

QUESTION 3

Preparing an Indoor Basket Ball Court for a Student's Farewell Get-Together

Rekha, John, Aisha, Samir, Keshav and Jiya, this year's student organizer's are in a bit of a pickle since the advent of the weekend.

The venue for the farewell get-together that they were organizing for their seniors, just got cancelled due to fire accident tonight. The group conferred with the college committee and was informed to use the indoor basket-ball court as the new venue. Being one of the few teams who can truly throw a event, at reasonable costs, the group decided to take it as a sign to use their creative talents along with the tech-talents to augment the place with the best possible facilities for the event.

The group introduces themselves to you and announces that you have been brought in as the problem solver as you have been known to be few of the brightest performer in your classes.

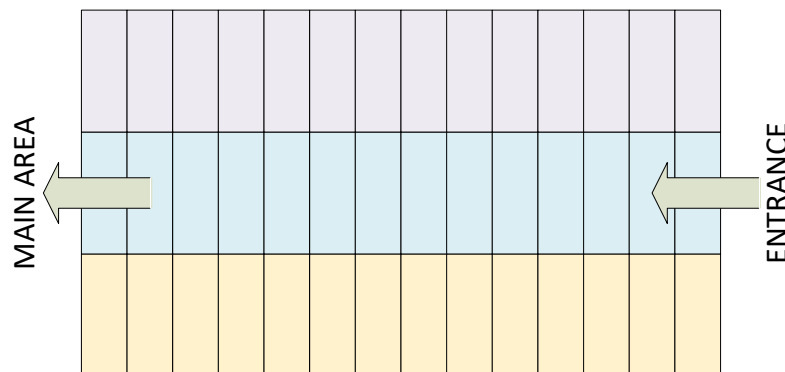
Rekha and Samir quickly jot down the point of renovations that you are to help them build.

1. Add rudimentary people counting system along to keep track of the people.
2. Enhance the standing fans that have been supplied to the court for the guests, with temperature control features.
3. Augment the lighting mechanisms with a bit of mood-lighting.
4. Add an audio-ques to the red-carpet walkway.
5. Distribute the music playback across the court for an all-round pseudo-surround experience of the music.

Jiya is excited about the "Audio-ques to the red-carpet walkways" and informs you quite promptly that it is known that the walkway to the main area of the court will be covered with red-carpet and that the length and width of the pathway is around 7 feet long and 3 feet across.

Jiya says, "I want that every time a person or person walk on the pathway, different music notes shall play.". She continues, "if a person walks straight from the beginning to the end of the pathways, the entire seven notes of the music Sa Re Ga Ma Pa Dha Ni shall play twice."

Samir curbs Jiya's enthusiasm and explains to you that say, "the entire pathway is a broken down into tiles of 6in x 18in, then there will be around 14 tiles length-wise and two width-wise."



Samir continues, "if anyone steps on one blue, then another blue, the previous sound will switch off and so on. If, however, anyone steps on one blue, then another purple or yellow, both sounds for each tile will play." He asks you plainly to first build a 3x2 grid of the same as a sample to show them first.

Task 1 : Design a 3x2 grid sub-circuit, where

- a) Each tile of same colour plays an audio note of increasing frequency. Say, 2V {1KHz, 2KHz, 3KHz, 4KHz, 5KHz, 6KHz, 7KHz} (The values of the audio note frequencies are unimportant but the mechanism that they can play is important.) The playing of the audio is regarded as switching-on of an output. The stepping of a person on the tile is regarded an input sinusoidal voltage signal (0 to 5V) which changes by a threshold value, say 3.4V when someone steps on it.**
- b) Two adjacent tiles of different colours will play notes of same frequency by different amplitude. Blue tile, if plays 2V amplitude, Yellow tile will play 4V and Purple tile will play 1V. The ratio of the amplitudes of the adjacent tiles are important. All adjacent tiles will have the same input audio as sinusoidal voltage signal with fixed frequency.**
- c) Combine parts (a) and (b) to create a combine 3x3 grid circuits (Use LTSPICE or LogiSIM as necessary)**

Rekha informs you that another task that is the mood-lighting part. She says, "Light arrangements are already there, for the place, but each lights need to stay". These lights need to stay one when people come near it and then speak at some loud volume. The lights will stay on until the volume does not go below some threshold. When it does, lights will go off. Next time again, when it hears loud volume, it will switch on.

Task 2:

Design a sub-circuit which if attached to the system can take audio noises as voltage signals (0 to 5 V range) and switch-on the system when volume is above 4V till the volume goes below 1V. The output of this sub-circuit will control one or bunch of lights together. (Use LTSPICE or LogiSim as applicable)

Samir say “we also need you to create a rudimentary person entry-exit counter”, for each door separately.

Task 3:

Design a sub-circuit which if attached to a door will count up when a person enters fully through the door i.e. it will detect the movement almost simultaneous from two sensors. Say if sensor 1 goes high, followed by sensor 2, then the counting is increased by 1. If the sensor 2 goes high, followed by sensor 1, then the counting is decreased by 1. After every increase/decrease, the sensor value will reset if needed. Assume all sensors have a voltage input range of 0-5V. (Use LTSPICE or LogiSim as applicable)

John says “we also need you to create design a temperature controlled fan switch-on-or-off system”, for each door separately.

Task 4:

Design a sub-circuit which if attached to the fan, will detect temperature as a voltage signal of 0-5V from the front and back of the fans. If the average value of the sensors, goes below say 1V, then the fan will switch off, else stay on. (Use LTSPICE or LogiSim as applicable)

Aisha, the audio-expert of the group says “I hate sudden sharp spicks in the music. Lets find a way to chop them-off.”.

Task 5:

Design a sub-circuit which will capture audio signals as it and chop of any peaks that are above a user-choice based level of voltage reading. (Use LTSPICE or LogiSim as applicable)

