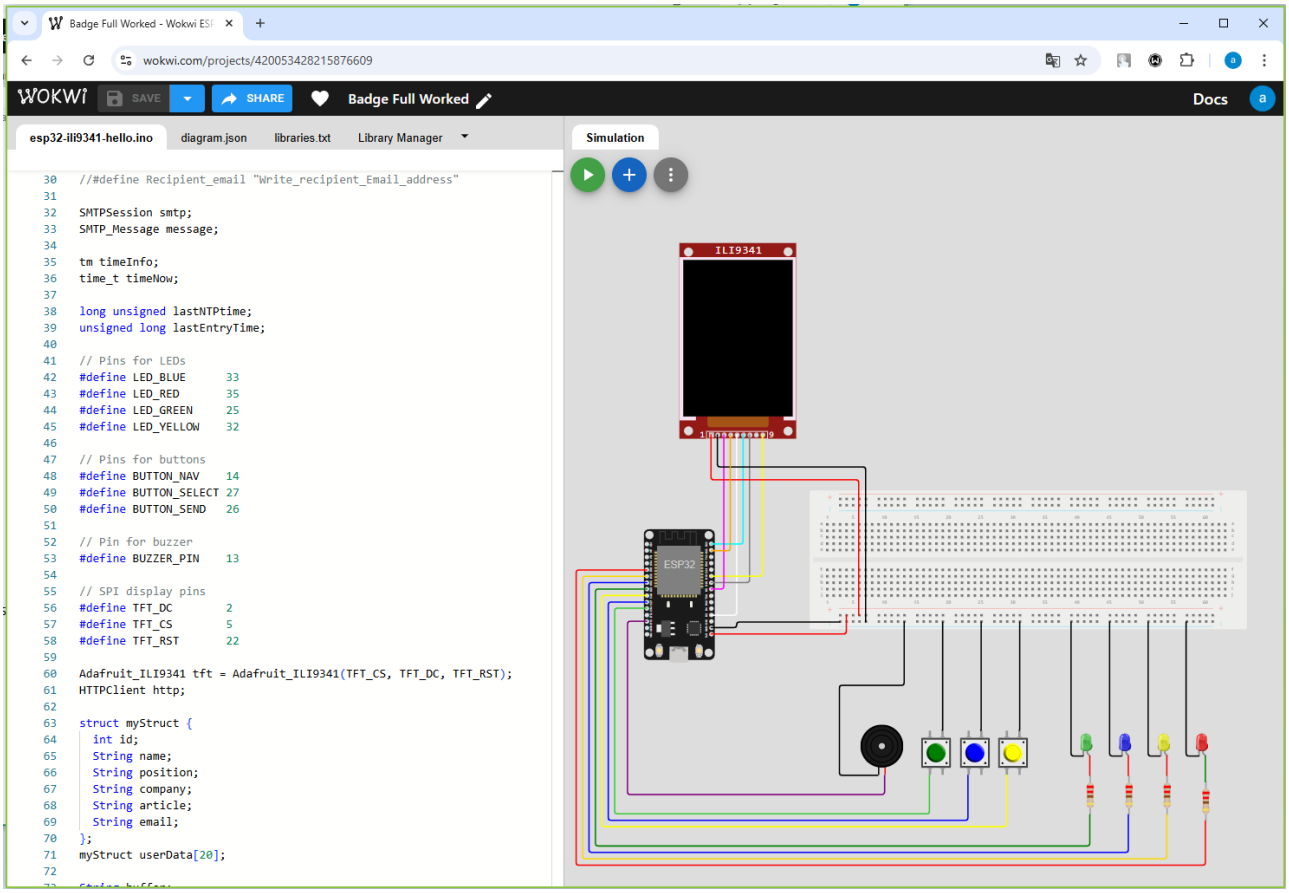

Fig. 3.4.1 Conference Badge software development

The flowchart diagram of the program algorithm is shown in the following figure.

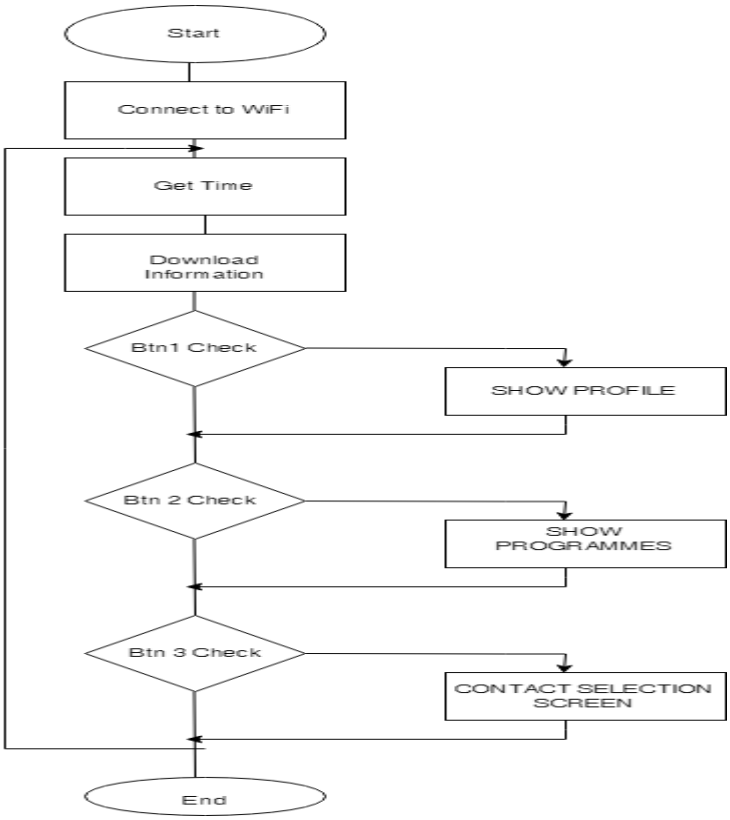

Fig. 3.4.2 Conference Badge software algorithm flowchart diagram

The device startup process is shown in Fig. 3.4.3.

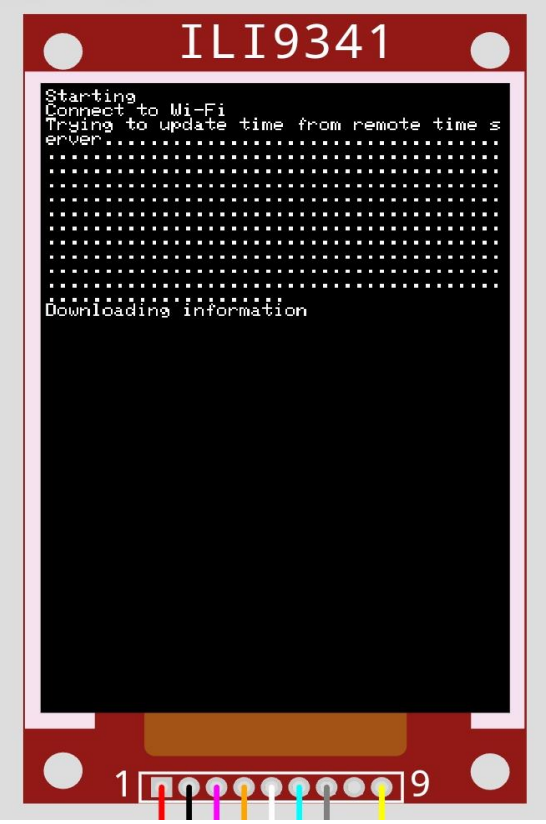

Fig. 3.4.3 Starting the Badge

After the start, the Badge connects via WiFi to the conference server, downloads information from the file and is ready for use.

Information on the server must be prepared before the start of the conference. Thus, there is no need to reflash the Badge - it will update the data itself after a reboot.

In order for the information on each Badge to match the user who wears it, it is necessary that the Badge ID matches the user number from the conference program (inside the file on the server)

When the Badge is initialized, it is synchronized with the time server. Thus, at the start of the conference, it will display a corresponding message. The real time clock built into the EPS32 is responsible for changing the time even when there is no connection to Wi-Fi.

The user interface of the Conference Badge is shown in the figure 3.4.4.

Fig. 3.4.4 Conference Badge Software User Interface

The text of the program for the Conference Badge is given in the appendix.

3.5 User manual

Step-by-step guide on how to use the electronic conference badge.

Getting Started

- Ensure the electronic conference badge is fully charged before arriving at the event.
- Use the provided USB cable and charger to power up the device.
- Press on and hold the power button until the badge turns on/
- Follow the initial setup prompts displayed on the screen.

Navigation and Control

- Use the navigation and selection buttons to scroll through the menus and select users.
- Press send button to send contact information.

Contact exchange

- Open the “Contacts Exchange” section on the badge.
- Search for the desired attendee.
- Select the attendee’s profile and press Send button.

Maintenance

- Use a soft cloth to clean the badge’s display or exterior.
- Avoid overcharging your badge to
- Store your badge in a safe place when not in use.

3.6 Summary

The functions of the various components of the electronic conference badge were discussed. We overview different shapes and sizes of an electronic badge, also an illustration of the functional diagram as well as the 3D picture of the badge which provides a detailed visual representation of its components and layout was given. The overall principle of working for the electronic conference badge was explained and a user manual was given.

SUMMARY

The development of the electronic conference badge has been a comprehensive and innovative project, leveraging cutting-edge technologies to create a wearable device that enhances the conference experience. This project has successfully integrated an ESP32-S3 microcontroller, display, LiPo battery, piezoelectric buzzer, 4 pushbuttons, and 4 LEDs to create a feature-rich and user-friendly badge.

Throughout this project, we have:

- Introduced the concept of electronic conference badges and their potential to revolutionize the conference experience.
- Conducted a thorough literature review, examining existing conference badge technologies and identifying areas for improvement.
- Selected and justified the use of specific components, including the ESP32 microcontroller, display, LiPo battery, piezoelectric buzzer, 4 pushbuttons, and 4 LEDs.
- Provided a detailed explanation of each component's function and how they integrate to form the electronic conference badge.
- Created a functional diagram and 3D picture of the badge, illustrating its components and layout.
- Explained the principle of working, including how the badge receives conference information, exchanges information, and is configured.
- Developed a comprehensive user manual, guiding attendees on how to use the badge and access its features.

The electronic conference badge developed in this project offers numerous benefits, including:

- Enhanced information exchange and networking among attendees
- Real-time updates on conference schedules and sessions
- Increased engagement and participation through interactive features
- Improved accessibility and convenience for attendees

In conclusion, this project has successfully designed and developed an innovative electronic conference badge that leverages advanced technologies to enhance the conference experience. The badge's features, functionality, and user-friendly design make it an ideal solution for conferences and events.

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