ABSTRACT
Internet of Things (IoT) is a rapidly expanding technology area that is shaping up to bring the next revolution in information systems and computing technologies with intelligence to communicate between devices without the human intervention. Implement IoT to count the people in the buildings using PIR sensors with Raspberry pi. With the proliferation of IoT Devices such as smart phones, sensors, actuators, cameras, and RFID etc. It is possible to collect massive amount of data for localization and counting of people within commercial buildings. PIR (passive infrared radiation) sensors are used for the detection of existence of the persons and it will count the people in the buildings entering. When PIR sensors detects an object, it actuates the webcam and lighting system connected with PIR. The Webcam will start to record and store the video in secure server for effective analysis.

1. INTRODUCTION
Recent advances in data gathering and analysis are opening up new possibilities for smart building technology. Smart building development focuses on defining and incorporating intelligent information infrastructure into the building architecture and power management for network systems. Also developing simple, flexible, and scalable network systems for buildings. The rate of increase in resource consumption needs to improving and rolling out digital infrastructure and digital services, smart buildings will be crucial to maintaining quality of life as urban populations rise and natural resources scarcity. People counting is one of the key components in smart building applications for accurately counting traffic that enters to the building or facility empowers organizations to make smarter business decisions. People counting system creates the basis for a range of high-tech solutions, including retail analytics, queue management and security applications. The systems provide actionable information that help organizations to increase profitability and improve operational efficiency. Managers have been looking more data to draw conclusions about their customers. There are a lot of factors that have to come together for a visitor to become a customer. In addition to this even more has to be known to maintain customers loyal. One of the most important data a store manager can look at is the traffic rate. Because traffic is the real potential of a store. People who come into your shops are close to buying something as they ever can. In order to understand and analyze their potential, retailers and shopping malls started with manual counters and tried different technologies like beam sensors, thermal cameras and many more that came afterwards. The reasons to implement people counters in smart buildings are measuring traffic trends, determine conversion ratio, evaluate effectiveness, optimize staff labor, and people counting leasing. It is possible to collect massive amount of data for localization and tracking of people within commercial buildings. PIR sensors are used for the detection of existence of the persons and it will count the people in the buildings entering.

2. INTERNET OF THINGS FOR PEOPLE COUNTING
The Internet of Things is a paradigm where everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate between devices and services over the Internet to achieve some objective.
3. TECHNOLOGIES

A vast global network of data-generating devices such as actuators, sensors, and their URLs, known collectively as the ‘Internet of Things’. Underlying monitoring and communication infrastructure that consists of integration of smart devices such as sensors, cameras, RFID, meters, and actuators. These smart devices, with the communication infrastructure, are referred to as Internet of Things (IoT). Sensors are increasingly being installed in buildings to gather data about movement, heat, light and space usage. In this people counting system can use PIR sensors to detecting the existence of the persons and it will count the people in the buildings entering. PIR sensor motion detector is very easy interfered by the varies of heat sources, and sunlight so PIR is more suitable for the movement detection of objects. It does not emit the infrared rays, it receives the emitted infrared ray by objects.

Many different technologies are used in people counting devices, such as infrared beams, thermal imaging, computer vision, and wifi counting and many other motion detection methods. The state-of-the-art technology for people counting is based on video-based counting. This technology allows to reach the highest accuracy and other advanced metrics that its predecessors could not.

4. IMPLEMENTATION OF IOT BASED REAL-TIME PEOPLE COUNTING SYSTEM FOR SMART BUILDINGS

4.1 Architecture

An architecture of iot based real-time people counting System for smart buildings is shown in fig 4.1. in this system consists a PIR sensor along with webcam and a lighting system. PIR sensor detects the change in infrared radiation of moving object. The lens on the sensor focuses any infrared Radiation present around it towards the infrared sensor. Our bodies Generate infrared heat and as a result this gets picked up by the PIR Sensor. The sensor outputs a 5v signal for a period when it detects the presence of a person.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Properties</th>
<th>First generation</th>
<th>Second generation</th>
<th>Third generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology</td>
<td>Infrared beam counters</td>
<td>Thermal counters</td>
<td>Video &amp; WiFi counters</td>
</tr>
<tr>
<td>2</td>
<td>Working principle</td>
<td>horizontal infrared beam across an entrance which is linked to a small LCD display unit at the side of the doorway</td>
<td>Array sensors detect heat sources. Typically implemented using embedded technology</td>
<td>use complex algorithms perform counting using camera imaging WiFi Counting functionality collects WiFi probe request signals</td>
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<tr>
<td>3</td>
<td>Advantage</td>
<td>low cost and simplicity of installation</td>
<td>‘Master and node’ configuration provides more accurate counting on wide entrances</td>
<td>Achieve 98% Accuracy. Potential privacy and security issues with the taking of video images</td>
</tr>
<tr>
<td>4</td>
<td>Limitations</td>
<td>Used only for outdoor installation, due to it adopts transmitter and receiver theory for detection.</td>
<td>It cannot be mounted on a high ceiling. Thermal counters can only cover a narrow door entrance, Difficult to verify the accuracy.</td>
<td>Sensitive to changes in image background, such as floor colour and other background features, which can cause miscounts</td>
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Table 3.1 Comparison between different technologies
Fig 4.1 An architecture of iot based real-time people counting System for smart buildings

When the PIR Sensor detects a person, the generated voltage amplified and used to turn on the webcam and lighting system connect along with PIR. When the webcam gets turned on, start to capture and record video and the video passed to raspberry pi. The Raspberry pi is well programmed using python in order to send the information to a secure server with connection protocol IPV6. The remote server collects all the informations and stores to the corresponding tables in the predefined database for analysis. And we define what the raspberry pi should do as it detects an Intruder through python coding. Here we are just printing: “intruder Detected”. Once the intruder moves out of the detection range of the PIR sensor, the webcam and the light gets turn off.

5. CHALLENGES IN PEOPLE COUNTING SYSTEM

- People must be detected in highly dynamic scenes, since motion is generally very high shortly before approaching and during stops.
- People must be identified in public transportation scenarios, which includes a wide range of illumination, fast changing lighting conditions that decrease the quality of sensed information.
- people standing close to each other or partially occluding each other and appearance in the context of clustered background.
- The appearance of people yields high variability in pose, texture, and size range. In addition, people can carry different objects and wear different clothes.

6. APPLICATIONS

- It is mainly used in shopping malls and supermarkets, helping stores to identify customer trends, staffing requirements, conversion rate and more.
- In Industry, to deliver significant savings for our end users.
- Helps in occupancy monitoring of smart building.
- It is beneficial for hospitals and museums.
- Counting people at airports and railway stations delivers valuable data about footfall, retail opportunities and more.
- In hotels, to improve customer service.

7. CONCLUSION

A novel people counting system with IoT via infrared sensor which detects the change in infrared radiation of warm blooded moving objects. According to the change in the infrared radiation, the sensor outputs a 5V signal for a certain period when sensor detects the presence of person. The generated voltage is amplified and turn ON the webcam and lighting system. When the webcam gets turned on, start to capture and record video and the video passed to raspberry pi connect along with sensor and webcam. The Raspberry pi is well programmed using python in order to send the information to a secure server with connection protocol IPV6. The remote server collects all the informations and stores to the corresponding tables in the predefined database for analysis. Once the intruder moves out of the detection range of the PIR sensor, the webcam and the light gets turn off.

This system provides actionable information that help organizations increase profitability and enhance operational efficiency. It helps to determine how much sales revenue is being generated, how much staff is needed and analyze effectiveness to make proper business decisions.

REFERENCES

[3]. Xucong Zhang1 Junjie Yan1 Shikun Feng1 Zhen Lei1,2 Dong Yi1,2 Stan Z. Li1,2, “Water Filling: Unsupervised People Counting via Vertical Kinect Sensor” 2012 IEEE, DOI 10.1109/AVSS.2012.82.


