"Smart Queue Management System with Real Time Tracking Using DNN"

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Abstract - Queue management is a malady faced by the wide majority of burgeoning organizations as demand for service is increasing. However, this doesn't mean that backed up lines and grumbling customers is 'the norm' or a situation that can't be solved. Queue management technology can help you take the edge off both the actual and apprehended waiting time for customers, improve customer satisfaction, and provide the data your managers need to further optimize the service experience. This project is based on a smart queue management system for providing real-time service utility request for the convenience of customers as well as administration team of organization. The proposed system aims at minimizing the dissatisfaction with services with medium to long waiting times. At this point, the system enables the administration to receive an input if there is any kind of mishandling or long queue inefficiencies, with the help Wi-Fi module. The proposed system also performs the predictive analysis by regularly updating its database and then after a particular time period it will help the administration to open the closed counters before the queue exceeds the limit. The image processing concept is essential parameter to count number of people in count detection. This system is using Open-CV platform and CNN algorithm for image processing with real-time person detection and taking the record of number of counts of the people. The future predictions based on the count of people in a particular interval of time are done by analyzing the past data using machine learning algorithm as the DNN.

Keywords – DNN, Open-CV, image processing through CNN.

I. INTRODUCTION

1.1 Background

The prime hindrance faced during the smart queuing systems such as accessibility to a varied client base, reduced cost of deployment, ease of use utility, reduced the overhead and slowdown associated with false requests, needs to be assessed with attention. There is also a physiological barrier for clients worrying that leaving the waiting area will more than likely disconnect them from the system causing for the lengthening waiting times upon return. Furthermore, the ignorance in improving the customer experience despite the inconvenience of misadministration with the waiting queues makes it undesirable. Developing solutions to the tedious task of waiting for services is of an imperative necessity, especially due to the growing demand as the population of the world continues to elevate. Since web applications are now integrated within the virtually active societies, using such a mean to better queuing systems is instinctive. Henceforth, we propose a web of things to solve the problem.

1.2 Problem Definition:

To provide Smart Queue Management System by Real time Queue tracking using DNN to enhance the environment for people as well as administration by proposing the solution to the problem of client dissatisfaction concerning the long waiting time associated with the services of the organization such as D-mart.

1.3 Objectives:

To inform the administration in advance about the prediction of count of people.
For improving the customer satisfaction by creaking a proper management for handling the queuing inconveniences.
For designing and developing a comprehensive Web based queue management application

II. LITERATURE SURVEY

1. A Smart Mobile System for the Real-Time Tracking and Management of Service Queues International Journal of Computing and Digital Systems

ISSN (2210-142X) Int. J. Com. Dig.Sys. 5, No.4 (July-2016)

Function:

The smart queue management system has the potential to improve client satisfaction and productivity, and to solve the problem of improving waiting time for services. delivery of audio-visual updates using smartphones, and entertaining clients with reading material and a TV audio stream can be done using it. An android smartphone application represents the user unit, for the registration and verification units NFC antennas are used, and for audio capturing and streaming embedded Linux target board is used. The system comprises connected units forming a web of things. There are different units for audio capturing and streaming, queue management, and user units as smartphone applications.

Advantages:

To reduce waiting time and make them more tolerable.

Disadvantages:

In the system, a radius near the desire service is specified where the app may be used to reduce false service requests, which also make the dynamic time prediction algorithm more accurate.

2. Tackling Rare False-Positives in Face Recognition: a Case Study

IEEE 16th International Conference on Smart City.DOI 10.1109/HPCC/Smart City/DSS.2018.00260.

Function:

This application is about developing a queue management system which uses facial recognition for an airport in the UK. The approach involved capturing the faces of passengers while entering trough Boarding Pass Gates (BPG) and while exiting through Security Gates (SG). Thereafter, detecting and comparing of the faces is done, within a fifteen-minute window, from BPG against the ones from SG. If the match is found, the time that someone has spent inside the security area is calculated, using the capture time of matched face. This is called as the security queue time. Like any other application based on face recognizing, dealing with minimizing the count of false positives, i.e. falsely matched faces are considered. In this application false positives are analytical rare events. That is, the same pair of pictures is improbable to occur in a calculable time. They invented a scoring system as same as Dlibs by taking advantage of Dlibs Facial Landmarks, or selecting the most appropriate frontal pose from all faces featured to a specific person. Due to this there is a quantifiable minimization in the rate of false positives in this system.

Advantages:

This application is about developing a queue management system which uses facial recognition for an airport in the UK.

Disadvantages:

We have to deal with reducing the number of the false positive, i.e. incorrectly matched faces.

3. GSM Based Queue Management Device for OPD

International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 04 | Apr-2018

Function:

In the assessment of health care quality assessment Patient satisfaction is major priority. Waiting time is considered as an important factor of patient satisfaction. In general hospitals when patient comes to visit to a Doctor, he/she have to go through a process of first registering their names in OPD section and then waiting for their turn to come. This all procedure is handling by a human being on the basis of first come first serve basis. But many times, the criteria of first come first serve fails due to human error or influence then patients may get frustrated and may feel less satisfied with the services. So, in order to tackle such situation and to serve patient efficiently we have developed this device "GQMDO" for smooth functioning of OPD's without intervention of human being.

Advantages:

The system is useful to deal with increased rate of population and their demand for the healthcare service.

Disadvantages:

The issues like customer retention, value, safety, litigation, and reputation may be faced by the healthcare organizations.

4. Design and Development of an Infrared Remote-Controlled Queue Management System

International Journal of Scientific & Engineering Research Volume 9, Issue 1, January-2018 ISSN 2229-5518.

Function:

In this paper the design and development of queue management system controlled by an infrared (IR) remote has been described. The system becomes more efficient with the use of IR remote and it prevent cluttering of wires for large systems. This developed system supports the NEC protocol based infrared remotes. The circuit for the system uses the micro controller ATmega328p. For showing the output three 7-segment displays have been used. The outputs of these registers have been decoded by BCD to 7-segment decoder IC and fed to the display units. C programming language has been used for developing the program that provides the intelligence of the system. The performance of the system has been studied and it is found that the system works properly without any interruption of noise.

Advantages:

In future, for developing the same type of system, this system can be expanded for advanced and centralized queue management system. It is possible to introduce preliminary IR remote configuration so that the system works for any IR remote available in the market.

Disadvantages:

In large companies or banks where there are multiple queues providing service to the customers, a conventional fixed wire system causes multiple problems such as wire cluttering and difficulty in maintenance and recovery in case of system failures. A wireless system nullifies these problems.

5. Context-Aware and Pro-active Queue Management Systems in Intelligent Environments

Proceedings of the Federated Conference on Computer Science and Information Systems 2017 ISSN 2300-5963 ACSIS, Vol. 11 DOI: 10.15439/2017F362

Function:

The important factor of ambient intelligence paradigm is the electronic environments. These environments are sensitive and quick to react to the existence of people. Queue systems which are realistically utilized in various institutions and profit-oriented enterprises establish a problem for the intelligent environments in smart cities. The management system for the customer guarantees that the system will exclude or reduce the queues. Also, it assures about the economic advantages including the satisfaction of client of the better service quality. The system is developed as the pro-active and context-aware system consisting number of low-level sensors and devices forming the IoT network. The developed context-driven system is distinguished by user friendliness, as well as considering the client behavior understanding to generate actions that help clients. The chosen features of the prototype version have been imitated. This prototype can be used as the required experience for developing the target system meeting the necessary needs and suppositions typical for context-aware and pro-active system based on IoT networks.

Advantages:

The system is useful for improving the quality of life for citizens. With the help of it, the sustainable usage of resources can be enabled.

Disadvantages:

The actual scenario which helps to reach this goal is not present.

III.EXISTING SYSTEM APPROACH

Crowd Control Management Solving Queue problems in Banking Industry: Managing Long queues during peak business hours has always been a huge problem for banks. In retail banking industry, queuing remains one of the most common reasons for customer disgust. Despite technological advances such as online and mobile banking, customers still complain about their bank. "TOKEN SYSTEM".

IV. PROPOSED SYSTEM APPROACH
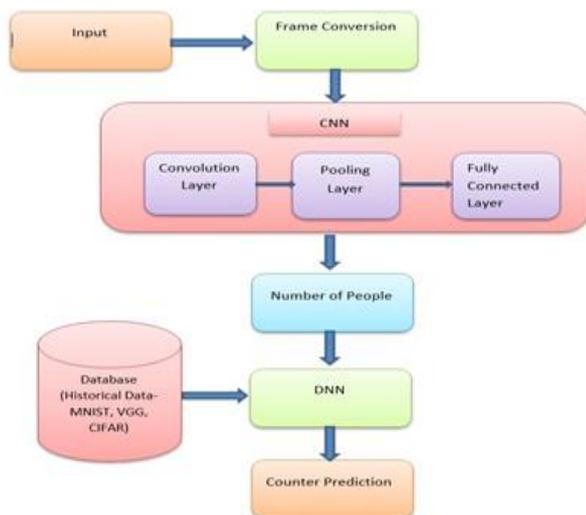
Fig.1 System Architecture Diagram of Proposed System

The above figure is the block diagram of the system that we are going to implement that is "Smart Queue Management System". In the above diagram the system has a video input. After taking the input frame conversion is done. For the person detection we are using the CNN algorithm. On the basis of human detection, person counter will be increased. Analysis will be done on the gathered data. By considering the specific average time for each person, prediction of number of people who will be there on counter will be done and according to this, the prediction of number of counters will be done. And for this prediction we are using DNN algorithm.

V. METHODOLOGY

1. Image Acquisition (Open-Computer Vision)

The Image acquisition is the process of collecting input image sample. The component collects scenes containing objects of interest in the form of images. Here, generally system webcam is used for image acquisition. We use Python and Open-CV to make our very own image detector. We are working with all image operations by using open computer vision python library. It is an Open source Computer Vision and a machine learning software library which is a common infrastructure for computer vision applications and to accelerate the use of machine perception. The use of OpenCV in this system is to process the image, remove the noise and extract the required information from the image, creating them as the boundary boxes.


2. Gray Scale Conversion

After get image acquired by open-cv this color image further converted into a gray scale by reducing noise. Gaussian filtering is used to blur images and remove noise and detail. Image shown below: Fig.2 Gray Scale Conversion Pre-processing of document images is the way of using image processing techniques to enhance the quality of images. Its purpose is to improve and extract objects information of images for later processing purposes. Two pre-processing works, binary conversion and noise removal, are performed here.

3.Convolution Neural Network (CNN)

It processes the image and classifies it in certain categories and detects the human, as a result giving the output as the human count.In neural networks, Convolutional neural network (ConvNets or CNNs) is one of the main categories to do images recognition, images classifications. Objects detections, recognition faces etc., are some of the areas where CNNs are widely used.

- Convolution Layer: Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel.
- Non-Linearity (ReLU) :ReLU stands for Rectified Linear Unit for a non-linear operation. The output is $f(x) = \max(0, x)$.
- Pooling Layer: Pooling layers section would reduce the number of parameters when the images are too large. Spatial pooling also called subsampling or down sampling which reduces the dimensionality of each map but retains important information.

1. Input image   2. Extract region proposals (~2k)   3. Compute CNN features   4. Classify regions
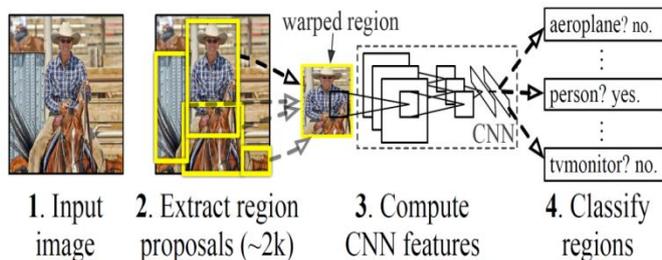
4. DNN

It uses sophisticated mathematical modeling to process data in complex ways. The use of DNN in our system is to predict the number of counts by taking the input from CNN and the database. Deep neural networks (DNNs) are currently the foundation for many modern artificial intelligence (AI) applications. Since the breakthrough application of DNNs to speech recognition and image recognition, the number of applications that use DNNs has exploded. These DNNs are employed in a myriad of applications from self-driving cars, to detecting chance to playing complex games. In many of these domains, DNNs are now able to exceed human accuracy. The superior performance of DNNs comes from its ability to extract high-level features from raw sensory data after using statistical learning over a large amount of data.
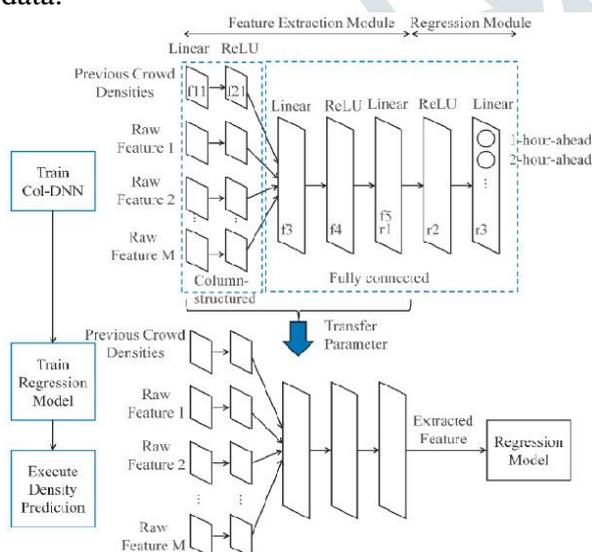
VI. RESULT AND DISCUSSION

In this Person detection and counting system we have been invented greatly trained model that can accurately recognize real time images. In this system we used tensor-flow machine learning framework and predefined libraries. The proposed work is relay on CNN and DNN frameworks.

A. Training Models
Accuracy Rate of Object Recognition

All object sample images trained by our trained model based on CNN. The object images trained based on currency categories, so we have been concluding the accuracy rate above 95%. We achieved 95% accuracy in currency detection model. For object detection get achieved nearly 99% accuracy.

B. Testing Models

Below table1, shows graph number of person on the basis of hour

SR.NO	Hours	Number of Person
1	1	150
2	2	170
3	3	350
4	4	330
5	5	247
6	6	292
7	7	520
8	8	490
9	9	560
10	10	530
11	11	400
12	12	412

Table 2:- Number of Person on the basis of hour

Below table3, shows graph on the basis of hours,offer and number of person.

SR.NO	Hours	Offer	Number of person
1	1	1	150
2	2	0	170
3	3	1	350
4	4	1	330
5	5	0	247
6	6	0	292
7	7	1	520
8	8	0	490
9	9	1	560
10	10	1	530
11	11	0	400
12	12	0	412

Table 3:- Number of Person on the basis of hour and offer

Below table4, shows graph on the basis of hours, and number of person.

SR.NO	Days	Number of person
1	1	150
2	2	170
3	3	350
4	4	330
5	5	247
6	6	292
7	7	520

Table 4:- Number of Person on the basis of day

Below table5, shows graph number of person on the basis of event for bar chart

SR.NO	Event1	Event 2	Event 3
1	200	215	250
2	350	245	275
3	240	300	350
4	360	115	207
5	320	197	230
6	145	326	312
7	125	245	350

Below table6, shows graph number of person on the basis of event and day

SR.NO	Event1	Event 2	Event 3	Day
1	200	215	250	1
2	350	245	275	2
3	240	300	350	3
4	360	115	207	4
5	320	197	230	5
6	145	326	312	6
7	125	245	350	7

Below graph1, shows graph on the basis of hours,offer and day.
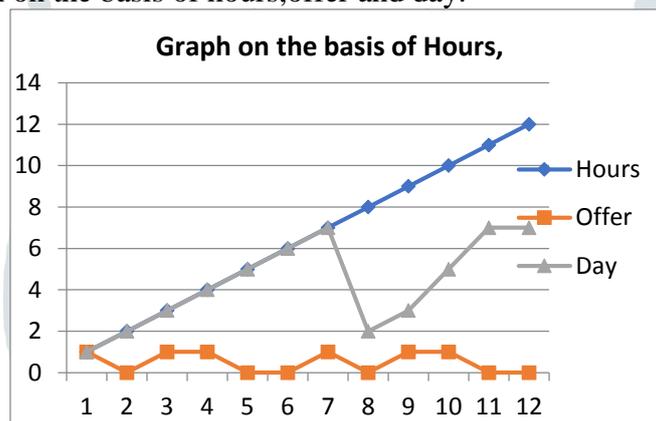
Graph 1:Graph on the basis of hours,offer,day

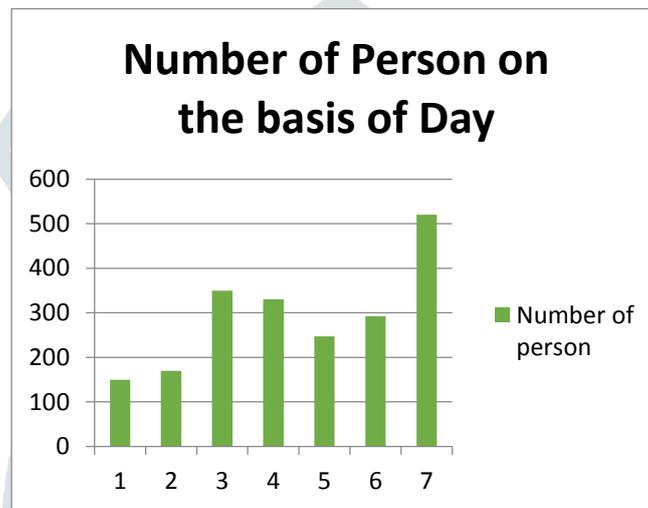Below graph no.2 shows number of person on the basis of hour

Graph 2:Graph on the basis of hours

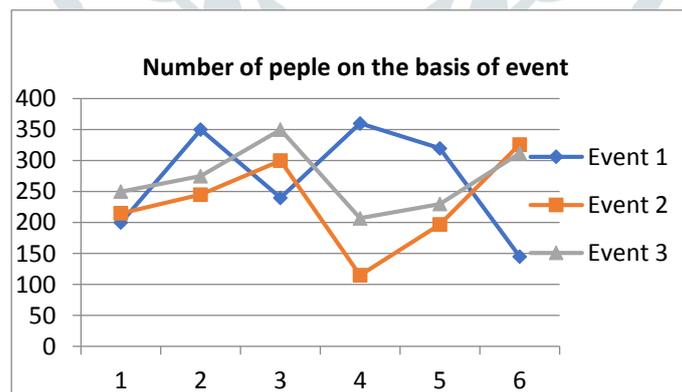Below graph 3,shows graph on the basis of hours,offer and person
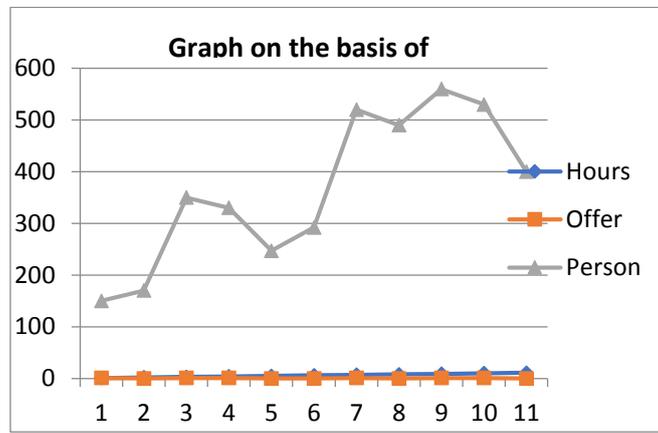
Graph 3:Graph on the basis of hours,offer and person

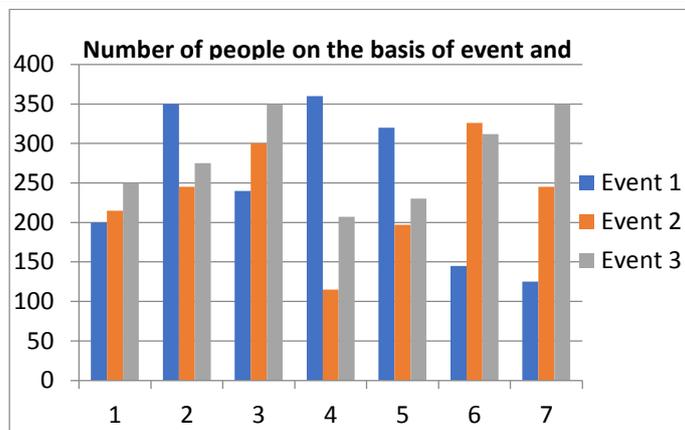Below graph 4,shows number of person on the basis of day

Graph 4: Number of person on the basis of day

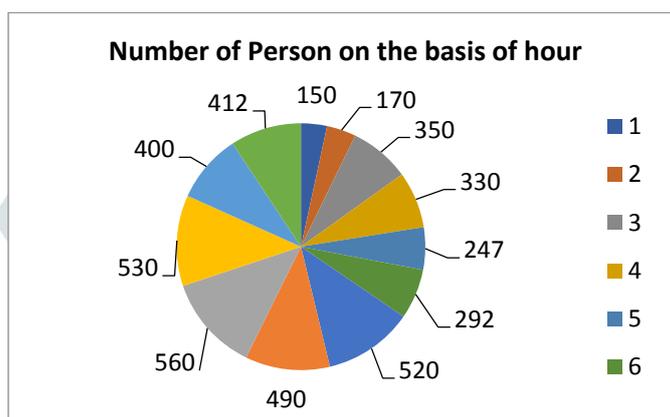Below graph 5,shows number of people on the basis of event

Graph 5: Number of people on the basis of event

Below graph 6,shows number of people on the basis of event and day

Graph 6:Number of people on the basis of event and day

Below graph 7,shows number of person on the basis of hour

Graph 7 :Number of person on the basis of hour

VII. CONCLUTION

This project leverages the expressiveness of CNNs object detector. The simple Formulation of detection can yield strong results when applied using a multi-scale course-to-fine procedure. During the design-space exploration process, it is necessary to understand and balance out the main system metrics. Camera captures, images and videos are taken as input and further processed for person detection. Person counting and Queue prediction is done using the convolution algorithm, deep neural network techniques and DNN algorithm. The system pays heed on delivering real-time service request updates to organization in the form of audio notification system accordingly with the success or failure of the results. The system to its core is a queue management system with real-time. Along with this, the proposed system improves the quality of the waited time on location. To conclude, the smart queue management system has the potential to improve client satisfaction and productivity, and to mitigate waiting time for services.

ACKNOWLEDGMENT

REFERENCES

[1]Mohammed Ghazal, Rania Hamouda and Samr Ali, **"An IoT Smart Queue Management System with Real-Time Queue Tracking"** 2015 Fifth International Conference on e-Learning.
[2]K. Nathani, R. Suthar, J. Shelke, V. Vatharkar, and A.J.Patankar, **"Smart queue management for hospitals,"** IJAFRC, vol. 2, pp. 94–98, 2015.

[3]S. Shahbandari, **"Uae to introduce star ratings for government departments,"** Gulf News, February 11, 2014. Available http://gulfnews.com/news/ gulf/uae /general/uae-to-introduce- star –ratings for- government-departments 1.1289766 .

[4]P. Kumar, M. U. Kalwani, and M. Dada, **"The impact of waiting time guarantees on customers' waiting experiences,"** Marketing Science, vol. 16, no. 4, pp. 295–314, 1997. [Online]. Available: http://dx.doi.org/10.1287/ mksc.16.4.295

[5]B.-I. Lee, J. M. Ham, K. S. Park, S.-H. Ok, J. M. Kim, and H. K. Choi, **"Development of the investigation scheduling system using mobile phone utilization of the department of nuclear medicine,"** in Enterprise networking and Computing in Healthcare Industry, 2005. HEALTHCOM 2005.Proceedings of 7th International Workshop on, June 2005, pp. 325– 326.

[6]Q. Li, Q. Han, X. Cheng, and L. Sun, **"Queue sense: Collaborative recognition of queuing on mobile phones,"** in Sensing, Communication, and Networking (SECON), 2014 Eleventh Annual IEEE International Conference on, June 2014, pp. 230–238.

[7]S. Shahbandari, **"Uae to introduce star ratings for government departments,"** Gulf News, February 11, 2014. Available: http://gulfnews.com/news/gulf/uae/general/uae-to-introducestar-Ratings-for- government-departments-
1.1289766.

[8]Y. Lin and Y. Lin, **"Mobile ticket dispenser system with waiting time prediction,"** Vehicular Technology, IEEE Transactions on, vol. PP, no. 99, pp. 1–1, 2014.

[9]R. Arun and P. Priyesh, **"Smart queue management system using GSM technology,"** Research India Publications, vol. 3, no. 8, pp. 941–950, 2013.