

# IOT-BASED BLUETOOTH LOW ENERGY BROADCASTING ADVERTISING PACKETS QUEUING SYSTEM FOR CLIENTS

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## 1. INTRODUCTION AND BACKGROUND

The growth in population is now not compatible with the current hospital facilities due to the raising demands [1]. The world has been facing the COVID-19 pandemic crisis where people have to prevent physical contact. Non-physical tickets queuing system is, therefore, worth being suggested as a solution to avoid the spread of COVID-19. In this study, the Bluetooth Low Energy (BLE) is used for medical facility is proposed. BLE BeaCon (BC) mode provides broadcasting with the range up to 6 meters [2] and can be used with mobile phone, which is very convenient.

## 2. METHODOLOGY

The system consists of four main components, i.e., i) Screening Station (SS), a System on Chip (SoC) based broadcaster, ii) Doctor Room (DR), SoC-based scanner, iii) Medicine Counter (MC), SoC-based scanner, and iv) User's Mobile Phone (UMP), broadcaster and scanner.

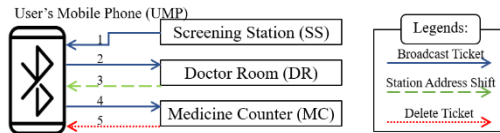


Figure 1. The system overview

The system overview is shown in the Figure 1. First, the SS broadcasts tickets to the UMP, the UMP starts broadcasting the received ticket. Then, the UMP receives a call from the DR. Next, the ticket address is changed for the MC. Lastly, the MC sends end queue so that the ticket is deleted from the UMP and the broadcasting is stopped.

**BLE Beacon mode, Eddystone-UID framework:** The BLE's broadcasting advertising packet with Eddystone Unique IDentification (E-UID) framework is used in this study.

Table 1. Eddystone-UID framework specification

| Byte Offset | Field         | Description          |
|-------------|---------------|----------------------|
| 0           | Frame Type    | 0x00                 |
| 1           | Ranging Type  | 0x00                 |
| 2-6         | NID[0]-NID[4] | Const alphabets.     |
| 7-8         | NID[5]-NID[6] | No. of ticket.       |
| 9           | NID[7]        | Ticket type.         |
| 10          | NID[8]        | Issue status.        |
| 11          | NID[9]        | No. of statio.       |
| 12-17       | BID[0]-[5]    | Reserved for DB.     |
| 18-19       | RFU           | Reserved for future. |

The E-UID framework consists of Namespace IDentification (NID), and Beacon IDentification (BID). The NID is utilized for the advertising and scanning strategies and the BID is reserved for the patient DataBase (DB). The detailed information of E-UID is given in Table 1.

**Finite-state machine concept:** In order to optimize performance, maximizing the utilization of an SoC microcontroller, Finite-state machine concept is applied. It allows the SoC to perform one of the finite number of states by the given conditions. Table 2 shows the summary of the SoC's states.

Table 2. Summary of SoC's states

| Mode  | Broadcaster            | Scanner             |
|-------|------------------------|---------------------|
| -     | Deep sleep             | Deep sleep          |
| Wi-Fi | Over-the-Air update    | Over-the-Air update |
| BC    | Broadcasting           | Scanning            |
| -     | Manual ticket printing |                     |

## 3. RESULTS AND DISSCUSSIONS

The proposed system based BLE is successfully developed. Broadcasting ticket and user's application are shown in Figures 2a) and 2b), respectively. However, there are still research gaps for utilizing the remaining bytes which can be integrated the cloud system. Moreover, a proper security encoding needs to be concerned in future work.



Figure 2. a) Broadcasting Ticket, b) User's application

## REFERENCES

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