

# IOT Based Crowd Counting Smart Mat

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**Abstract**— An automatic crowd-counting system in real time is important in several application areas where the activity of people needs to be analysed or monitored. If we get the number of visiting people for a period, it is easy to manage and control people and special areas such as business complexes, parks, and so on. Several systems have been developed for these purposes. Most of these systems are based on a camera. Taking into consideration the limitations of camera based crowd counting systems that it fails to recognize the exact count of the people entering simultaneously. This can be accomplished by our technique IOT Based Crowd Counting Smart Mat. Where we can get exact count of human transactions depending on which the safety measures can be taken and this count can be displayed on web page of the organization. Thus one can get the real time count of every instance.

**Key words:** Switch Matrix, Real time, IoT, Web page, Smart Mat

## I. INTRODUCTION

An automatic people-counting system in real time is important in several application areas where the activity of people needs to be analysed or monitored. If we get the number of visiting people for a period, it is easy to manage and control people and special areas such as business complexes, park and most of systems are based on a camera, the existence network such as the Internet, and use an electric power including a wire power line. Also, some systems are for indoor such as at gates, at entrances of buildings and so on. In recent years different technologies for counting people have been developed and used.

The following list gives a short overview and provides an informal assessment of the respective strengths and weaknesses. Counters based on active infra-red sensors are typically low-cost, have low power consumption, allow for a simple installation and are portable. These devices, however, are not able to discern between pedestrians and other moving objects (e.g., rain-drops) and cannot separate multiple pedestrians crossing a given line-of-sight at the same time. An automatic people-counting system in real time is important in several application areas where the activity of people needs to be analysed or monitored. Our project works a step ahead on by modifying a simple people counting system into a Smart People Counting System". This project has existence of internet through which the Real Time count of people can be monitored by sitting at a distant place. The count of the footsteps of people along with its direction (entry/exit) is taken using a switch matrix. The count is monitored on the web page using internet through GSM/GPRS facility. These systems are usually simple to set up and require only moderate installations. However, bidirectional counting for higher people traffic densities and the short time-spans can be covered in this way by using this method.

## II. PROBLEM STATEMENT

Nowadays there is need of crowd management in many of our surrounding places where there is frequent crowd on daily basis. We can see many instances lately where there were many people stuck in stampede situations at many places like endangering their lives. So our sponsor "Sivananda Electronics" came up with a requirement of such system which will give an exact count of people visiting a particular place.

## III. RELATED WORK

An approach for person identification using morphing footsteps measured from a fabric based pressure mapping sensor system [1]. The Flexible fabric sensor is 0.5mm thin and operates under a 5 mm thick normal carpet; therefore, it can be easily implemented into modern smart living spaces. The system is evaluated with 13 participants wearing shoes and walking normally across the carpet. Overall 529 footsteps are recorded, and the resulting average identification accuracy is 76:9 percent. Real data on the people's mobility are an essential input for decision-makers of city and regional planning [2]. There are various optimizations in traffic routes, public places or safety measures at public events. Obtaining such data in an automated and reliable way is a burdensome task since usually the requirements on the respective solutions depend on the actual situation. An efficient and reliable approach to automatic detection segmentation, tracking and counting of people, used in surveillance systems and even in any public places [3,4] . A fuzzy-based rule system as well as a fixed video camera can be used for tracking and people counting and is applied to people surveillance. While to count the number of people crossing a counting line the system consists of a motion detection module which determines whether any person has entered the scene which is a tracking module combining prediction and matching then follows people until people reach the counting line. Implementation of the Real-Time People Counting System using Wireless Sensor Networks' for counting and tracking moving people using image processing by a camera have been proposed, recently [5]. To process image data, these systems were based on motion analysis of moving people.

## IV. PROPOSED ALGORITHM

The main aim of this paper is to expand the security measures to handle the crowd which is a requirement in crowd places for safety and security of people. For such a system to work for prolonged period of time in a premise where there are more chances of mishap, stampede, etc. Many times in adverse situations like stampede it is found difficult to get the perfect count of total persons present at the current time instant and number of persons that are stranded. Thus to overcome these shortcomings we are

proposing a method which can count the number of people within a premise along with number of people entering or leaving the premise.



Fig. 1: Switch Matrix Mat

Our system works according to following algorithm:

- 1) System is powered using a +5V DC supply generated from AC supply of 230V 50Hz.
- 2) Important parts of system like Switch matrix mat, GSM Module, LCD display, Smoke detector and ARM 7 Board is supplied with power from the DC power supply.
- 3) Switch Matrix Mat is a 8\*8 switch matrix with switches made of vellostat material. This mat is connected to the arm7 microcontroller.
- 4) Total 16 pins are connected to microcontroller coming from the mat, thus these pins act as input pins to Arm7. Out of 16 pins, 8pins are from the columns of matrix and rest 8 pins are from the rows of matrix.

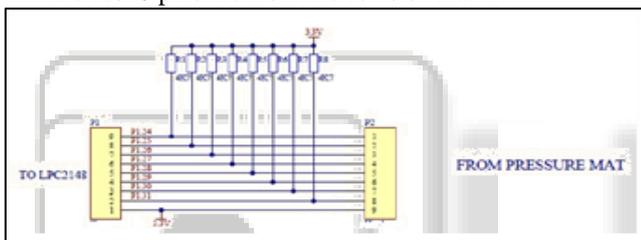


Fig. 2: Matrix Column Section

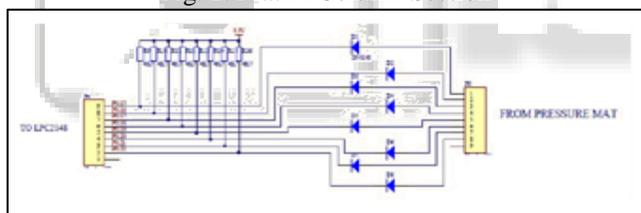
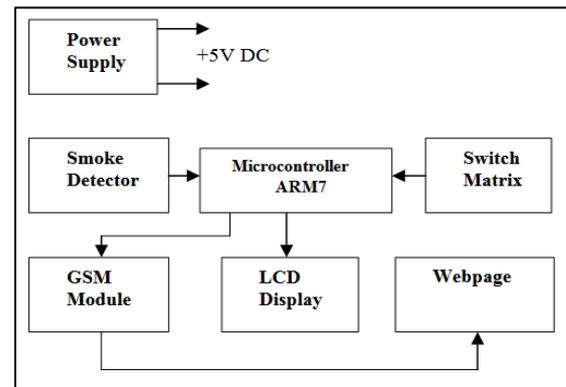


Fig. 3: Matrix Row Section

- 5) This mat is placed at the entrance of a particular premise, whenever any person is about to enter the premise the foot of the person is placed on the mat. As soon as the foot falls on the mat switches under the foot gets pressed and depending on conditions declared in the software program microcontroller decides the direction of the foot and accordingly increments the IN count.
- 6) Similarly, when the person is leaving the premise according to the switches pressed the OUT count is incremented by one. Thus it also provides the Net count of people present inside the premise.
- 7) This count is instantaneously displayed on the LCD panel placed near the entrance. Also this count is sent as input data to GSM module, which will display this data onto a webpage having a predefined IP address.
- 8) Additionally, a smoke detector is also connected at one of the gpio pins of arm microcontroller. Whenever the smoke or fire is detected the smoke detector sends a

signal to microcontroller which will send the alert message on a mobile number through GSM.

## V. BLOCK DIAGRAM



### A. Power Supply

This project will contain different parts which require power to be supplied in order to get driven, like the main component of our project that will be Microcontroller, will require +5V supply to perform all the necessary actions. Along with Microcontroller, Switch Matrix, LCD Display, GSM Module and Fire Sensor will also require power to get driven. Hence we have designed a +5V Power supply.

### B. Microcontroller

Controller increase the count by one when firstly inner most switch is pressed then incoming count will be increase and if outermost switch is pressed first then outgoing count is increase. Simultaneously processor calculate the number of people remain in the premise. So that control room can be aware of the number of people actually present at the instant of time.

### C. Switch Matrix as Crowd Counting Mat

The pressure mat will be placed at the entrance of the premise which detects the number of incoming and outgoing people. The pressure mat will be made up of matrix of switches of Vellostat material. Depending on which switches are pressed it senses in and out direction i.e. it gives bi-directional counting. It is easy to use, very flexible and like modular system.

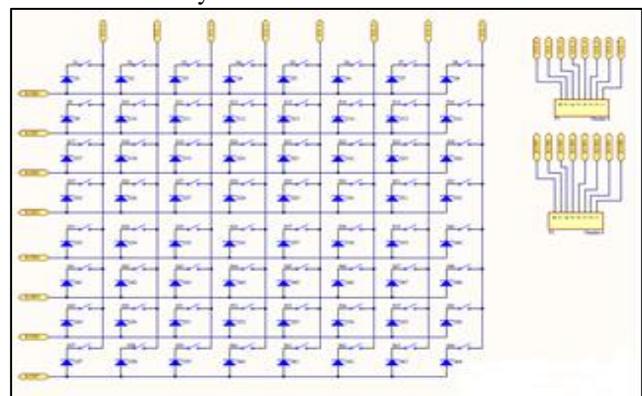


Fig. 4: Switch Matrix Schematic

#### D. LCD Display

When microcontroller increments the IN/OUT count this data will be sent to LCD to be displayed. LCD display will show the IN/OUT count and the number of people inside the premises. This LCD will be placed near the installation of mat. LCD display will be a 18X2 display.

#### E. GSM Module

The Switch Matrix Mat will be placed at the entrance of the premise which detects the number of incoming and outgoing people then the processor analyse the count and sends this data to GSM to get displayed on the web page. Also controller will analyse the crowd at a particular place, if the count of the people exceeds the capacity of that particular premise the signal will be conveyed to the control room via GSM. The use smoke detectors which will detect the smoke and if detected then it informs processor and processor interfaced with GSM send message to control the situation. This is called IOT i.e Internet Of Things which is a new emerging technology in the world of electronics.

#### F. Web Page

Through GSM the count data is to be given to the web page at real time. This web page can be made using .NET or PHP programming. Web browsers coordinate various web resource elements for the written web page, such as style sheets, scripts, and images, to present the web page. A static web page is delivered exactly as stored, as web content in the web server's file system. In contrast, a dynamic web page is generated by a web application, which helps the browser (the client) to enhance the web page through user input to the server.

#### G. Smoke Detector

A smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system.

#### H. Merits

##### 1) A Non-Intrusive System

The textile sensors can be integrated under existing mats or carpets which decorate the area to be monitored. In this way, clients do not have the feeling that their movements are being monitored.

##### 2) Easy Installation:

No installation work is required; simply place the mat at a chosen point.

##### 3) Easy Maintenance:

If a smart mat, forming part of the monitoring network, is damaged it can simply be replaced with another mat. No installation work is necessary.

##### 4) Modular System:

For occasional or mobile events, the system allows rapid installation/removal in addition to a wide range of configurations.

##### 5) Precision:

The system has shown over 95 percent reliability on a pilot test carried out with the standard development kit based on low sampling frequency and spatial resolution.

## VI. CONCLUSION

This Paper presents a report on smart switch matrix mat that will facilitate an automatic counting of people crossing from over the mat. Also will detect the mishap like fire accident or stampede like situations. The approach has the potential for use even in dense premise both indoors and outdoors and will thus provide an optimum data base for crowd management purpose. This system is applicable at many places such as a business enterprise or any company premises, schools and such places where the day-to-day count of people needs to be analysed.

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