

Smart Token Management System for Hospitals using IoT

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Abstract—Nowadays management of large number of patients at hospitals is a significant challenge in smoothing out medical care services. The fundamental idea discussed in this paper is on how to reduce the long waiting and trouble faced by patients for booking tokens. This automated token booking system helps hospitals to improve outpatient flow at hospitals that enables management to efficiently organize staff, resources and patient queues so that patients receive the right care at the right time in a comfortable and hassle free environment. In the proposed system patients can book their token through a Graphical User Interface touch screen implemented at hospital. Our system is controlled by Raspberry pi that is compatible with python IDLE and is linked to the database server website. Here the database is designed using My Structured Query Language. During token booking, patient details are compared with pre-recorded My Structured Query Language patient database and token is generated once the details are matched. After each booking token number is updated in the server website.

Index Terms— token management, graphical user interface (GUI), internet of things (IoT), my structured query language (MySQL) and python IDLE.

I. INTRODUCTION

Today one of the unavoidable significances is hospitable service to people. A growing population base will continue to put pressure on existing hospital facilities. With the limited facilities cycle, there is a coupled shortage in staffs that causes long queues while visiting a hospital and other public facilities at any time. People should have to wait in the long queue as long as they need services even if there are staff shortages, facility shortages or insufficient capacity for the population area they serve. Long lines are an undesirable and unnecessary burden on the public and hospital staff. Even though long queues create a negative image on the hospital management, the unlying truth makes people to adapt the situation.

Patients expect the best treatment and services from the main healthcare facility center of their region/state. However, the queuing in many of such hospitals creates a big issue for the public. Furthermore, the very long queue for treatment may lead to unsatisfied consultation, inefficient treatment and finally a decline in the patient's health. Introducing a smart and efficient queue management system shall be a pronounced solution for this problem. It not only reduces the queue length but also introduces a pleasant hospitality and a drastic reduction in the time spent for booking their slot.

In this paper, the work is focused on the implementation and testing of the requirements of the Thrissur Medical

College - Cancer Centre. Here an effective way of queue management at TMCC hospital is designed via the development of an IoT based GUI supported raspberry pi based queue management system.

A. Proposed System

The hospital is a healthcare facility that treats patients with specialized nursing, medical staff and medical equipment. Long patient queue for booking at hospitals became a significant challenge in the medical care field. Here comes the need of an easy token booking. The proposed system is an embedded IoT device using raspberry pi. Patients can book the token through a graphical user interface touch display of the system. This smart token booking system is linked to a database server website. The database is created and stored using My Structured Query Language. While booking an appointment the patient enters their Cancer Register (CR) number using virtual kiosk on the screen and the CR number is compared with the pre-recorded patient details in the MySQL patient database and if the CR number matches then token is booked and token number will be saved and viewed in the server. If the CR number does not match then it will show as invalid and need to perform rebooking. Once a patient books the token he cannot book again on the same day and this minimizes the chances of duplicate token booking.

The proposed system solves current booking issues and offers the following benefits: resolve queuing problems in hospitals, efficient, convenient and easy token booking, optimum utilization of staff and workflow, paperless token and better hospital experience.

II. RELATED WORKS

Aiman Zakwan Jidin, Norfadzlia Mohd Yusof¹, Tole Sutikno [1] presents an effective way of managing queue at customer service offices via the development of Arduino Uno based paperless queue management system, which consists of a processing unit which is connected to a GUI on a Windows-based PC. Furthermore, the processing unit is likewise connected to a GSM module and for this reason, the paper tokens may be changed through SMS tokens that are messaged to customers' cell phones, this reduces the use of papers. Besides, extra features which includes reminder SMS and remote token request will reduce the queuing period and the number of patients within the premises. The functionality of the proposed system is observed in the results and discussion section.

Chi Yi Lin, Guan Ying Jhu and Siang Siao [2] innovate the way Bluetooth beacons are used. Specifically, the uniqueness of our implementation lies in that beacon devices need not advertise fixed identifiers all the time that is we allow a single beacon device change its advertised identifier dynamically. In our use case, we associate each customer with a unique identifier. When the queue management system calls a specific customer, we embed the identifier associated with this customer in the advertised beacon packets. When calling the next customer we simply change the embedded identifier in the beacon packets. At the customer side, a message will pop up on the mobile phone as soon as his unique identifier is detected in the beacon packets.

Chin Pei Fen, Amar Faiz Zainal Abidin, Kamaru Adzha Kadiran, Mohammad Bin Abdullah, Ahmad Khudzairi Khalid, Haszeme Bin Abu Kasim, Diana Che Lat, Roslizayati Razali and Noor Shazreen A. Rahman [3] proposes a concept of Queue management system that is able to give priority to handicapped patients automatically. Arduino Mega 2560 acts as the control unit for this system, ESPressor Lite V2.0 module used as communication device and 2.4 TFT LCD screen display the queue information to the customers. RFID module associates with the processor unit used to recognize the handicapped privilege card, which permits the impaired to cut the line.

Arun R. and Priyesh P. P. [4] developed a system that uses GSM technology, a PC as the main server and a microcontroller, which means that it is embedded in nature. The entire system is controlled by a master VB controller program and access to the PC is via the standard RS232 (serial communication) protocol. Although the system is designed for clinician-patient clinical applications, it can be modified and appropriately expanded to serve many. The design relies heavily on perfect synchronization between the three main elements of the system: GSM, personal computer and microcontroller. The system has been successfully evaluated and the results obtained are promising.

Md. Nasir Uddin, Mm Rashid, Mg Mostafa, Belayet H, Sm Salam, Na Nithe and SZ Ahmed [5] develop an automated queue management system to organize a queue system that can analyze the status of queues and decide which customer will be served first. This queue architecture model can switch between different planning algorithms depending on the test result. The average waiting time using two different queue control systems have been developed. Several processes are performed that control the Intel Galileo microcontroller.

III. METHODOLOGY

The proposed work in this paper is an automated token booking system for hospitals which makes the queue management simpler and easier. This IoT system is controlled by raspberry pi 3B+. The Raspberry pi is a very low cost computer that runs Linux, however it conjointly provides a set of General Purpose Input/Output (GPIO) pins, allowing you to control electronic components for physical computing and exploring Internet of Things. The operating system for Raspberry Pi is Raspbian which is a version of Linux. Here the programming language used is Python. Python is high level- general purpose programming language used to develop graphical programming applications, websites, and internet applications. Fig. 1 illustrates the block diagram of the proposed token booking system. The system consists of a graphical user interface based application on a 5 inch resistive touch screen which is compatible with raspberry pi 3B+. A minimum of 5V- 2A adaptor can be used for powering the pi.

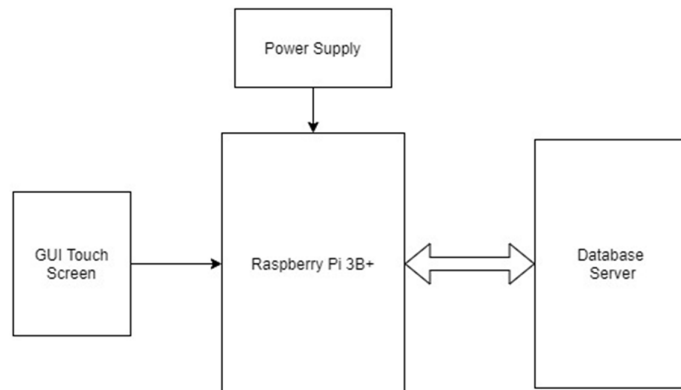


Figure 1. Block diagram of the proposed system

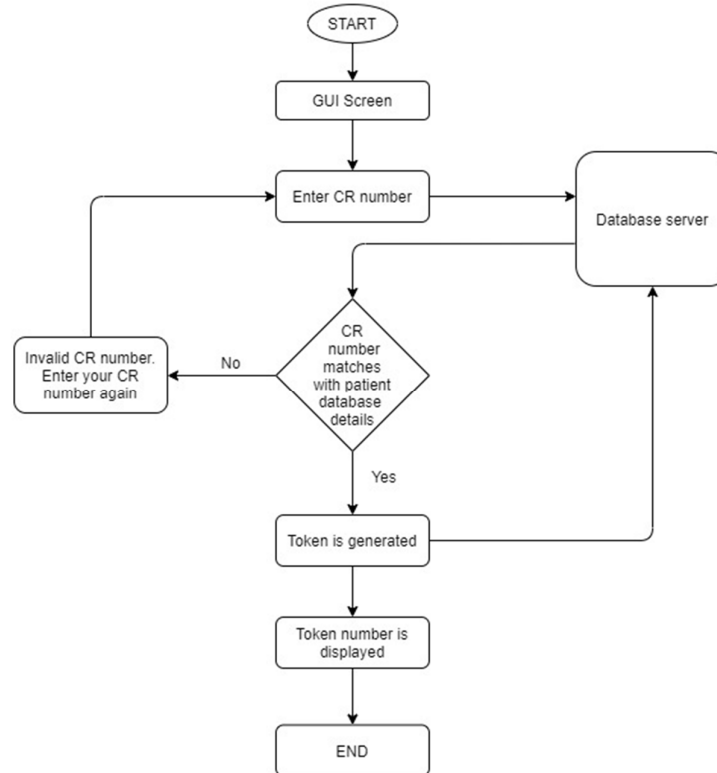


Figure 2. Flow chart of the work

The working of proposed system as a flow chart is shown in Fig. 2. Here the patient can book appointment through the GUI application on resistive touch screen. A virtual kiosk system is designed in the GUI screen through which patients can enter their CR number. While entering the CR number the patient details are compared with the pre-recorded patient database. The database is created and stored using MySQL application. If the entered CR number with the patient database is matched then token is booked and a token number is generated, which is automatically updated in the server. The proposed system allows booking only for existing patients. The details of existing patients including their CR number are stored in the My Structured Query Language (MySQL) database. MySQL is a database management system. This application is used for a variety of purposes including data storage, e-commerce, web registration applications etc. However, the most common purpose of MySQL is for the web database.

IV. IMPLEMENTATION AND PRELIMINARY RESULTS

Our current implementation of the smart token booking system is based on the raspberry pi system. A five inch resistive touch screen is interfaced with raspberry pi. To enable interaction between user and the system a python based GUI is designed. In the following we introduce some results by showing the images of GUI screens and MySQL database in localhost phpMyAdmin.

Fig. 3 shows the initial state of the token booking system. This welcome screen is created as per the requirements of Thrissur medical college cancer centre. Here we can see a button named “TAP HERE” at the lower middle of the screen. When we press this button initial screen goes to next screen.

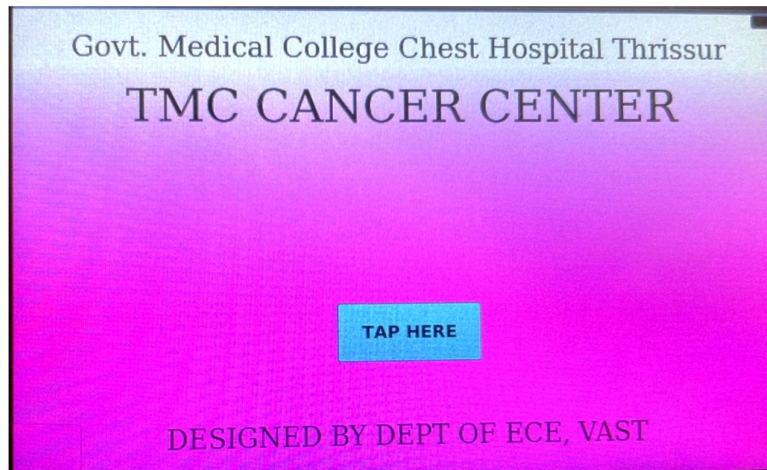


Figure 3. Initial screen

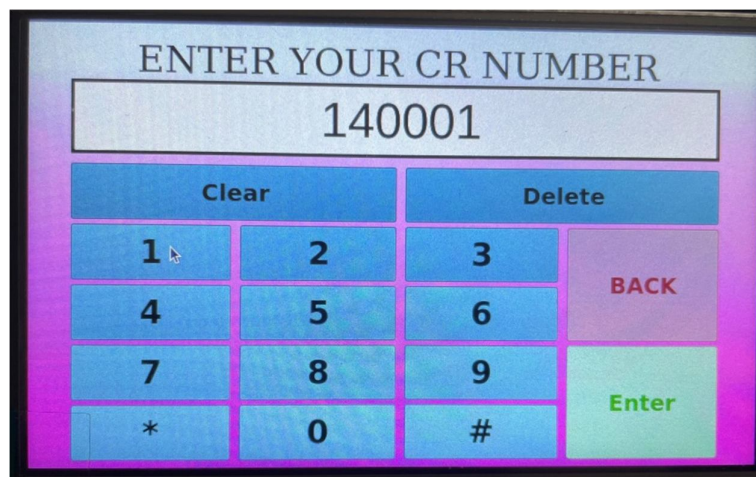


Figure 4. Virtual keypad with CR number on screen

Fig. 4 shows the next screen of the system after pressing TAP HERE button. A virtual kiosk system is designed in this graphical user interface screen. CR number of the patient is entering in this screen. Numeric keypad in this screen helps us to easily enter the CR number which is 6 digit numbers. Just like any kiosk system this virtual kiosk can also do multiple operations. If the number entered is wrong we can entirely clear the wrongly entered number using clear key in the numeric keypad. Similarly if we have to delete one single digit we can use delete key for this purpose. i.e., if the CR number is 140003 and we wrongly enter it as 140006 we only needed to delete the last digit 6 using the delete key and enter the correct digit 3. A back option is also provided in the kiosk which will take us back to the initial screen. After the CR number is perfectly entered and then pressing the ENTER button will take us to the next screen.

After entering the CR number of the patient this CR number do compare with the pre-recorded database of patient in MySQL. If the CR number entered is wrong a message “CR number is valid enter the number again” will show on the screen and we have to enter the CR number again for token booking. If the CR number matches with the database details then we go to the next screen which shows the token number of the patient and is shown in Fig. 5. MySQL database stored in local host is shown in Fig. 6.

Figure 5. Booking confirmation with token number

tbl_id	tbl_cr	tbl_name	tbl_age	tbl_gender
1	140001	KANAKAMANI	53	F
2	140002	SANTHA	48	F
3	140003	MANOJ	32	M
4	140004	SOBHA	47	F
5	140005	KOCHUMON	65	M
6	140006	HASEENA	26	F
7	140007	SIDHIQUE	45	M
8	140008	SHAHARBAN	35	F
9	140009	VIJAYAN	59	M
10	140010	RAMACHANDRAN	48	M
11	140011	GOPALAKRISHNAN	67	M
12	140012	RAJAPPAN	58	M
13	140013	KABEER	42	M
14	140014	MARY JOSE	68	F
15	140015	JESSY	50	F
16	140016	MARY SUNNY	50	F
17	140017	AYISHA	42	F
18	140018	ALI	60	M
19	140019	POULOSE	55	M
20	140020	MADHAVAN	85	M
21	140021	SASI KUMAR	65	M
22	140022	GOPALAN	74	M
23	140023	MUSTHAFA	60	M
24	140024	RAJAN	62	M
25	140025	VIMALA	62	F

Figure 6. MySQL database in localhost phpMyAdmin

V. CONCLUSION AND FUTURE SCOPE

This framework is a raspberry pi based IoT system for token booking in Thrissur medical college cancer center. This raspberry pi based system is linked to the database server website. Here both pi and server are connected

through same Wi-Fi or LAN connection. And the database is developed and stored in the server using MySQL. In this system patients only need to enter their CR number on the screen. This will reduce not only the long waiting in queues but also the effort of patients in token booking.

The current implementation is merely a proof of concept. The test results show that all functions in the system have performed correctly, where all possible cases are verified. In future work we can develop the system in a way to arrange smart token booking for laboratories, pharmacies and bill payments in the hospital.

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