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Various Crowd Control Techniques and Seat Availability in Public Transportation System- A Survey.

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ABSTRACT

In recent years the population has increased drastically due to which mobility has also increased. Due to this, transport has become a challenge in our day to day life. To manage the population more number of transport facilities has been introduced. This leads to air pollution and more traffic on roads. People has started using more number of private transport due to inconvenience caused in the public transport system. A novel technique has been proposed for helping in reduction of inconvenience caused in public bus facility. Generally major factor in public transport is crowd management. In this work, crowd management has been planned for students using bus facilities. In colleges there is no bus allotment system for particular stops due to which some buses gets overcrowded and some are left vacant. In our proposed solution we are focusing on implementing hardware circuits consisting of microcontroller, GSM and GPRS in every bus to get the real time location and seat availability in upcoming buses. We will be showing real time statistics of availability of seats and bus location by developing a web application which will be used by each student. With the help of this app they will have the knowledge of upcoming bus location and available seats in them. With the help of this, students and staffs will be able to board the suitable and less crowded bus. This will also help students in time management and avoid inconvenience in travelling.

Keywords: seat allotment, crowd counting, real time localization, route sensing, mobile crowd sensing

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INTRODUCTION

Crowd Management is a technique use for proper handling of a large group of people at a particular place. It is integral to running a safe, enjoyable event, and should be considered in the earlier stage of planning. In recent years population has increased drastically due to migration of people for job and education which impact travel due to which students and staffs face inconvenience to use the college buses. Since there is no crowd management system few buses get overcrowded and few are left vacant. Thus a novel technique has been purposed for crowd management and real time localization of buses.

The proposed work focuses on the crowd management system in buses. IR sensors are implemented in the bus to count the number of staff and students. In addition the real time localization of the bus is also found by implementing GPRS & GSM. In this project IR Sensor will be used to detect person crossing the gate. For each person count will be taken while they enter or exit the gate. IR Sensor interface to pin-A1 to A5 of Arduino controller. GSM will be used to access internet data so that seat occupancy details can be uploaded to server along with coordinate for tracking. We will be using GPS to get geo location from satellite and same will be uploaded/ updated to server with GSM and controller. GSM & GPS is interface to Arduino Pin- SDA.

VARIOUS TECHNIQUES TO CONTROL CROWD IN TRANSPORT

Milica G. Kusic (2016) et al proposed a novel technique for detection of seat occupancy by wireless inductive sensor. This technique also improved the design of wireless inductive sensor with novel parts integration with a suitable mechanical device. The proposed technique is used for seat occupancy detection with adjustable weight. Sensor like inductor, steel spring and ferrite plate and antenna has been used in this technique. Mechanical device has been used for transferring the scale weight device to the sensor. The system is designed as well as when the weight is applied to the sensor the spring will compressed which result the distance between the inductor and ferrite decreases so, the sensor changes inductance and consequently antenna sensor frequency which is used for electric output . its prototype function and performance based on three segment linear characteristic with following sensitivity. 0.9MHZ for weight 0.20kg, 1.86MHZ/Kg for 20-40kg & 0.19MHZ for 40.00kg. By this technique the inductive sensor detect the weight, therefore the sensor is used for seat occupancy detection in a vehicle and airbag system.[1]

Yao Jing et al (2017), develop a novel technique for tracking system based on mobile crowd sensing (MCS). Mobile crowd sensing technique is totally different from the traditional video-based tracking system. In this technique in real time crowd tracker take photo of the object to get prediction and tracking by minimum cost. The MPRE model by T-centric and P-centric algorithm is used to predict the movement of object and task allocation. By P-centric and T-centric algorithm the crowd tracker select the object in the prediction region. Experimental results show that this technique effectively track the object with the low incentive cost.[2]

Sachin Vidyasagaran et al(2017) proposed a novel technique that can detect and display the seat availability status of bus and train in low cost IOT based smart seat. The occupancy status of seat in bus and train is given as real time by internet or mobile communication. The NETSIM simulation software is used for the feasibility of the technique and the hardware part like Arduino, raspberry Pi-URF are implemented in bus and train using the IEEE802.15.4 standard to get the result. This technique was tested for various loads and seating profile prototype was build which gives software simulation results of an average of 89 bps and delay average of 0.516 sec. And 4.88 second delay of speed 1Mbps of hardware prototype[3]. Adriaankitzig et al (2016), proposed a novel technique to monitor the taxi and for safe drive. In this technique, capacitive sensor method is implemented to seat occupancy detection. In this the object is detected using the single electrode. the integration of wireless sensors is implemented using Zigbee process. In real time application, if any error is found, the network is modified/alterd using Zigbee module where sensor can be added or removed without any modification. The mathematical model of the capacitive sensor is implemented in this work to determine the relation between the unoccupied and occupied seat clearly.[4]

Raman Khoebal et al (2016) develop a novel technique for reducing RFID ticket inspection time as well as its process of inspection. In this system RFID/NFC ticketing system and infrastructure of Netherland is implemented. The countless RFID card is used in this proposed system which work of the basics of inductive coupling which read and check-in and check-out gate at very short distance. This system also useful for the localization and NFC setup. This system will also cope with the situation where some passengers don't have a

ticket and is therefore able to possibly detect fare dodgers[5]. Anita Chaudhari et al proposed novel method of an intelligent ticketing system using NFC based android phone by the use of QR code technique. This system is faster compared to existing system using RFID. It works on the principal of electromagnetic induction. The machine learning algorithm used for making the system faster whereas the usage pattern of the user is recorded. The user pattern of booking is known by the mining process. The eTC application will be used by TC to check the validity of the Ticket. It is time saving as passengers do not need to wait in queue for booking ticket. It is easy to use and secured[6]. Sanam Kazi et al (2016) proposed novel technique the smart application that will automatically allocate the seat to passenger. It will also help to reserve the ticket digitally and booking can be done cashless therefore this proposed system also promotes digitalization and smart city development. In this proposed system, when user is connected to installed device source will added automatically. A novel algorithm is introduced by which the user can find the occupancy of the seat as well as user can book the expected location of bus. If the seat is not available, the ticket will be reserved automatically whenever it becomes available the automatically whenever the seat is available. Once the ticket is booked, it automatically generates the E-ticket for further help.[7]

Noorag Farooi (2017) proposed a novel technique of safety Management system for crowd using sensor to improve the safety level and to reduce the danger. This technique identifies hazards and avoids disaster in crowd by external environmental safety issue and internal environmental safety effect by implementing multiple sensors like movement sensor and heart sensor to detect any crush and stamped. The system also connected outside to find external environment and it consists of storage, control & presentation modes.[8] Wei-Teng Weng and DAW-Tung Lin (2018) proposed a novel technique to modify weight estimation method by a three tier multicolumn convolution Neural Network (MCNN) system, to estimate crowd density by differentiating three layers from near to far crowd density map. From this map, change in size of crowd according to distance and the crowd density is measured. By this technique (MCNN) error rate of MAE and MSE reduces to 26.6 & 41.3 to 20.6 & 33.6 respectively. This method also outperforms the other state-of-the-art methods.[9] Solahuddin Yusuf Fadhlullah & Widad Ismail (2017) proposed a novel technique, path loss method to find the crowd pattern parameter in addition to the crowd size in estimating the number of people within the crowd. To count a number of people by implementing Non-participatory method supported by design of experiment (DOE) statistical method. By this method it recognises inflicted major signal loss of crowd properties. This technique gives the number of people in monitor area accurately.[10]

Yuichi Kawamoto et al proposed a novel system to crowd dynamic management using IOT technologies to solve the problem of congestion. In this system considering three characteristics of user behavior, user sensitivity, the power of instruction and transmit time the effect of crowd dynamic management is controlled By utilizing feedback control theory for presenting proof of concept. This system also contributed to the development of future crowd dynamic management application as an evaluation tool.[11] Kevin Laubis (2016) et al proposed a novel technique for crowd sensing to perform a sensitivity analysis to investigate the monetary implication on vehicle owner by the use of crowd based data source and a vehicle cost mode3I. by this data the vehicle type and fuel cost is found this means the fuel cost is depend on the vehicle type so this system show the amount of road segment with high roughness index, the car were rerouting to the smooth road profile.[12] M. Hoffmann (2018) et al proposed a novel technique to detect the rear seat occupancy by using the four channel imaging radar system at 24 GHz SRD (ISM) with the bandwidth of 250 MHz. An antenna array with the detection radiation pattern is implemented to the radar system. The seat location is determined by the DBF approach which is applied to four receiver channel in order to detect angle of arrival. By the use of National instrument the data acquisition is done and the signal processing and the evaluation of the results are performed with MATLAB.[13]

Qianling Wang (2018) et al proposed a novel model to describe pedestrian crowd dynamics in a typical unidirectional environment such as corridors, pathways, Railway platform etc. This model is a two-time-scale hybrid system. In this model constrains can be found by increased complication in mathematical analysis of crowd management.[14] Osama Masutani (2015) proposed a novel technique to enhance sensing coverage of crowd sensing system for route control. This technique is composed of sensing demand aware cost assignment and a cooperative path reservation. Without much addition travel of sensing vehicle the crowd sensing can be significantly enhanced. By the help of traffic simulation route control is evaluate in this model. The total sensing ability can be increased with enhancing sensor ability or enhancing the number of sensing vehicle.[15] Hongming yang (2017) et all proposed a novel technique to an electric vehicle (EV) route selection and charging navigation optimization model based on crowd sensing. A road velocity matrix acquisition and restoration algorithm is

proposed along with the aid of crowd sensing. In this technique the vigorous mathematical model based queue theory for waiting time at charging station was found. By this model the effect of real time traffic information acquisition, travel route & effect of charging and discharging of EV on the load level are also analyzed.[16]

Peipei Zhou (2015) et al develop a novel algorithm to crowd counting by implementing information entropy (IE) by this number of person can be quickly obtained without extraction features or tracking object with more stable performance than other method. In this method firstly the moving object segmented by background subtraction and then interested target are normalized to avoid perspective effect. Finally IE is compute of the normalized image.[17]

Ganesh Venkat Sundar and Balaji Ganesh Rajagopal(2017) proposed a novel technique to a solution leveraging the internet of things. In this technique the electronic Ticketing Machine (EMTS) is used for simulation via android application. The EMTS connect with the server via Application program interface (API). In this technique the crowd estimation is done by list of live ticket of each bus at the server side and also GPS is implemented in the EMTS for the real time tracking of the buses. The crowd information and location of the buses display in the client side Android application.[18] Suresh Sankarananayanan and Paul Hmlton (2014) proposed a novel technique to bus tracking and ticketing system by using RFID and GPS technology in the public transportation system. In this model the RFID is used for the tracking of the passenger that when they board and exit buses and GPS is used for the live location of the buses. By the help of LCD screen at the bus stop the user and used this method.[19] Poovandizhi (2017)et al develop a novel technique to detection of seat occupation and water level monitoring in the train. The wireless sensor is implemented for the real time application. The wireless mesh network is used for seat occupancy checking and water level monitoring in train. The sensors are used to collect the data which is transmitted via ADC to microcontroller. The universal Asynchronous Receiver Transmitter is used for transfer data through the wireless mesh network. The method is very simple to implement and cost effective and reduces the problems faced by passengers in train.[20] Anilacryil (2017) et al proposed a novel technique for public bus transport planning. This technique investigates various aspects related to demand modeling and line planning for the bus transport system. From the ETM database the origin-destination (OD) matrix of the bus commuters can be determine so, it will help for the future preplanning of the transit system. By implementing the program the link volume in terms of passenger flow on the transmit network is also determine. This technique is useful for travel demand modeming, and strategic and operational planning in public transport.[21]

Arkadillaz Drabicki et al(2017) proposed a novel technique to monitor the real time crowd information in public transport. This technique is based on the simulation and extend macroscopic. The real time crowd information is detected using the route congestion level, passenger behavior, the RTI-CL penetration rate and information provision type. The result is illustrated by implementing the sample transit network algorithm in which the RTI-CL provision is investigate. This model is considered as a proof-of-concept for modeling transit systems real-time crowding information.[22] Karoly Farkasetal (2014) proposed a novel technique to monitor the real time public transport information for crowd control. In this technique , the participatory sensor is implemented for real time public transport information service and prototype based smart phone application called traffic info for live traffic information. The live traffic update on the Google map is display on the traffic info only and give support top source data collection and passenger feedback.[23] Lokingwei and Toni Anwal (2017) proposed a novel technique to identify the correct motivation and approach for public transportation . In this technique the mobile crowd sensing is implemented to identify to key component that needed motivation by designing the motivation model. The mobile application and evaluating the application with real life data this model help to provide a low budget to motivated user. This technique has successfully run for 1 week experiment can collect up to 36 installation and 44 questionnaire data for evaluation.[24]

Said Kerrache et al (2013) proposed a novel technique to crowd evacuation method for transport. in this technique the evacuation plan is implemented based on optimal mass transport . The safety and the feasibility of the compute data is to ensure by the safety model which consist in a set of soft and hard constraints on the evaluation plan is implemented as an additional factor in the optimization. The proposed technique allow avoiding dangerous place, spreading out of the crowd , limiting the crowd of the density and imposing one-way circulation. The numerical method is also introduced to solve the resulting optimization problem. The convergence and the quality of the evacuation plan produced by the proposed algorithm are demonstrated by simulation.[25]

VARIOUS TECHNIQUES TO FIND THE AVAILABILITY OF SEATS IN TRANSPORT

Y. Tsuchida et al (2015) have proposed a novel technique to prevent road accidents due to drivers dozing off. Car driver's dozing off at the wheel is prevented by using a magnetic sensor which is built in driver's seats of cars and trucks. Difference of magnetic properties of torsion bars because of the torsion stress is measured by a magnetic sensor to monitor car driver's condition. A DA converter is controlled by a PC to excite the excitation coil through a power amplifier and pickup signals are transferred into the PC from the pickup coils through an AD converter. The voltage varies when the load is controlled by a compression stress machine. The detail measurement data during driving condition is shown. [26] Hind Abdalsalam Abdallah Dafallah (2014) has proposed a technique to present an accurate and reliable real time tracking system using GPS and GSM services. The system permits localization of a portable tracked unit and transmitting the position to the tracking centre. The GPS tracking system uses portable tracked device attached to an object to monitor its location and display it in google maps. The location coordinates from the satellite received by the GPS is processed by the microcontroller. It instructs the GSM modem via serial communication to send SMS containing the longitude and latitude of the mobile tracking device. [27] Md. Faisal Mahedi Hasan (2010) has proposed a novel technique to prevent malicious argument among public, corruption and most of all traffic jams. It works as uniform access of passengers in daily rides through an automated server being updated every single time the passengers travel by carrying the RFID based tickets. It uses a RFID containing tags are embedded into the buses. It has a reader that is connected to the main server charging of ticket fare from the passengers through a keypad. The whole system can be used in vehicle on highways, their toll payment and in the railway ticketing system. [28]

Karthick. S I, Velmurugan (2012) has proposed a technique to avoid queuing and waiting for getting tickets for public transport. "GPS" facility through smartphones to validate and delete ticket automatically after a specific interval of time once the user reaches the destination is used. Ticket information is stored in a CLOUD database to search for the user's ticket with the ticket number. In this project a mobile ticket application has been developed for Android 1.5 using Java, SQLite, MySQL and PHP on the server. Dynamic display of Train locations by fitting GPS devices is done in trains to show its location in the Google map. Hardware devices to validate the QR codes before the user enters or leaves the station, where the user can have access towards platform after being validated by the hardware device. [29] H. A. Rahim and all (2010) have proposed a novel technique to monitor and increase the vehicle security in urban area. Integration of GPS and GSM to permit users to communicate with their vehicles via a Short Message Service (SMS) has been done. The real-time moving car location by using cellular phone is tracked. This device is able to locate the vehicle using GPS receiver by using specific processor, that is Digital Signal Processor. The DSP processor retrieves the SMS number from this ACK message and sends commands to read the SMS. The CCS C code has been written to implement the integration of GSM/GPRS module with GPS module receiver. It has been concluded that DSP processor is capable of handling the control task besides signal and image processing tasks. [30]

Seokju Lee et al (2014) has proposed a novel technique for tracking the movement of any equipped vehicle from any location at any time. It combines a Smartphone application with a microcontroller. The designed in-vehicle device works using GPS and Global system for mobile communication / General Packet Radio Service technology. A microcontroller is used to control the GPS and GSM/GPRS modules to get geographic coordinates at regular time interval. A vehicle's geographic coordinates and a vehicle's unique ID obtained from an in-vehicle device are recorded in a database table. A web interface written in PHP is implemented to directly connect to a database. A vehicle tracking system to track the exact location of a moving or stationary vehicle in real-time is developed and tested. [31] Ashish Kulkarni, Narendra Kumar and Ramachandra Rao Kalaga (2015) have proposed a novel technique for online ticket booking through internet and android based smart phone applications. A bus fleet is has been fitted with GPS based AVL system for effective tracking and monitoring of the intercity and interstate bus movement and predict its arrival time at scheduled stoppages. In this project Intelligent Transport Systems is used for location, information and communication to make travel safe, energy-efficient, seamless and comfortable by triggering the change. [32]

Girish L. Deshmukh and Dr. S.P. Metkar (2015) have proposed a novel technique to improve the level of supervision and management for cargo transport vehicles, school buses, etc. In this project a vehicle's GPS coordinate is obtained and transmitted using the GSM modem to the server using GPRS connectivity. An RTOS is also used for time deterministic behavior and multi-tasking so different sensors are introduced to send its data to server. The proposed work has been successfully implemented as a tracking application working in tandem with a Google Map Engine web server. [33] Mitsunori Miki (2013) et al have proposed a novel technique with an

Intelligent Lighting System to provide desired luminance to a desired place. In this project Lighting System judge that luminance is unnecessary in the place, when the worker has left their seat. A seating sensor is placed that can judge to automatically detect worker's seating statuses of a person by sensing the pressure. The Intelligent Lighting System is composed of lights equipped with microprocessors, portable luminance sensors, and electrical power meters, with each element connected via a network. By this technique electricity consumption on the whole shifts to a lower level after seating sensors were implemented.[34] Di Zhang et al (2016) has proposed a novel technique to enhance individually each vehicle's local performance, and coordinate globally to limit grid peak current, reduce current fluctuations, and improve efficiency. In this paper a novel methodology has been introduced that employs load prediction, optimal control, and distributed predictive control for current management in such networked systems without vehicle-to-vehicle communications. Trolleybus System is used for simulation case studies on the new management strategies. Estimation accuracy, prediction reliability, and performance improvement from the integrated predictive control strategies are demonstrated. Successful implementation of this methodology can potentially attenuate feeder current fluctuations, reduce feeder peak loads, and alleviate disturbances to main grids.[35]

TABLE 1: SUMMARY OF VARIOUS TECHNIQUES

Title	Author	Methodology	Advantage
A feedback control based crowd dynamics management in IOT System	Yuichi Kawamoto, Naoto Yamada, Hiroki Nishiyama, Nei Kato, Yoshitaka Shimizu, Yao Zheng	Crowd dynamics management applications that are expected to resolve crowd congestion has been used in this project	. This system also contributed to the development of future crowd dynamic management application as an evaluation tool.
Crowd sensing of road conditions and its monetary implications on vehicle navigation	Kevin Laubis, Viliamsimko, Alexander Schuller,	This system uses crowd sensing to perform a sensitivity analysis to investigate the monetary implication on vehicle owner by the use of crowd based data source and a vehicle cost mode3I	This system help in crowd management and also low fuel consumption
A four channel radar system for rear seat occupancy detection in 24 GHz ISM band	M.Hoffman, D. Tatarinov, J. Landwehr, A R Diewald	A four channel radar system of 24 GHz ism band has been used	This system is used to find the occupancy of rear seat.
Two-time-scale hybrid traffic models for pedestrian crowds	Qianling Wang , Hairong Dong, Bin Ning, Le Yi Wang and George Yin	This system is a two-time-scale hybrid system. Constrains can be found by increased complication in mathematical analysis of crowd management	By this system the pedestrian crowd can be easily managed
A sensing coverage analysis of a route control method for vehicular crowd sensing	Osama Masutani	Route control method is used in this system	By this system we can easily find the crowd in route of vehicle
Electric vehicle route selection and charging navigation strategy based on crowd sensing	Hongming Yang, Youjun Deng, Jing Qiu, Ming Li, Mingyong Lai and Zhao Yang Dong	Electric vehicle (EV) route selection and charging navigation optimization is used in this system	it reduce users' travel costs and improve the load level of the distribution system

IoT based passenger information system optimized for indian metros	Ganesh Venkatsundar, Balaji Ganesh Rajagopal	In this technique the electronic ticketing machine (EMTS) is used for simulation via android application	The crowd information and location of the buses display in the client side android application.
Video-based crowd counting within formation entropy	PeipeiZ, Qinghai Ding, Haiboluo and Xinglinhou	Information entropy is used in this system for crowd management	By this number of person can be quickly obtained without extraction features CR tracking object with more stable performance than other method
Title	Author	Methodology	Advantage
Mobile enabled bus tracking and ticketing system	Suresh Sankarananayanan, Paul Hamilton	RFID and GPS technology is used in this system	By this system crowd and live buses can easily find
Automatic water level monitoring and seat availability details in train using wireless sensor network	Poovizhi S, Premalatha M, Nivetha C	The wireless mesh network is used for seat occupancy checking and water level monitoring in train	By this system seat occupancy and water level monitoring can be easily done
Electronic ticket machine data analytics for public bus transport planning	Anila Cyril, Dr. Varghese George, Dr. Raviraj H. Mulangi	EMT database is used in this system to collect the data of the origin-destination (OD) matrix of the bus commuters	This system help for the future preplanning of the transit system
Simulating the effects of real-time crowding information in public transport networks	Arkadius Zdrabicki, Oded Cats, Archillefonzone, Rafalkucharski	This technique is based on the simulation and extended mesoscopic	Real time crowd management is done in this system
Participatory sensing based real-time public transport information service	Karolyfarkas, Adam Z soltnagy, Timon Tomas and Robert Szabo	In this technique the participatory sensor is used and prototype based smart phone application called traffic info for live traffic information	The live data is found on the google map
Analysis of motivation approach in mobile crowd sensing application	Lokingwei and Toni Anwal	. In this technique the mobile crowd sensing is implemented	This system helps to provide a low budget to motivated user
RFID-based ticketing for public transport system: perspective megacity	Md. Foisalmahedihasan, Golamtangim, Md. Kafiul Islam, Md. Rezwanulhaque Khandokar, Arifulalam	RFID containing tags s used in this system	By this system crowd management is done and ticketing is easily in the transport system
Android suburban railway ticketing with GPS as ticket checker	Karthick. S, velmurugan. A	Mobile ticket application is develop for ticket generation and gps is used for location detection	Avoid queuing and waiting for getting tickets for public transport.
Implementation and analysis of integration GSM/GPRS modem in a tms320vc6713 digital signal processor for vehicle location	H. A. Rahim, R. B. Ahmad, a. S. M. Zain, U. U. Sheikh	GSM GPRS is used in this system for short message of location of vehicle	Vehicle location is easily found by the short message on the phone
Its implementation in bus rapid transit systems in India	Ashish Kulkarni, Narendra Kumar and Ramachandra Rao Kalaga	AVI system is used in this project to track the bus and	It is easy to use and helpful for crowd management

		ticketing	
Design and implementation of vehicle tracking system using GSM/GPRS/GPS technology and smartphone application	Seokju Lee, Girmatewolde, Jaerock Kwon	GSM, GPRS & GPS is used in this system for detect location of vehicle	Vehicle location is easy found on the mobile location
RTOS based vehicle tracking system	Girish I. Deshmukh, Dr. S.P. Metkar	Arm 7, GSM, GPS is used in this system	Vehicle location is easily found on the google map
An intelligent lighting system with a seat management mechanism	Mitsunori Miki, Kazukimatsutani, Hisanori Ikegami, Shohei Fujimoto	Seating sensor is used for seat management	Crowd is easily control by seat management
Title	Author	Methodology	Advantage
Detection of seat occupancy using a wireless inductive sensor	Milica G. Kistic, Nelu V. Blaz, Kalman B. Babkovic, Ljiljana D. Zivanov and Mirjana S. Damjanovic	Sensor (inductor, steel springs and ferrite plate), an antenna, and a mechanical device are used for transferring the scaled weight to the sensor.	This system easily used for detect the occupancy of seat
Crowd tracker: optimized urban moving object tracking using mobile crowd sensing	Yao Jing, Bin Guo, Zhu Wang, Victor O.K. Li, Jacqueline C.K. Lam, Zhiwen Yu	VCS-based system that recruits an optimal set of workers to collaboratively take photos to track important moving objects in the city	Object tracking system based on mobile crowd sensing (mcs) is used for sensing the crowd
A low cost IoT based crowd management system for public transport	Sachin Vidyasagaran, Adityavarma, Haricharan S. Renuga, Rajesh A.	IoT based smart seats that can detect and display the seat occupancy status in real time over an internet or mobile application.	This system is easily tracked by mobile application
Prototype for intelligent ticketing system using NFC	Anita C., Brinzel Rodrigues, Pratapsakhare, Caston Fernandes	An intelligent ticketing system using NFC based android phone by the use of QR code technique	This system is time saving as passengers do not need to wait in queue for booking ticket
Smart e-ticketing system for public transport bus	Sanam Murtuza , Farheen Sheikh Anamta Sayyed	The smart application is used that will automatically allocate the seat to passenger	Supporting the cashless economy. Amount is debited directly from the user's bank account
Intelligent safety management system for crowds using sensors	Norah Farooqi	The system is developed to detect both internal and external threats of safety using multiple sensors	This system aims to provide safe, secure, and healthy environments for crowds
Crowd density estimation based on a modified multicolumn convolutional neural network	Wei-Tengweng, Daw-Tunglin	Develop weight estimation method by a three tier multicolumn convolution neural network (MCNN) system, to estimate crowd density	This system improve crowd estimate density map results

CONCLUSION

Various techniques for crowd management have been discussed in this paper. Techniques like RFID, sensor, capacitors etc. are implemented to detect the availability of the seats. Technical efficiency of the techniques were less than 80%, the delay was high and the cost of implementing the hardware was also high. Thus a novel technique has been proposed using IR sensors. Extracting various drawbacks from the existing papers this technique would reduce the complexity of the hardware and the access to the data will be much easier. The proposed technique focuses on the cost effective implantation of the device in the college buses.

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