



Real Time Occupancy Monitoring System

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Abstract:

People observation and counting is of interest in many commercial and non-commercial scenarios. The number of people entering and leaving the compartments, the occupancy of train compartments or the passenger count of commuter provide useful information to the metro authorities and the commuters. To this end, this thesis develops a distributed people counting system using raspberry pi with OpenCV. A Real Time Occupancy Monitoring System is a system used to count the number of commuters walking through a door or corridor of the metro trains.

The availability of free space in public transport is an important factor for a traveller to decide for using public transport for him/her to travel or not. Addressing the regional train network as well as the metro train operators by developing a system for detecting free space just in time and present this information at the smartphone or website to the commuters while a train is approaching the station. This provides information about the number of a person in different coaches of the Metro train. This application offers information services based on how much of the space is available.

Keywords – Raspberry Pi, OpenCV, Camera Module.

I. INTRODUCTION

Public transportation ridership has grown significantly over the past decades and this growth is expected to continue into the future. Crowding in train and metro stations is therefore experienced more frequently, resulting in safety issues, decreased comfort levels, increased total travel times and modality shifts. On the long term large infrastructural changes can be considered to increase the capacity but for the short term more flexible and cheaper crowd management measures can be applied. Little scientific research has been dedicated to study the effects of crowd management measures or when to apply them.

People counting system can be implemented in various domains such as libraries, schools, airports, malls, etc. In public transportation, people counting system can streamline the following functions:

- Metro authorities can develop yearly statistics so as to allocate necessary amount of budget for taking specific measures to manage crowd.
- With people counting system, the data can help in managing the service of operation of metro train depending on the increase or decrease of crowd.
- Data from people counting system can also help metro authorities in analysing which compartment is crowded, mostly used.
- Accurate counting system can make people aware of number of passengers in the compartments of metro train.

The aim of this thesis is to design a method to systematically select and assess effective crowd management measures to increase the safety and throughput in train and metro stations.

About Image Processing:

Digital Image Processing is the use of a digital computer to process digital images through an algorithm. In order to get enhanced image or some useful information.

Steps in Image processing

- 1.Importing the image.
- 2.Analyzing and manipulating the Image.
- 3.Output Data.

About Raspberry Pi

Raspberry Pi is the name of a series of single-board computers made by the Raspberry Pi Foundation. The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT) (fig.1)

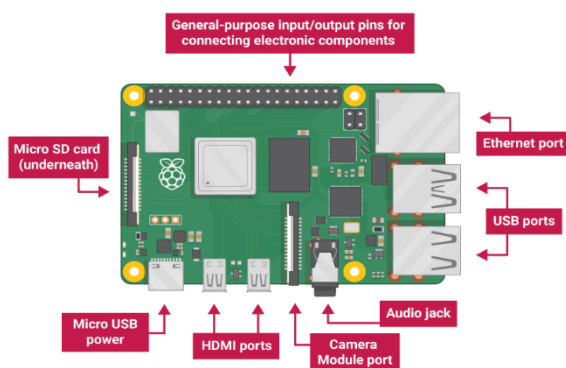


Fig: 1 RaspberryPi Board

II. LITERATURE SURVEY / PREVIOUSLY USED TECHNOLOGY

People counting is a widely studied and commercially exploited subject. This section briefly reviews the typical technologies used for people counting.

A. Ultrasonic Sensors:

The authors of introduce a system employing ultrasonic sensors. Per each

observed area a three-node sensor cluster is established, whereby each sensor node mounts an ultrasonic sensor. Multiple clusters are joined to cover a wider area. Nodes in each cluster communicate sensor readings by an RF link to the cluster's coordinator node. The latter contributes its own sensor measurements. By means of a distributed algorithm, nodes decide on whether to count a detected person. The sensor nodes require clock synchronization at the millisecond level in order to correlate the data exchanged. Despite the availability of clock synchronization protocols this imposes a disadvantage to this approach. The system achieves an overall counting accuracy of 90% using a probabilistic estimate of the total count, despite individual clusters achieving only around 50-70% accuracy.

B. Infrared Sensor:

IR arrays combine a matrix of IR sensors to form array detectors. As the name suggests the sensor signals are provided as a matrix, where each element of the matrix corresponds to one IR sensor. Pattern recognition algorithms are able to detect people moving across the sensor's view at a claimed accuracy of 95%. This holds true even if two pedestrian's paths cross, or people walk in parallel. IR arrays provide a cost-effective solution and also operate without any ambient light source. IR arrays are widely used in commercial systems.

C. Infrared Motion Sensors:

In people counting system based on PIR motion detectors for each passage monitored, three PIR sensors are installed at a distance of 0.8m. The sensors are connected to a coordinator by a wireless RF link. Sensors detect motion events and send these data to the coordinator. The coordinator infers a people count from correlating the number, phase and time difference of peaks found in the signal. The system achieves a rate of 100% to detect

the direction of movement, and accurately detects 89% of the number of people passing. PIR sensors provide an alternative to IR sensor arrays, however the cost and effort of employing multiple sensor nodes for each entry/exit point is a cost-side disadvantage. The goal of this thesis is to develop a system based on just one PIR sensor and one sensor node per each observed entry/exit point. Sensor Fusion Results of a building occupancy estimation system applying different types of sensors is found in . The system consists of camera, CO2 and PIR sensors. It uses a Hidden Markovian Model (HMM) based on an Extended Kalman Filter (EKF) in order to derive building occupancy. The approach integrates historical data and current sensor readings to estimate the true state of the system, adjusting for sensor noise (false observations) and stochastic processes, e.g. uncertain people movement patterns.

III. REQUIRED PYTHON LIBRARIES FOR PEOPLE COUNTING

Opencv: OpenCV is a library of programming functions mainly aimed at real-time computer vision.

NumPy: NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Dlib: Dlib is a general purpose cross-platform software library written in the programming language C++. Its design is heavily influenced by ideas from design by contract and component-based software engineering. Contains various machine learning algorithm.

Imutils: Imutils are a series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images

easier with OpenCV and both **Python 2.7** and **Python 3**.

urllib: urllib is a Python module that can be used for opening URLs. It defines functions and classes to help in URL actions.

IV. SYSTEM ARCHITECTURE

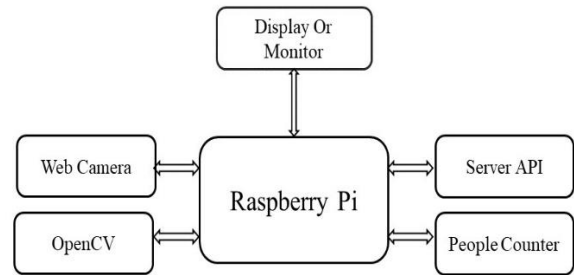


Fig: 2 System Architecture

In this project, to count the number of people entering from the door, Raspberry Pi board has been used Which is a SBC, on which we interfaced a PiCamera. PiCamera is used for capturing the images of the people. The Raspberry Pi board is connected to the monitor (Display) through HDMI port, for getting the results. The monitor shows the number of people captured by PiCamera. The number of face detected is displayed on the counter. OpenCV is a library which is used for interfacing the camera to the board or on the application/website through server.(fig. 2)

V.CONCLUSION

Our project design will help the user to get real time update about status of congestions in metro. So the user will be able to decide whether to board the metro or not.

VI. REFERENCES

1. People counting system using raspberry pi with OpenCV

Badhan Hemangi, K. Nikhita

International Journal for Research in Engineering Application & Management (IJREAM)

ISSN : 2494-9150 Vol-02, Issue 01, APR 2016.

[URL:https://www.ijream.org/papers/IJREAMV02I01894.pdf](https://www.ijream.org/papers/IJREAMV02I01894.pdf)

2. Bidirectional Vehicle Counting system

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[URL:https://www.semanticscholar.org/paper/Crowd-management-in-train-and-metro-stations](https://www.semanticscholar.org/paper/Crowd-management-in-train-and-metro-stations)