Study of Smart Cafe Using Responsive Web & App

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Abstract. Recently with the supply of IoT, the development of smart equipments to use responsive web & app has greatly contributed to user-convenience priority. In particular, IoT has been processing vigorously in every field of smart home as well as smart equipment. This study proposes practical smart cafe system using smart equipments and IoT sensors for the improvement of startups' and small enterprisers' business efficiency. This system enables not only kiosk but also a smartphone to make an order and supplies user Auto-ID (automatic identification) function based on Beacon. Applicating Geo-Fence, it is able to customize the order without waiting to get user's location, as well. At the end, this study provides weather, temperature and time based on big data, and recommended service based on users. In conclusion, this system can increase cost reduction and the convenience of customers compared with other previous cafes.

***Key Words** : IOT, Smart Home, Communication, Beacon, Kiosk, Geo Fence, Networking*

1. Introduction

With the universalization of various smart devices including a smartphone, diverse products equipped with smart functions have been released. The recent smart services check smart devices and IoT equipments within networks, and supply controllable services. Some of these services, free from device control as well as user's name and location, provide controllable functions of devices within networks. IoT which connects cooperatively diverse elements such as humans and things, things and services of things with sensing, networking and data processing without human's intervening has been a great issue[1]. The convergence of IoT technology and technology of smart devices has greatly contributed to the improvement of small enterprisers' business efficiency and makes popularization in smart home[2]. Therefore, this study proposes smart cafe system based on IoT for the improvement of business efficiency and effectiveness in one person cafe which is typical startup of small enterprisers[3]. With the help of IoT technology and smart devices, this system, making up for the complaints of previous cafes and ineffective functions, would finally make it a smart-type cafe. In Chapter 2, we introduce related studies, In Chapter 3, propose system design and interface. At last, in Chapter 4, suggest conclusion and further studies.

2. Related Studies

IoT, without humans' intervention, collaboratively connects space networks of things which make smart relations of sensing, networking, and data processing, etc., about humans, things and dispersed circumstantial elements[4]. And to collect and share organizationally the information of surroundings, it connects smart networking technology with wire and wireless network[5]. This IoT is applicated and utilized in various kinds of fields and also includes a large number of technological elements. Among them, the essential elements of IoT technology are classified as networking technology, sensor/device technology, and interface technology.

2.1 Networking Technology

Networking technology of IoT internet has greatly contributed to the development of network as connecting reciprocally to utilize wire and wireless networking functions dispersed in surroundings such as things, humans, and services, and so on. While connection among equipments makes use of protocol technology based on IP, it uses 3G, 4G, LTE, and WiFi, etc. Devices not using IP like Bluetooth, Zigbee, Zwave, RFID, etc can share the information linking internet or other equipments by means of sink node[6]. In home network circumstance for smart home service, devices can be mainly linked through WiFi from wire and wireless sharer. Recently some companies such as SmartThings, Withings, and Philips have recently released products like home-based smart bulbs and sensors[7]. These sensors, for the exchange of information between devices, primarily use ZigBee and ZWave, and through sink node called Hub and Bridge, transmit and receive while linking Status Message with internet[8-9].

2.2 Sensor/Device Technology

To acquire the information of things and surroundings, sensing technology using a variety of sensors like level of illumination, gas, temperature, humidity and ultrasound makes applications to remote sensing, location and motion trace[10]. The sensor technology of IoT originated from the steps of things perceiving information and producing has evolved in diverse types. Surveying the information from measurement object, with the changed form of signal which makes the system interpret the existing sensor provides, and smart sensor is built with MCU

and combined with SoC(System on Chip) technology utilizing functions like communication, judgement, control and storage. In home surroundings, many smart sensors and smart equipments built with smart sensors have emerged. In particular, not only the existing built-in-sensors applicated in smart home electronic appliances, smartphones but also application service development grafted with external sensor information is built.

2.3 Interface Technology

Interlocking with application services which conduct special functions, interface technology is applied to major elements of IoT. It is composed of detection base technology meaning date processing, standardization, detection, extraction, handling and storage functions, and security, data mining, location information base technology and web service technology[11]. Using diverse platforms from various companies, interface technology of this IoT is provided by applications and services. And open-source based controller, single board, and Hardware Platform with sensor connection have developed services in the field of network gateway[12-13].

3. Design

Smart-type cafe management system proposed in this study has grafted complaints from the viewpoint of the existing cafe customers and managers with IoT technology and then ultimately makes the effective cafe management. The characteristic of this system is firstly that order service function is provided with utilizing kiosk and a smartphone application[14]. Customers who enter the cafe can order and pay directly in kiosk. While ordering and paying at the same time with the a smartphone app outside the cafe, the customer can be given with waiting-time information, and also receive the ordered item. In particular when using kiosk, the customers can be recognized by beacon conveniently so they are able to make an order effectively[15]. Secondly, with the analysis of big data, they can receive the information of weather, temperature, sales volume, order contents, advertisement base recommended services in real time. Thirdly, approaching near radius 100m of the cafe location, customers are provided with discount coupons when using Geo-Fence. Geo-Fence makes it possible that customers who have already registered in membership can only receive the information. Fourthly, instead of offline processes of order, payment breakdown, customer attractions, online processes enable customers not to wait in lines[16-17].

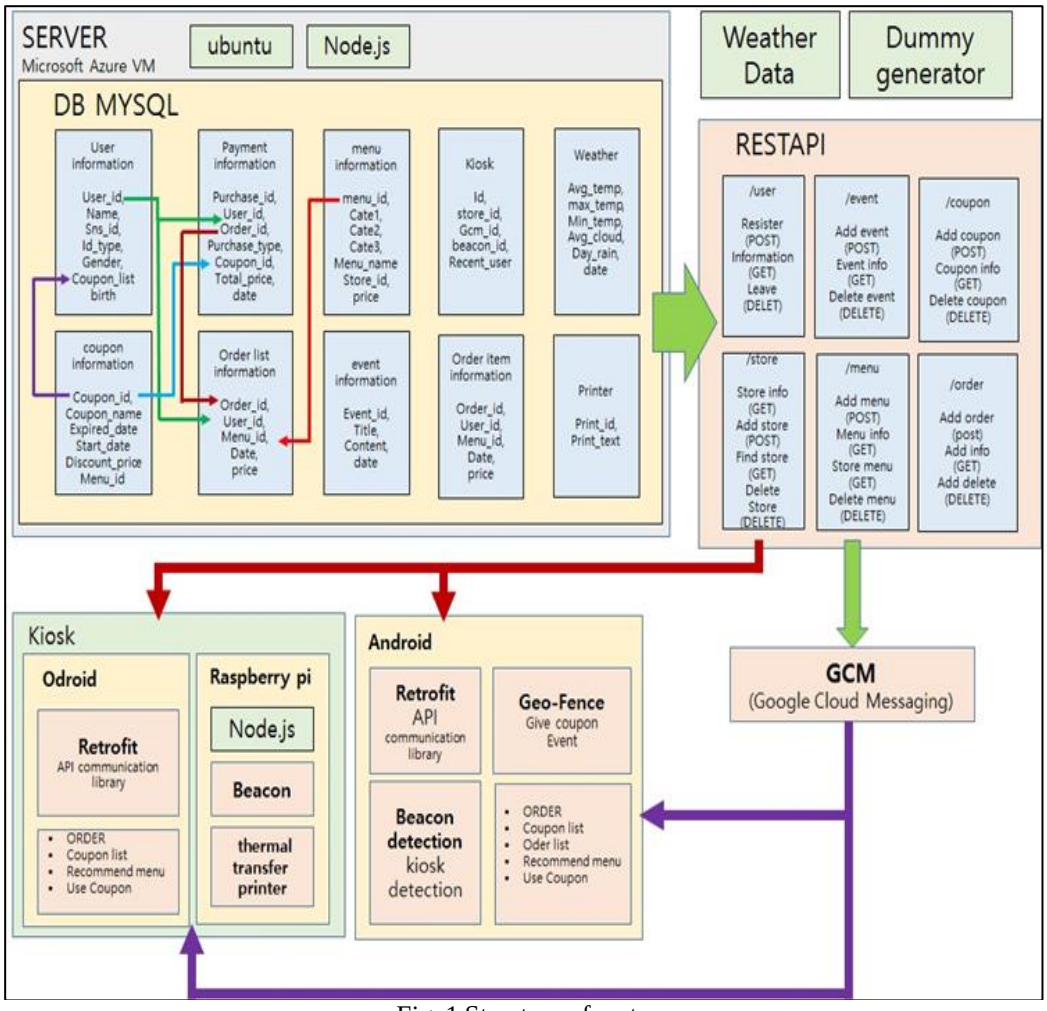

Fig. 1 Structure of system

Figure 1 pictures the structure of the whole system of smart-type cafe. DB which has been used is suitable to one-person store and uses also what's not heavy MYSQL DB. And utilizing world-wide trend Node. Js and cloud message in Google simultaneously, we can make the date in a smartphone provided in real time. In a user circumstance, there are kiosk and a smartphone, and therefore Kiok makes Beacon-recognition with the use of Raspberry Pie3 and makes sensor functions putting panel on LED TV. Though there are Android and iOS in a smartphone, we design the most widely used Android base. As weather information and like this can be provided from the weather center in real time, this data stored in database can recommend an appropriate menu to users. We describe detail functions of server as follows.

Detail functions of server are like this.

-Server: order and offer the recommended menu in Kiosk and Android Application.

-Server structure: Microsoft Azure VM + Ubuntu + Node.js

-Process synchronization with the use of 'Wait.for' Library because of Node js' Callback Issue.

-User: API implementation of membership registration, deletion and members' information.

-Store: API implementation of adding stores, deletion, and store information.

-Printing store lists located in the wanted places by using longitude and latitude of users and stores

-Printer: In network structure, Raspberry Pi having difficulty in approaching polling API for printer release directly from Kiosk, the order information has been sent from Kiosk and printer uses polling the data.

-Order: Divided OrderList and Order Item, receiving the order information from Json and producing and checking the order relevant to User-ID.

-Menu: After putting the prepared menu beforehand, offer using Nginx

-Kiosk: After defining API related with GCM and Beacon, bringrecently acknowledged User or conduct the registration related with GCM of Kiosk.

-Event: API which makes crud tables about recently processed event

-Suggest: API, with the use of order temperature, time, frequence, etc. based on order history, calculating the scores of each menu, finally delivers recommended menu.

-If there's no order history, users also calculates and suggests with order history of similar age.

-After crawling and parsing the pages about previous weather information in weather center, to store the data about a 2-year average temperature and humidity, etc.

-Coupon: managing usable coupon in present, the information of coupon, deletion, and addition, etc.

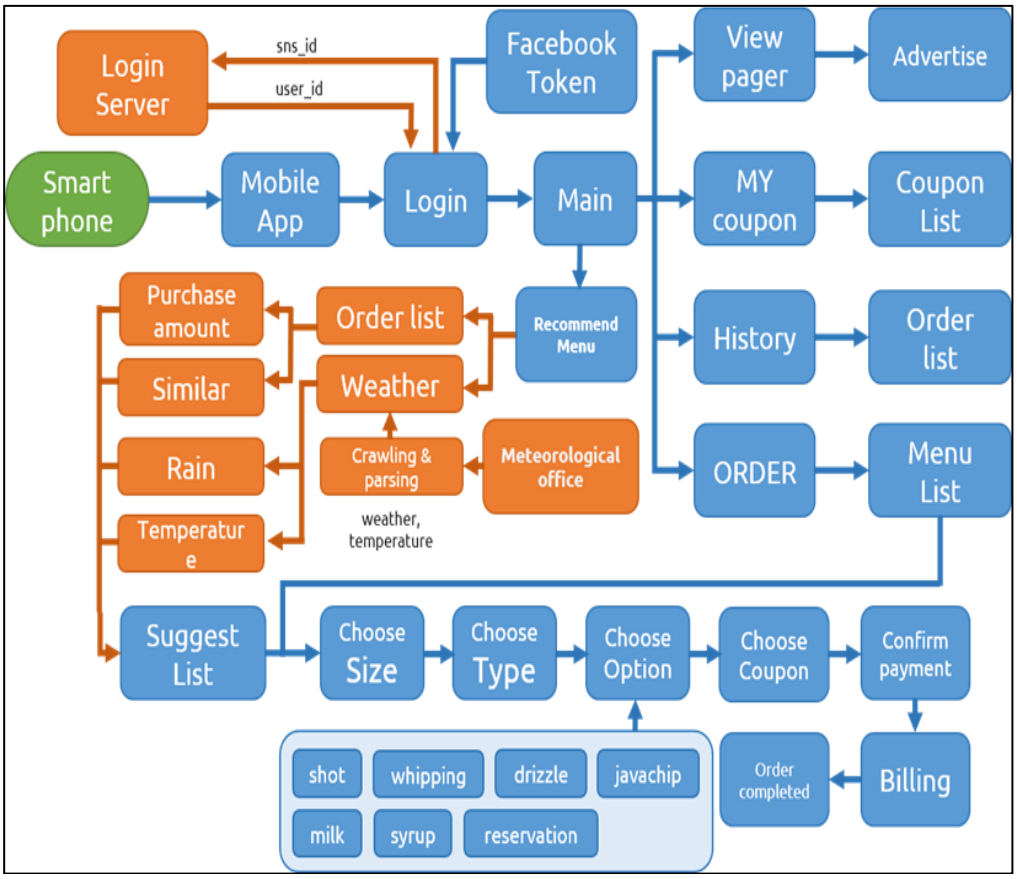

Fig. 2 Structure of smartphone

Figure 2 describes the structure of data flow in a smartphone. To log in with a smartphone, approaching in real time, and identifying users and information, it provides recommended menu suitable for customer's taste in servor. And based on customer private information, event coupon, and order and the information about waiting time are provided in real time. Method of payment is divided into payment at store and with a smartphone. When paying directly, server provides message with a store manager: payment has been completed. When logging in a smartphone, login information is offered in a server, and it offers coupon to users by Geo-Fence. Users are able to select the menu and make an order, and then can read coupon list by my coupon information. If there are any discount coupons among coupon items, users an order with discount coupon while ordering the menu. When users are hesitating to order the menu, they are recommended diverse menus based on weather and information like that by server and are able to order the menu with this information.

Detail functions of Smartphone App are as follows.

-Offer menu lists on sale: menu name, price, and image description in accordance with menu data by server

-Menu order: menu select > size select > the temperature of beverage select > private option > payment

-Order data occurred in every process can be stored in instance which stores every order data, and maintains and manages.

-Event and Promotion: After users scroll promotion in main scene by ViewPager, they check event and ads.

-Registration coupon based on location: when customers are approaching within radius 100m of cafe, with the use of Geo-Fence, event coupon is released automatically, and it attracts them.

-Store Beacon Recognition: Bluetooth equipped with Raspberry in Kiosk sends Beacon signal in a store and after recognizing Beacon installed at Beacon store, a user approaching near a distance and he is given Beacon recognition by server.

-Coupon Box (Possession Coupon History Check): to read coupon list registered in User_id and then to check the coupon the user possesses.

-History (Order History Check): check order history after bringing order history--menu name, date, option, and payment amount, etc --stored in User_id from server in the order of recent date.

-Recommended Menu: on the basis of Order history, by means of recommended algorithm using temperature in a order day, time, and frequency, user's preferable menu is recommended directly so he confirms the recommended menu in main scene.

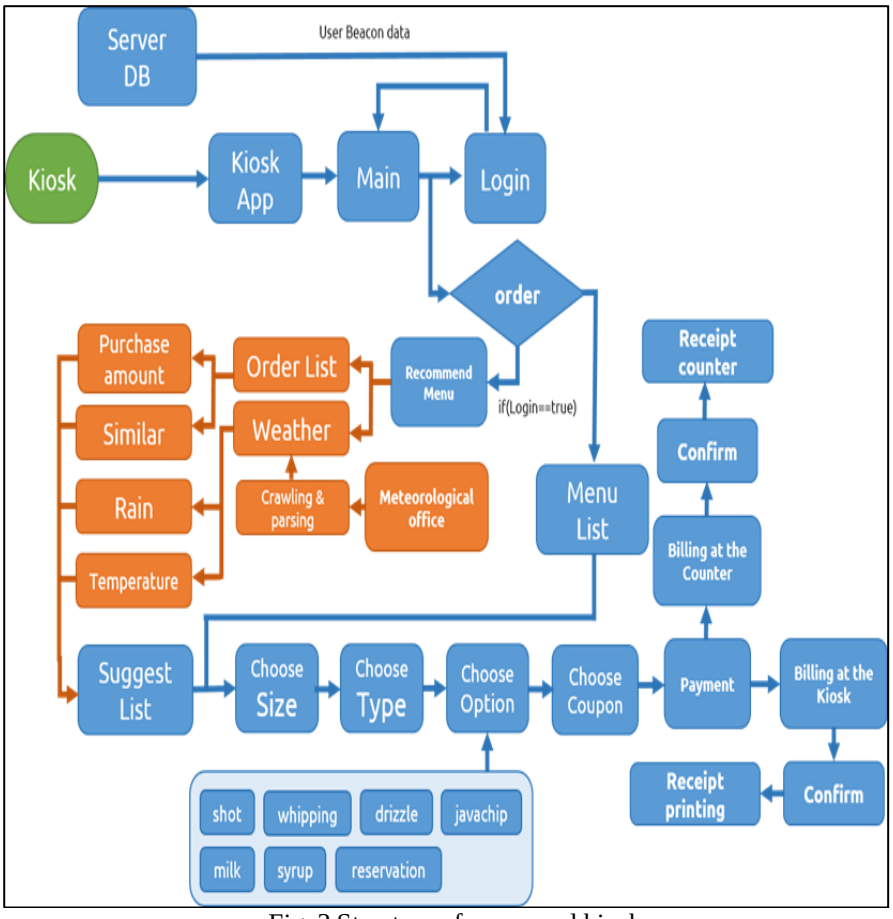

Fig. 3 Structure of server and kiosk

Figure 3 pictures the data flow between server and Kiosk. Once the customer comes in a store and stands in front of Kiosk, it automatically recognize the user's information by Beacon. Received information provides in real time by server, and with this he is given the customized recommended menu. If the user puts the information in Kiosk circumstances to order a menu, he can be recommended the menu by stored information in real time by server. In Kiosk circumstance, he can pay directly with a plastic card, a smartphone, and cash. When a customer orders and pays at the same time, he can be given a receipt which is presented completing payment under Kiosk and a waiting number information in real time[18-19].

The Detail Functions of Kiosk are as follows.

-Digital Signage which is able to make Android-base order

-If dragging the upper part down in full-screen mode, StatusBar is activated, so a user can control the setup and alarm of Android.

-NavigationBar adds hiding flagoption by DecorView's setSystemUiVisibility method

-In need of a manager's Android setting manipulation, it is able to operate pushing Android's setting button.

-Offer the menu list on sale: display of menu name, price, and image in accordance with the menu data by server.

-Image loading library uses Bumptech's Glide library

-Order data is stored in instance which put all order data, and keeps and manages data.

-If data isn't put for a long time by users, it is initialized.

-Order specifications and receipt: after a customer finishes ordering the menu and pushes the order completion button, then order specifications is released.

-Printing out specifications with thermo-electronic printer connected with Raspberry Pie.

-Node.js app is operated to print out the specifications

-In Node.js app of specifications, polling order data from server in real time and regularly.

-Beginning to print out received order data in the form of a receipt type by serial communication

-After receipt format transmitting order of thermo-electronic printer and setting beforehand, to print out text.

-Offer event and promotion progressed in store at present

-Screen protection and advertisement: if there's no input of users for a long time, for the protection of private information and convenient use of others, all data is initialized and is set to return to the startup scene.

-If the scene is fixed for a long time, afterimage remains, so indicating moving promotion periodically and finally protects scene.

-Beacon-base user recognition function: as Beacon recognition status transmitted from user app is delivered to server, server uses Firebase Cloud Messaging and notices the recognition of users by Kiosk.

```
CREATE DATABASE soma DEFAULT CHARACTER SET utf8;
use soma;
insert into User (user_name,sns_id,id_type,gender) values('suchang','good','fb','m');
CREATE TABLE User(
        user_id int(10) unsigned NOT NULL AUTO_INCREMENT,
        user_name VARCHAR(20) NOT NULL,
        sns_id text NOT NULL,
        id_type CHAR(2) NOT NULL,
        gender CHAR(1) NOT NULL,
        coupon_list text,
        birth datetime,
        stamp int(10) DEFAULT 0,
        PRIMARY KEY(user_id)
) DEFAULT CHARACTER SET utf8;
CREATE TABLE Menu(
        menu_id int(10) unsigned NOT NULL AUTO_INCREMENT,
        cate1 VARCHAR(20) NOT NULL,
        cate2 VARCHAR(20) NOT NULL,
        cate3 VARCHAR(20) NOT NULL,
        menu_name VARCHAR(30) NOT NULL,
        menu_img text,
        menu_content text,
        menu_quantity int(10),
        store_id int(10) unsigned NOT NULL,
        menu_price int(10) unsigned NOT NULL,
        PRIMARY KEY(menu_id)
) DEFAULT CHARACTER SET utf8;
CREATE TABLE OrderItem(
        item_id int(10) NOT NULL AUTO_INCREMENT,
order_id int(10) NOT NULL,
user_id int(10) NOT NULL,
        menu_id int(10) NOT NULL,
        item_quantity int(10) NOT NULL,
        item_price int(10) NOT NULL,
PRIMARY KEY(item_id )
) DEFAULT CHARACTER SET utf8;
CREATE TABLE OrderList(
        order_id int(10) NOT NULL,
        user_id int(10) NOT NULL,
        order_type CHAR(2) NOT NULL,
        coupon_id int(10),
        order_price int(10) NOT NULL,
        order_date datetime NOT NULL
) DEFAULT CHARACTER SET utf8;
```

Fig. 4 Part of MY SQL DB source

Figure 4 represents a part of source which is implemented as MYSQL DB. It enumerates the formation of customer and menu table. The lower source describes order information table about order and order information list table while ordering.

Fig. 5 User information

Figure 5 is about user information which is to be stored in real time after receiving the request information of member's when registering membership. If the characteristic of member's information matches, after being checked by specific items, this situational information comes to be offered in real time.

Fig. 6 Relevant order information of Server

Figure 6 stores relevant order information into sever if a user asks for a menu with a smartphone and Kiosk. Stored information is stored again in order information list in real time therefore, one by one, offers order request

to manager, and at last a user is offered estimated time and payment information. As a user finishes the payment, payment information is provided to the manager in real time and then order begins.

4. Conclusion and Further Studies

In this study, to use Kiosk and Smartphone App analysing order service system and big data, weather, temperature, sales volume, and order specifications, recommended service on the basis of advertisement are offered in real time. As approaching radius 100m of cafe location, cafe event coupon is to be offered for free with Geo-Fence. Instead of order, payment, and customer attraction processed offline, they are offered online in real time, so non-operation expenses and job efficiency are made to increase. Further studies are to implement the design of existing system basis.

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