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Smart Cum Digital Classroom

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***Abstract*— In the present scenario, smart technology is being applied to every field, and education is just another field which requires it. Smart cum Digital classroom introduces power consumption and time saving technology to the fold and also is ecofriendly as well. This project presents the design and implementation of an intelligent automated system for conserving electrical energy using image processing, which can be used in large organizations like a University or an office. The proposed system works on automation, so that the electrical appliances can be automatically controlled and monitored without any human intervention. It uses the available infrastructure in a classroom which includes surveillance camera and Ethernet connectivity so as to minimize the cost criteria. . The proposed outcome of the project aims at multiple benefits, including saving on electricity bills of the University or any other organization it is deployed in, eliminating human involvement and manpower which is often required to manually toggle the lights and electrical device on/off, and also most importantly, conserve precious natural resources by reducing electrical energy consumption. This project also works as a proxy eliminator and acknowledge the staff members as well as the students that which classroom is free.**

***Index Terms*—Image Processing, Haar Cascade, IP Camera, Automation, Raspberry pi .**

I. INTRODUCTION

The basic design of this system is concentrated on being easily installable and cost effective, so as to make it accessible to maximum institutions. The system is powered by the power supply available and works without the need of human intervention. It applies Image Processing technology to distinguish between faces and other foreign objects. The system upon recognition of any face notifies the processor used which commands the relay to toggle appliances on/off automatically and also sends the data to the database and notifies staff about the number of students present in the classroom. The system hence is a time saver and leads to power conservation.

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II. MOTIVATION

The basic idea of this project originates from the real life scenarios of daily lifestyle where many a times there is wastage of electricity and resources. Basically a lot of this could be prevented with a bit of smart thinking and smart technology combined. Hence, this system uses image processing technique and IOT technology to save power by switching ON/OFF electrical appliances in a room based on the number of people present, using face detection algorithm, therefore preventing power wastage. It also notifies staff about empty classrooms using data transmission over a server hence reducing human effort.

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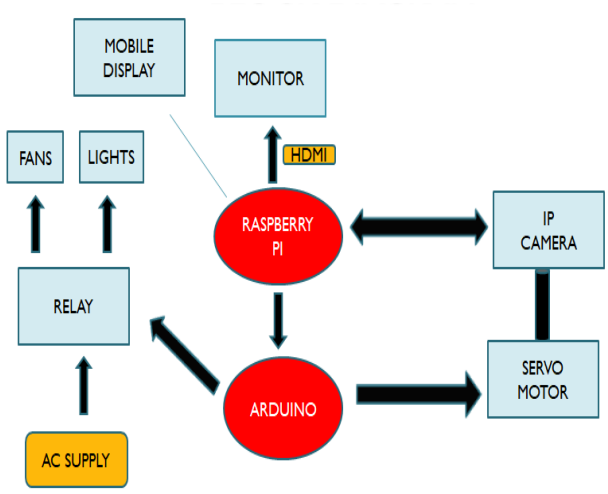
III. BLOCK DIAGRAM

The block diagram shows the Raspberry Pi3 as master processor that will be commanding the Arduino, and a microcontroller which further transmits the signals to the servo and the relay. The relay further accepts the signals in binary form from the Arduino and toggles the electric appliances on/off. The relay can take the amperage up to 10A which is quite normal for the average requirement of the appliance. The block diagram of the Smart cum Digital Classroom is as follows:



IV. MODULE DESCRIPTION

A. *RASPBERRY PI 3*

This module is a micro-processor which is a size of a debit card. External peripherals like keyboard, mouse and monitor can be additionally connected to this. It features a quad-core 64 bit ARM CORTEX clocked at 1.2 GHz. It is also having 1GB of LPDDR2-900 SDRAM. RASPBIAN Stretch which a Linux based Operating System should be installed in this along with the OpenCV.

B. *ARDUINO*

This is a microcontroller with Atmega328P, which is used to control different motors, relays, etc. It has 14 digital

input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button

C. RELAY

Relay is basically used as electrically operated switch. It uses an electromagnet to mechanically operate a switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

D. CAMERA

Cameras use USB 2.0 or USB 3.0 technology to transfer image data. USB Cameras are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. The accessibility of USB technology in computer systems as well as the 480 Mb/s transfer rate of USB 2.0 makes USB Cameras ideal for many imaging applications. An increasing selection of USB 3.0 Cameras is also available with data transfer rates of up to 5 Gb/s.

V. METHODOLOGY

- Firstly ,we install the O.S Raspbian on the Raspberry pi 3 and then we implement haar cascade algorithm in python in Linux O.S
- Then we install the OpenCV which is a computer vision Software on Linux to test the generated algorithm on it before burning it to the Raspbian.
- Next, we test the code and burn it to Raspbian.
- Afterwards, we run the code in raspberry pi 3 to check the performance and lag of real time video scenario.
- Next, we install the Arduino IDE in Raspberry pi 3 and use this microcontroller as slave to raspberry pi3.
- Raspberry pi 3 will be working as the master and Arduino will be working as the slave.
- Now we connect the relay to the Arduino and then connect relay to the AC fans and lights.
- Lights and fans will be automatically switched off if camera does not sense any human presence and ping the message using IFTTT or cloud services like twilio or pushbullet to all users who are connected to that particular server.

VI. HAAR CASCADE

It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle. OpenCV comes with a trainer as well as detector. If you want to train your own classifier for any object like car, planes etc. you can use OpenCV to create one.

ALGORITHM

```
import numpy as np
import cv2
face_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
eye_cascade = cv2.CascadeClassifier('haarcascade_eye.xml')
img = cv2.imread('sachin.jpg')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
faces = face_cascade.detectMultiScale(gray, 1.3, 5)
for (x,y,w,h) in faces:
cv2.rectangle(img,(x,y),(x+w,y+h),(255,0,0),2)
roi_gray = gray[y:y+h, x:x+w]
roi_color = img[y:y+h, x:x+w]
eyes = eye_cascade.detectMultiScale(roi_gray)
for (ex,ey,ew,eh) in eyes:
cv2.rectangle(roi_color,(ex,ey),(ex+ew,ey+eh),(0,255,0),2)
cv2.imshow('img',img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

VII. FUTURE CONSIDERATION

In future we can implement Artificial Intelligence in the classroom which will even further reduce the effort to verify who is present and who is not. This will include face recognition technique rather than face detection, which we are using right now. It will be able to self-determine the face and update their presence in the classroom.

VIII. CONCLUSION

The accuracy of face detection using this algorithm is almost hundred percent keeping in mind that processing should be good and having good specs as well as have a good GPU. Good processors like NVidia jetson tx1, odroid will give a

video feedback and processing without any lag. Even image recognition techniques can be applied without any lag in these hardcore processors.

IX. ACKNOWLWDGMENT

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