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# Theft Identification and Automated Passenger Count Management System Using Internet of Things

K. Chandrakumar[1], C. Kowsalya[2]

UG Student, Dept. of ECE, Bannari Amman Institute of Technology, Sathyamangalam, Tamilnadu, India[1]

UG Student, Dept. of EEE, Bannari Amman Institute of Technology, Sathyamangalam, Tamilnadu, India[2]

**ABSTRACT**: This paper presents an idea that addresses a very common issue or constraint in the travel buses across the world. That is the malpractice regularly taking place in the travel buses is, apart from booked tickets and allowed luggage few other passengers and luggage are boarded by the drivers and conductors and make money without the knowledge of the travels control room. Here we conceptualized a solution with combination of motion and thermal sensors which is interfaced dynamically to overcome every disadvantage in the previously available technologies.

**KEYWORDS:** Thermal Sensing, Count Management, GPS Tracking, Statistical Report.

## I.INTRODUCTION

This major problem is common in most of the long travel luxury seater and sleeper buses. Due to this betrayal activity many owners lost trust on every third party members involved in the scene. So here we suggested a solution which has no third party access. Only the owner or the control room can monitor what really happens in the bus throughout the journey. Count of the passengers booked already and spot booking are updated periodically whenever the bus starts motion. The authority can view the status in the mobile application or in the screen remotely. Here we used a combination of sensors which is interfaced dynamically to overcome every disadvantage in the previously available technologies. We interfaced a Motion sensor with a Thermal sensor and we make them GPS enabled. The major advantage of our system is all the sensors and system is hidden and not accessible to any third party members. Hence passengers and workers will feel their regular journey without any inconvenience.

## II.LITERATURE SURVEY

An eminent amount of research is carried out on Real-time public transport tracking and passenger flow detection which benefits the passengers in huge amount, but the researches and solutions for the benefit of owners in real life is quite sparse. This paper presents an assessment of pertinent literature, focusing specially on bus owner's problems at larger scale. A number of studies have been initiated in the past to address the bus arrival time prediction problem.

[1] Lin and Zeng proposed a set of bus arrival time prediction algorithms for a transit traveller information system implemented in Blacksburg, Virginia. Four algorithms were introduced with different assumptions on input data and were shown to outperform several algorithms from the literature. Their algorithms, however, did not consider the theft occurring at the buses routinely. [2] An attempt is made by Dipti R. Kulkarni, Sneha H. Kulkarni, Pooja B. Nalawade, Swati P. Jagtap, to review a wide range of methods used for face recognition and detection for passenger counting and to find best suitable method. Their algorithms can hopefully find number of passengers inside the public transit, but their work doesn't distinguish each individuals.

However, this algorithm was not suitable for large cities where both travel time and dwell time could be subject to large variations. Hence the live data with greater accuracy of distinguishing individuals is proposed in our model.

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## III.CURRENT ISSUES OR CONSTRAINTS

There are numerous solutions provided for this issue across the world but all in vein because every solution finds a disadvantage which is not acceptable to the owners. The client must not feel discomfort due to the automation and in the meantime malpractice must not take place. Here are the major disadvantages, [1] The Surveillance cameras installed inside the buses cause's security issues to the women and also passengers feel annoying. [2] The Load cell placed at suitable place in the seats and in luggage racks to monitor whether additional persons other than booked are boarded becomes failed, because when a person keeps his luggage in the next seat the load cell will send the data that a person is occupying. It is a flaw. [3] The Level sensors placed in back of every seat to monitor whether person is occupying the particular seat failed, because the children sitting in the seats may not be recognized by the sensor. It is also a flaw. [4] The Motion sensor placed above the seats to find whether the person is occupying or a luggage also failed, because due to the motion of the bus even the luggage placed in the seat may move and the sensor reads a false value. It is also a flaw. [5] The IR cameras placed at the entrance to count the persons entering and monitoring the persons if added extra also failed, because the conductor or driver who involves in such activities misplace it purposefully or may break it. Thus until the replacement of the cameras the data will be lost. It is also a big issue. [6] The temperature sensors can be placed at the right position to read the human body temperature and find whether it is a person or luggage also failed because the sensor precision and placement is a big problem.

## IV.FUTURE PROCESS FLOW

If our solution is used it overcomes the existing disadvantages in the system. In detail, [1] If the motion sensor is interfaced with thermal sensor the detection of only humans is 100% accurate. [2] Due to certain reasons along with passengers some other relatives/friends may accompany them till the bus sets off the journey, which makes a falls count. To overcome this problem GPS is enabled in the sensors which makes the sensors, detect and sends data only when the bus starts moving. [3] Also during journey bus may break down or may stop for various reasons, in that time some passengers may get down and get in and some may go by other means of transportation. Hence the count may be missed. This is overcame by this GPS enabled technology, whenever the bus stops again the sensors also stops monitoring and when the bus starts moving it again starts sending the data.

### IV.A.ADDITIONAL FEATURES

[1] The mobile application has a 3D virtual view of seats available in the buses and the occupied seats shows green and unoccupied shows red.
[2] At the end of the journey a statistical report/an excel report is generated which in detail conveys the number of passengers travelled in the bus crossing every major cities where the bus halts.
[3] Also during the journey if any additional persons boarded by the conductors automatically alert will be sent and data is generated as an extra person. So that he/she can question the concerned person for the constraint happen.

## V. SOLUTION OVERVIEW AND PROCEDURE

We used Passive Infrared- PIR (Figure - 3) as the motion sensor and OMRON D6T (Figure - 2) as the thermal sensor. All the sensors and GPS are interfaced externally with a gateway. Here we used Raspberry Pi 2 as the gateway. PIR is placed in suitable place inside the bus without its presence looking peculiar. The OMRON D6T is also placed as like the PIR such that it reads the value precisely. Both these sensors are wired and interfaced with Global Positioning System which makes it read or sends the data only when the bus starts motion. All these three major nodes are connected to the Gateway which is Internet enabled for lively transmission of data. Gateway is programmed in such a way that it sends the sensor reading to the prefixed cloud server from where it is transmitted to the particular mobile application node or software. The Gateway programming is made on Python and the interfacing of Cloud Vendor and its GPIO (General Purpose Input and Output) access is made on NODERED flow programming. Once the bus starts moving the GPS is enabled which makes the sensor circuits close and it starts detecting the human presence. If motion is detected by PIR and also the thermal sensor detects thermal radiation variation then the value is set to 1 and the HIGH signal is sent to the Raspberry Pi, else the value is set to 0 and the process is repeated until the recognition of all

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the passengers inside the bus. Once the bus halts somewhere, the sensor stops reading and the previously generated data and count is retained, when the bus again sets on motion it continues to read and sends the data to the gateway. The Gateway whenever receives a HIGH signal declares it as a count and sends the information 'one person occupying a particular seat' to the cloud vendor interfaced through internet. The cloud vendor sends the information to the travels control room in no time. Thus it gives an optimum result every time.

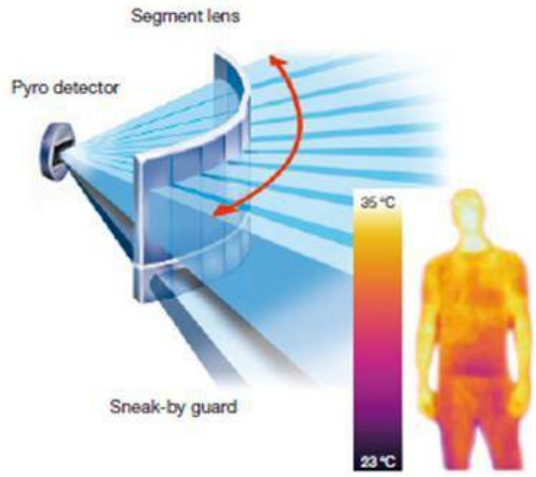


Fig. 1 Thermal Sensing of PIR Sensor of humans

**Fig.1 – Description:** Thermal image scanned by OMRON D6T and the motion detection by PIR makes use of pyroelectric principle which distinguishes humans from other organisms. Hence it is precise to categorise the individuals with their unique body heat temperature.


Fig. 2 OMRON D6T Sensor

**Fig. 2 – Description:** Omron's D6T Series MEMS Thermal Sensors are a super-sensitive infrared temperature sensor that makes full use of Omron's proprietary MEMS sensing technology. Unlike typical pyroelectric human presence sensors that rely on motion detection, the D6T thermal sensor is able to detect the presence of stationary humans by detecting body heat.

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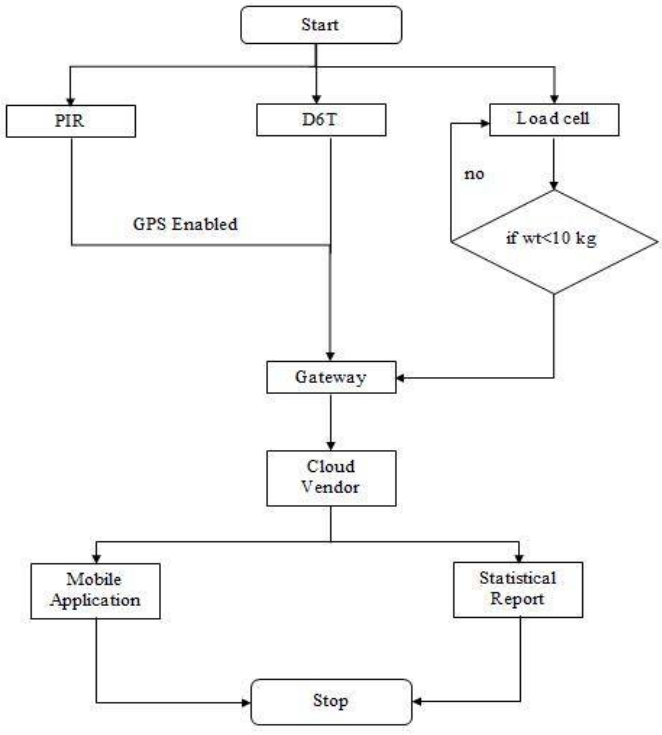
Fig .3 Passive Infrared sensors

**Fig.3 – Description:** An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.

## VI.A.FLOW DIAGRAM



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### VI.B.HIGH LEVEL ARCHITECTURE DIAGRAM

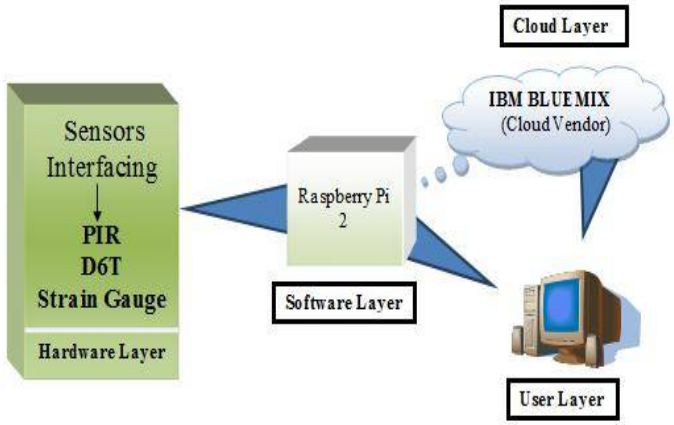


**Fig. 4 – Description:** High-level design (HLD) explains the architecture that would be used for developing a software product. Here the entire blocks are connected to a soul gateway which manages the other hardware and software blocks. The various sensors involved are interfaced to Raspberry Pi 2 with live wire connection. The pre-programmed gateway sends the acquired information to the Cloud Server IBM Bluemix specially designed for IOT Cloud applications. From the cloud server, the generated report from the data obtained is sent to the user application periodically. In the meantime, Raspberry Pi 2 also sends the sensor information and status to the user application

### VI.C. TECHNICAL STACK

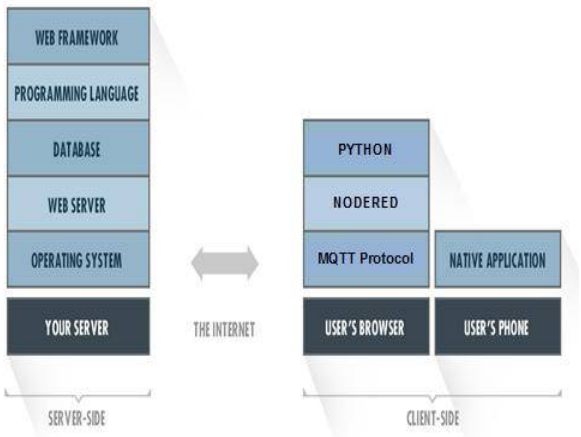


**Fig.5 – Description:** A tech stack is a combination of software products and programming languages used to create a web or mobile application. Applications have two software components: client-side and server-side. In server-side, web framework, programming language, database, web server and operating system is present. In client-side, python runtime environment, NODERED flow programming for gateway-cloud interfacing, Message Queuing Telemetry Transport Protocol (MQTT) which is a light weight protocol optimum for IOT applications and a user Browser is present. In other hand, an application is build and deployed using Adobe PhoneGap (cordova/ionic) with suitable features and requirements in User's mobile phone. Adobe PhoneGap allows easy creation of mobile applications in cross platforms such as IOS, Android, Windows OS, and Blackberry OS. The PhoneGap will create a layer of application which works on all platforms irrespective of its programming structures. Hence it is easy to create native application with basic knowledge of Hyper Text Mark-up Language (HTML), Cascading Style Sheet (CSS), and JavaScript(JS) and JQuery.

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## VII.CONCLUSION

This paper proposes a cost-effective real time passenger counting management system for the malpractice taking place in travel buses. By placing PIR and OMRON D6T we can overcome the malpractice and the owner is free from such betrayal and he/she is not necessary to depend on any third party members. Experimental results manifests that the proposed Real time passenger count managing system with 90% accuracy will be fascinating and attractive to travel bus owners.

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## BIOGRAPHY

**Mr. K. Chandrakumar** was born in Erode, India on August 31, 1997. He is pursuing BE IIIrd year in Bannari Amman Institute of Technology (Autonomous) in the domain of Electronics and Communication Engineering. His areas of interest include embedded system designing, Internet of Things (IOT), Cloud Computing and Augmented reality in Real time applications.

**Ms. C. Kowsalya** was born in Dharmapuri, India on September 22, 1998. She is pursuing BE IIIrd year in Bannari Amman Institute of Technology (Autonomous) in the domain of Electrical and Electronics Engineering. Her areas of interest include AC and DC Machines, Internet of Things (IOT), Cloud Computing and Augmented reality in Real time applications.