

Virtual person counter with Real-time automation

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Abstract – As looking into today's world everyone is trying to change their complex life into simple one. So, looking into their needs there is an urgent requirement to develop a circuit which could fulfill the need. This project title "Virtual person counter with real-time automation" is designed in order to count the number of people present in the room. The system tells the total number of people present in the room using face recognition technology. After implementation, it tells the number of people in the room and controls the appliances present in the room autonomously. As counting manually is time consuming and in-efficient so it helps to increase the efficiency and saves energy resources.

Key Words: KLT algorithm, Voila jones algorithm, Arduino, Face recognition, Multiple tracking

1.INTRODUCTION

Virtual person counter is a reliable circuit that has a main task of controlling the appliances of the room according to the number of the people present in the room counted by the camera with face recognition algorithm very accurately.

Counter is incremented as soon as camera detects the face of a person in the room and the appliances like light, fan, air conditioner etc are switched ON automatically and as soon as everyone leaves the room and count goes to zero the appliances are switched OFF and will remain off until another person enters the room. the total count is displayed on the LCD display. the Arduino UNO or Atmega 328 does the above job. It receives the signal from the software MATLAB serially and signal is operated with the software called Arduino(IDE). As mentioned real time it does the work on instantaneous mode where no data base is created in background and shows you the live count of the people present in the room without any delay making the system very user friendly.

1.1 PREVIOUS TECHNOLOGIES USED

The first-generation technology used in this field was IR sensors which provides the count on basis of the bounce back of the signal from the body and is detected by the diode .so the two pair of IR sensors were used to get the count of number of people entered and number of people leaves the room and on subtracting these two provided the count of the people present in the room. The limitation of this technology was that if more than one person enters the room

simultaneously still they would be counted as one which is going to disturb the entire count and is not reliable.



Fig - 1: IR sensor counter

The second-generation technology which was used is thermal counters in this thermal imaging system detects heat source using array sensors and needed to be mounted overhead for high accuracy. In this counter sensor detects thermal source from human body. But the limitations were range covered is narrow, placement over high ceilings is difficult and verification process is complex.

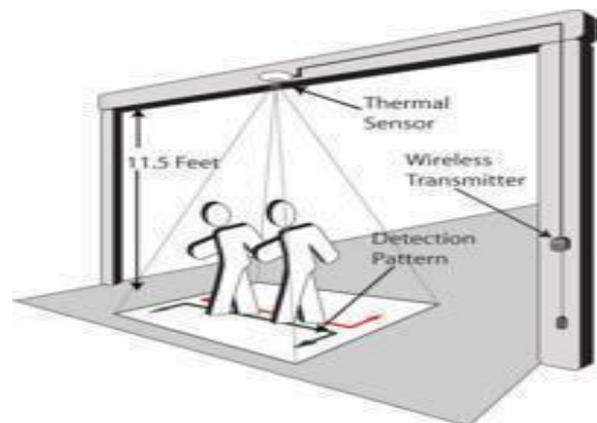


Fig - 2: Thermal counter

2. IMPLEMENTATION

As we are using face recognition and counter display both hardware and software part are involved to implement the circuit. So, in hardware part Arduino have been used and for software part OpenCV coding and MATLAB have been used for execution.

2.1 HARDWARE

The hardware part mainly consists of Arduino, LCD, relays which are being discussed below along with their specific feature.

A. Arduino

Arduino is a ATmega328 based microcontroller with 14 input and output pins, 6 analog inputs, a 16 Mhz crystal oscillator, a usb connection, a reset button and a power jack. It let user to connect interchangeable add on modules termed a shield. these shields have their independent functions which can be interfaced with Arduino by connecting pins as required.

B. LCD (LIQUID CRYSTAL DISPLAY)

LCD is an electronic display module and have wide range of applications and preferred over seven segment displays and other multi segments display. In this we have used a 16x2 LCD display reason being that they are economic, easily programable and can display special characters as well. Here 16x2 refer as 16 characters can be displayed per line and there are 2 such lines. This LCD consists of two registers, command and data. A command instruction is for pre-defined tasks like clearing screen, initializing, cursor positioning etc and data register is used to print ASCII value of the character on the display which are stored in it.

C. RELAY

Basically, relays are the switches which are operated both electrically and mechanically. Electromagnet helps to carry out the switching mechanism there are various types of relays like SPST, SPDT, DPST, DPDT but here we have used SPDT relays which have total of five terminals in which there are two coil terminals and a common terminal is included to connect to either of the other terminal.

2.2 SOFTWARE

In software part, we have used OpenCV and MATLAB to implement the face recognition and Multiple object tracking Algorithms. Tracking multiple object in real-time is necessary to build an effective surveillance system so here to keep up the live count we have used Kanade-Lucas-Tomashi (KLT) tracker. For face detection, we have used viola-jones face detection algorithm which not only detects the face but also have a part which could recognize the facial features as well. But to keep our process as simple as possible we have not integrated the facial recognition and moved forward with only face detection. By combining these two algorithms and with basic coding we can create a program which detects the multiple face with tracking feature for counting purpose.

3. METHODOLOGY

In this paper, our main aim is to propose a model for Virtual person counter. Below is the block diagram for the counter as shown in figure 3.

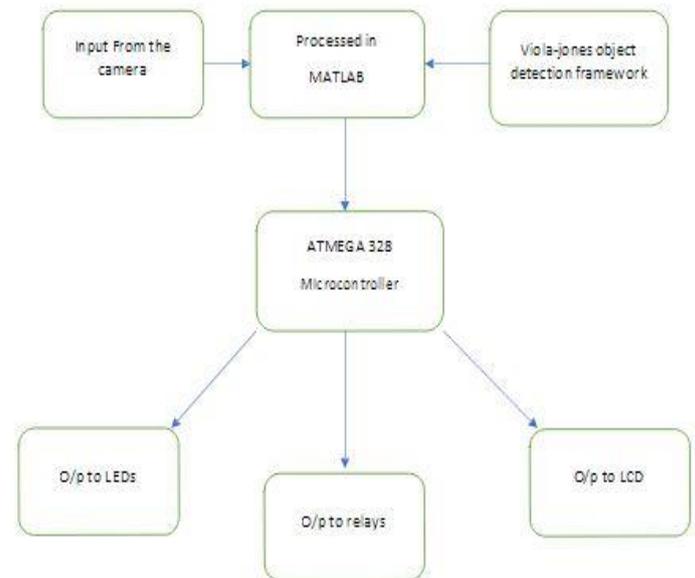


Fig – 3: Block diagram representing working of virtual counter

As we can see from the above block diagram the camera placed in the room is going to provide the video input to the MATLAB where viola-jones object detection framework has been implemented so this video is processed in the MATLAB giving the count of the people present in the room on basis of face detection now this count is serially transmitted to the hardware circuit as shown in the figure 4. Now the serial input is provided to the ATmega328 at Tx and Rx pins and then this input is processed in the Arduino coding where it checks the count. If the count is zero the appliances are switched OFF as zero is provided as binary input to the relay connected to the appliances and if the count is a positive number then these appliances are switched ON as one is given as binary input to the relay which are connected to the appliances. The count which is serially transmitted to Arduino is displayed on the LCD and the led's connected to know the status of the switches accordingly like red led glows when count is zero and green led glows when the count is a positive number. In this circuit, there is no database in backhand so the processing speed is fast and works continuously without the need of any manual interaction.

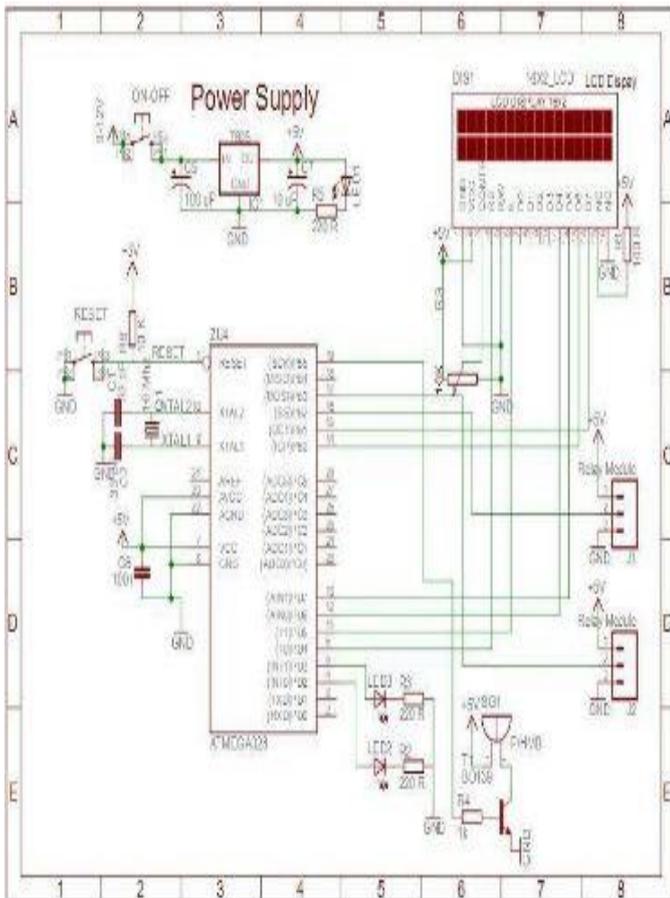


Fig – 4: Hardware circuit

So, this is the simple flow of the process for the virtual visitor counter.

4. EXPERIMENTAL EVALUATION

In order to implement and demonstrate the system, we have created a prototype that represents the system. Thus, the circuit prototype created is shown below in figure 5

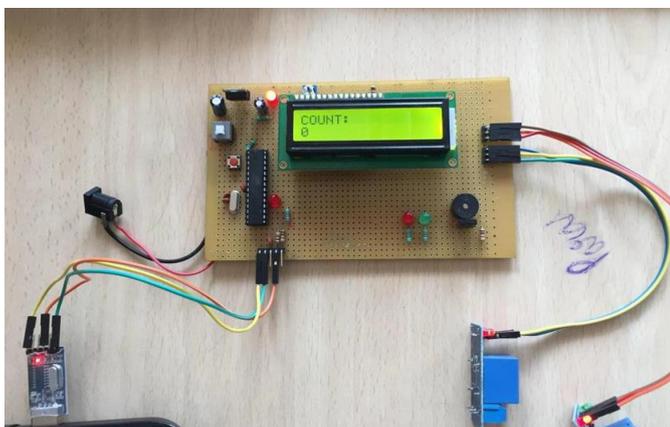


Fig – 5: Complete Circuit



Fig – 6: Face detection and count display

From the above figure 6, we can see different parts of the circuit that is developed and figure 6 shows the results for the prototype.

5. FUTURE SCOPE

This technology has wide number of applications which are going to be used in the future like counting of number of vehicles on highway, parking slot navigation according to the number of empty slots and will be can be used in solid product manufacturing industries.

The most futuristic aspect is that it will be enabled in the autonomous robot eye which is going to do crowd estimation near them.

6. CONCLUSIONS

A normal architecture is proposed and implemented in this paper for virtual person counter. It gives the basic idea of how to autonomously control the room appliances using the face detection algorithm and Arduino. The cost of this technology is very economical as it uses open source coding in OpenCV and Arduino which is also a free open source software. This low-cost system improves the living standard and saves the energy resources like electricity. Also, this system overcomes all the limitations of the previously designed person counters.

This system provides the accurate data and eliminates error wherever possible.

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