Library Footfall Analysis Using Barcode Scanner and RabbitMQ

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Abstract : Libraries maintain a register to record the visitor's name/ID, entry and exit time of visitor. Such record-keeping is necessary to analyze footfall of library but, the manual method of maintaining handwritten register is vulnerable to human errors and footfall analysis is hectic. The system for Library footfall analysis using barcode scanner and RabbitMQ uses barcode scanner connected to raspberry pi to scan barcode on the identity card of students. Use of barcode technology ensures speed and accuracy. Scanned barcode along with timestamp are published on rabbitmq. Rabbitmq provide a safe place for data until it is received for analysis and report generation. This system is useful in libraries where visitor have unique ID in the form of barcode.

IndexTerms - **RabbitMQ, Barcode Scanner, Raspberry Pi, Library Register**

I. INTRODUCTION

Every Library maintains a register to keep track of visitors who visit library. The registration number, date and entry-exit time are recorded in register. This record is helpful to analyze the footfall. Especially in colleges or universities footfall analysis is important to know how many students and faculty members visited library. This information is one of the factors considered at the time of accreditation of colleges. The system for Barcode based library footfall analysis uses barcode scanner to record the entry and exit of visitors. It also counts number of visitors who visited library. It generates analysis and daily report. Currently entry registration as well as report generation is done manually. All this work can be done automatically with the help of system consisting barcode technology, raspberry pi and cloud server.

II. ARCHITECTURE

In this system first visitor has to scan identity card with the help of barcode scanner. The data from barcode is retrieved and decoded. Python language is used to interface barcode scanner with raspberry pi. Visitors' personal information and entry-exit time is recorded.[4] Data is published on RabbitMQ through raspberry pi. System generates section vise summery and daily report. The modules in this system are:
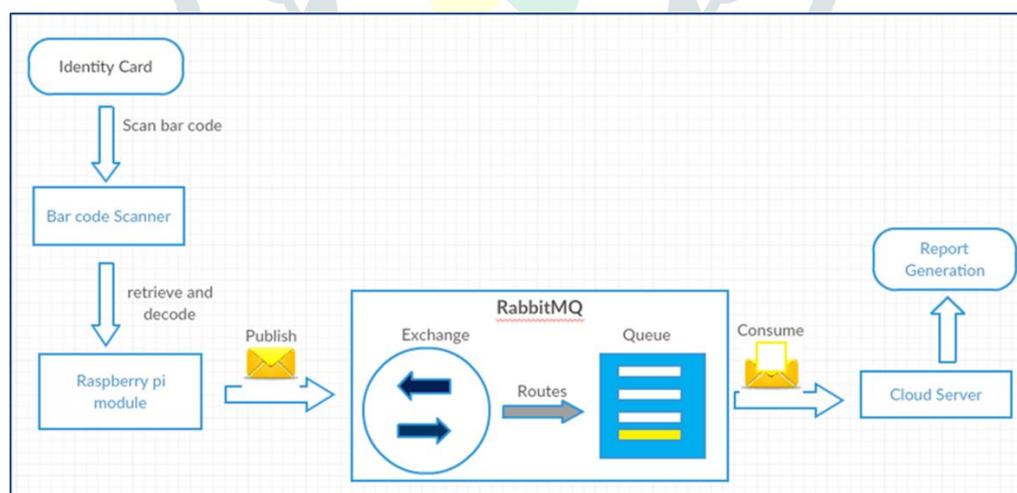

Fig 2.1: Architecture of Barcode based Library Footfall Analysis

2.1 Barcode Scanner:

A barcode is a visual representation of data that is scanned and interpreted for information. Each barcode contains a certain code which works as a tracking technology for products in this case registration number; and is represented in a sequence of lines or other shapes.[2] This barcode technology can be scanned by barcode readers along with newer technology on devices such as smartphones and desktop printers.

Advantages:

- Barcodes eliminate the possibility of human error. A barcode scan is fast and reliable, and takes infinitely less time than entering data by hand.
- Barcodes provide fast and reliable data for a wide variety of applications.[1]
- Data obtained through barcodes is available rapidly. It is ready almost instantaneously. This ensures that time will not be wasted on data entry or retrieval.

Disadvantage:
- Barcodes needs to be scanned individually.
- Some better technologies like RFID are available.
- Barcodes are more easily damaged
- If a barcode is ripped or damaged there is no way to scan registration number.[3]

2.2 Raspberry Pi:
The Raspberry Pi is a powerful, low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. Raspberry pi don't require much processing power, saves space, keep the cost low and make system portable.
RASPBIAN, PIDORA, OPENELEC, RASPBMC, RISC OS, and ARCH LINUX these are few operating systems which are used. It supports Python as the main programming language for functioning and coding. It also supports BASIC, C, C++, JAVA, and Perl and Ruby languages.

Advantages :
- Raspberry Pi is inexpensive
- Raspberry Pi connects to the internet
- The Pi has the entire Linux software stack available
- Variety of languages are available for Raspberry Pi

Disadvantages:
- It cannot run X86 operating systems
- Applications which needs high CPU processing are off-limits
- Hardware access is not real time. If CPU is bogged down hardware interfacing can be delayed
- Doesn't have power to drive inductive loads
- Pi lacks an inbuilt analog to digital converter

2.3 RabbitMQ:
RabbitMQ is open-source enterprise messaging system modelled on the Advanced Message Queuing Protocol (AMQP) standard. It acts as an intermediary platform to process communication between two applications to meet high-scale, high-availability requirements. [6]
Messaging enables software applications to connect and scale. It supports multiple messaging protocols. It gives your applications a common platform to send and receive messages, and your messages a safe place to live until received.

Advantages:
- It can be configured to use SSL thereby providing additional layer of security.
- RabbitMQ supports variety of messaging protocols.
- RabbitMQ offers features like reliability, including persistence, delivery acknowledgements, publisher confirms, and high availability.
- Offers clustering and is very good at it.

Disadvantages:
- RabbitMQ configuration must be done before implementing task queue.
- When compared with Redis for non extensive message brokers Redis obtains a slight edge due to its ability to multi-task.

III. IMPLEMENTATION

3.1 Hardware Setup
In this USB barcode scanner connected with Raspberry pi is used for registering the entries. Raspbian operating system is used in pi. Raspberry pi is used in headless mode. Python program running in background records the registration number scanned from barcode. Along with this, system time is also recorded.

3.2 Connection with RabbitMq
This system make use of CloudAMQP instance instead of downloading and installing RabbitMQ. CloudAMQP is a hosted RabbitMQ solution. The system use a cloudAMQP account to create an instance. CloudAMQP is be used for free with the plan little lemur. From that instance username, password and connection URL is used to setup connection between system and

rabbitMQ. The python program running on raspberry pi acts as producer which sends message containing the registration number and time to rabbitMQ.[6] The message is stored in the queue. This message remains in the queue until consumer application handles the messages.
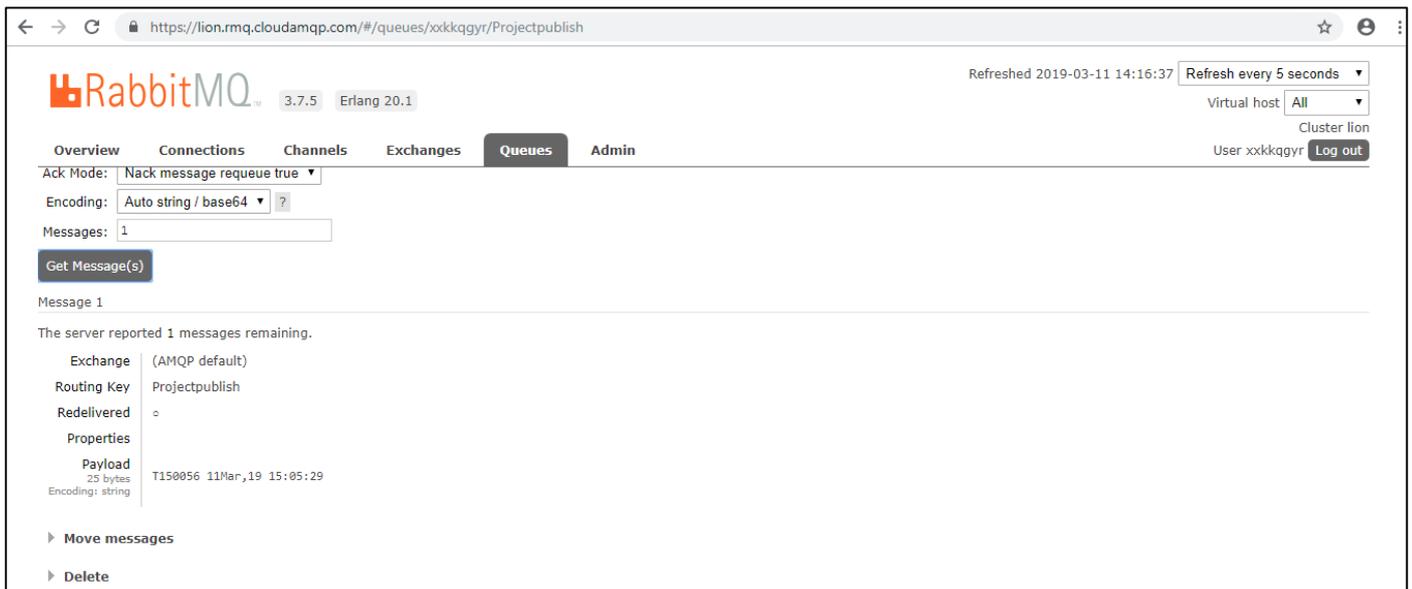

Fig3.1 RabbitMQ Queue Status

3.3Autostart Python Script at BOOT
The python program that is used to scan barcode needs to be run continuously throughout the day, as we are not going to use monitor with raspberry pi the python script should auto start at boot. Following are the option to auto start the script:

CronTab:
Cron is a tool for configuring scheduled tasks on Unix systems. CronTab is useful for scheduling commands or scripts to run periodically and at fixed intervals. Tasks range from backing up the user's home folders every day at midnight, to logging CPU information every hour.
The command crontab (cron table) is used to edit the list of scheduled tasks in operation, and is done on a per-user basis; each user (including root) has their own crontab.

systemd
In order to have a command or program run when the Pi boots, you can add it as a service. Once this is done, you can start/stop enable/disable from the linux prompt systemd is a Linux initialization system and service manager that includes features like on-demand starting of daemons, automount and mount point maintenance, snapshot support, and processes tracking using Linux control groups. systemd provides a logging daemon and other tools and utilities to help with common system administration tasks.
- • Create a python script
- • Create a unit file
- • Configure systemd
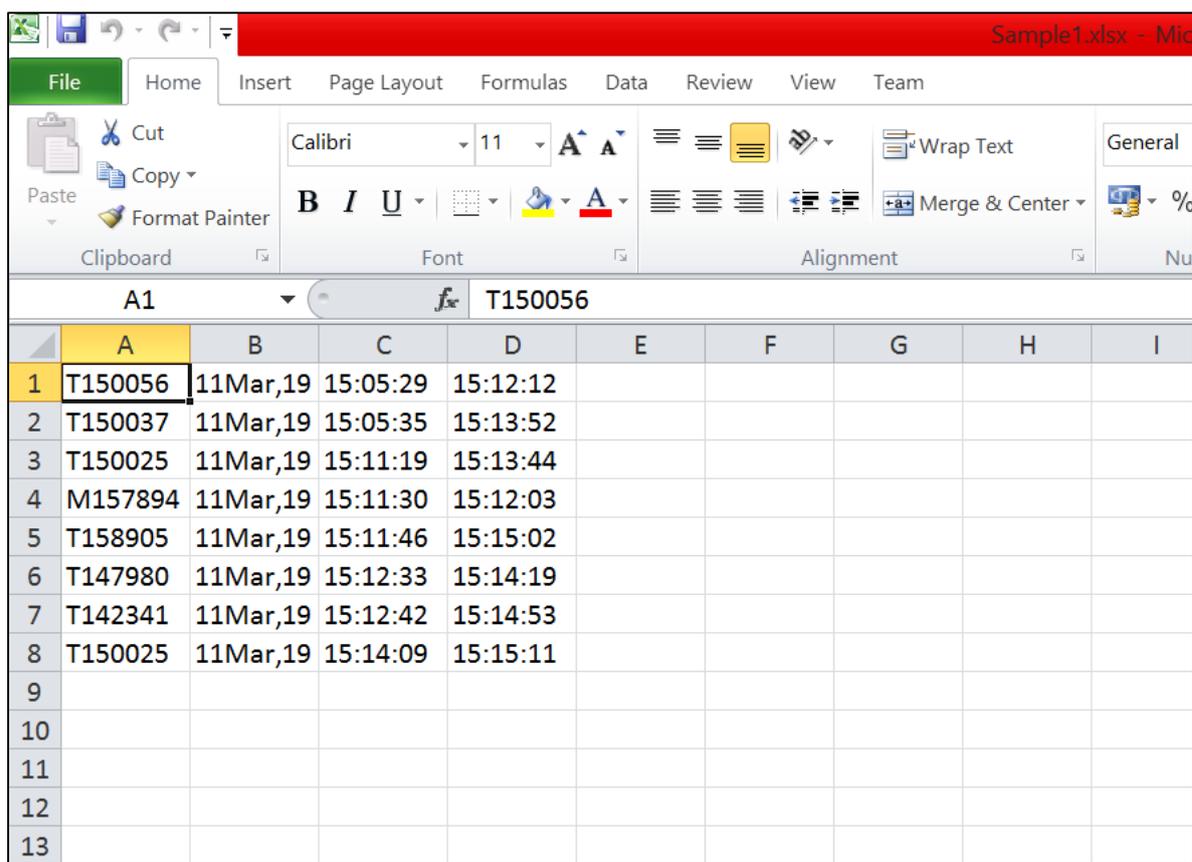- • Check status of service

Rc.local
In order to have a command or program run when the Pi boots, you can add commands to the rc.local file. This is useful when you want to plug your Pi in to power headless, and have it run a program without configuration or a manual start.
If script depends on any system features being available at that point in time such as the network being connected and available, the /home/pi directory is mounted and available for use or the System time has been updated by NTP then it would be ideal to use either systemd or init.d methods.

3.3 Report generation:
The consumer model for this project receives block of string containing registration number and time from RabbitMQ. This data is taken as input to generate report as per requirement. The daily records are stored in excel file. For this purpose openpyxl module is used which allows python programs to read and modify Excel spreadsheet files. These Excel files are used for analysis and report generation.

Fig3.2 Daily Excel Record

CONCLUSION

The Proposed barcode based library register can be used for recording and analyzing footfall count in library efficiently. This system combines advantages of different technologies to overcome limitations of existing systems. This reduces the manual work and eliminates the chances of human error while making entry in the registry book thus makes the access to the library quick.

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