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Stage Light Controller

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Abstract*: *Stage lighting is the craft of lighting as it applies to the production of theatre, dance, opera and other performance arts. Lighting professionals are hired and given the task of controlling and simulating the stage lights. To reduce human resource, time and efforts, our project proposes an intelligent lighting system which switches the colors of LED lights based on the constant frequency change of any music file provided as an input through simply a device which can do all the work of controlling both the light and music without any help of the event managers or organizers using IoT based Raspberry PI and Python. This system could be useful at live concerts, clubs or corporate events and public or open space shows etc. It also serves the purpose of indoor lighting providing mood based ambient lighting for indoor activities which can be used by non-professionals as well at home, offices, presentation halls etc.
Keywords: Raspberry pi, python, stage lighting.

I. INTRODUCTION

Lighting is a deliberate use of light to achieve practical or aesthetic effect which includes the use of artificial light sources such as Light Emitting Diodes (LEDs), gas discharge lamps like neon lamps, neon signs, mercury vapour lamps etc., lasers and flames where sodium in a gas flame emits characteristic yellow light. Lighting illuminates the performers and artists in a live theatre, dance or musical performance and is selected and arranged to create dramatic effects.

Proper lighting can enhance task performance, improve the appearance of an area, or have positive psychological effects on the audience whether indoor or outdoor. Stage lighting provides light for better sight.

The lighting should pull all the aspects of the stage together.

Show Organizers, Producers, Event Managers and all the other people responsible from setting up the show to executing it, meticulously work on planning the stage lighting, considering giving their audience the vibes of the event visually. It requires planning beforehand, human resource, manpower, constant monitoring and skilled knowledge of music and lights as well. Also, it increases financial burden on the organizers when the event is scaled, hence needing a larger taskforce right from monitoring to managing all the tasks concerned to light design.

In order to solve the problem of workload on task force we propose a system that implements a centralised system through which the audio as well as the visual components can be controlled with the help of IoT devices.

The entire system will be accessible through a web application which will provide ease of use to the user. Depending on the requirements of the user. The system can be configured to either work within a network or can be made accessible through the internet. With a high degree of adaptability and ease of use it takes advantage of a centralized control strategy. The lighting pulls all the aspects of the stage together. At Staging Connections, the smart lighting design is fundamental for every event from large conferences, parties, and festivals interactive exhibitions to small meetings and everything in between.

II. EXISTING SYSTEM

Stage lighting requires lighting professionals right from the setup to the execution of the plan. Their duties include:

A. Setting up and focusing lights.
B. Patching and or wiring up lights to dimmers or electronic control consoles.
C. Changing the set-up of lights during a performance or concert.

Setting up lights on the stage includes using a console control which takes input from an operator, transforms it to signals that the dimmers can read and sends it down a cable to the dimmers. The dimmers send out various amounts of power through the individual dimmers which gets distributed through fixtures.

This requires a lot of planning beforehand by the sound and light technicians to set the lights according to the right angle, position and area to get the best results on the stage.

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III. PROPOSED SYSTEM

This system proposed in this project implements this with the help of IoT devices. This implements a centralised system through which the audio as well as the visual components can be controlled.

The audio given as an input is split into different frequencies using a sequencer. The obtained frequencies are then used for controlling the lights. The entire system will be accessible through a web application which will provide ease of use to the user.

Depending on the requirements of the user, the system can be configured to either work within a network or be made accessible via the internet.

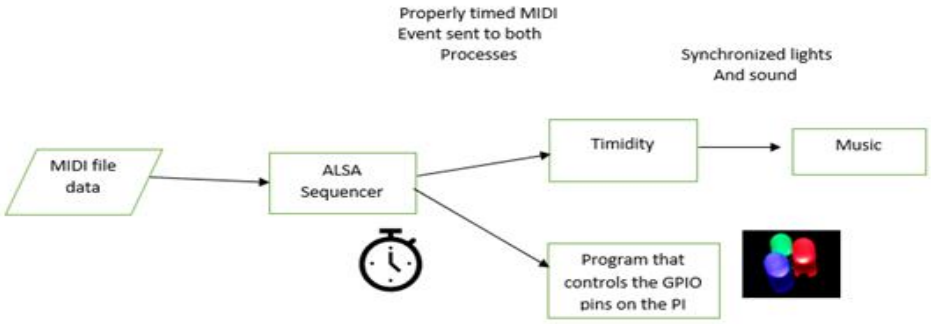

Fig. 1 Proposed System's Workflow

The diagram below represents the overall architecture of the proposed system. Following are the components present in the system:

A. MIDI File
B. ALSA Sequencer
C. Timidity
D. GPIO pin controller

A file with the .MID or .MIDI file extension is a Musical Instrument Digital Interface file that explain how the sound should be produced once attached to a playback device or loaded into a particular software program that knows how to interpret the data. Advanced Linux Sound Architecture (ALSA) is a software framework and part of the Linux kernel that provides an application programming interface (API) for sound card device drivers.

IV. SOFTWARE REQUIREMENTS

A. Python

Python is an interpreted high-level programming language which used here for converting the music samples into their discrete forms and applying logic over them and interfacing with GPIO pins of the Raspberry Pi to strobe the lights previous web applications.

B. Raspbian OS

Raspbian OS is a Debian-based operating system which comes preinstalled with Python, Java etc. preinstalled.

C. Web Browser

A web browser is used to access the interface to control the Raspberry Pi in order to play the music, turn the lights on/off and prepare a playlist.

V. HARDWARE REQUIREMENTS

The following hardware serves as the backbone for the functioning of the proposed system:

A. Raspberry Pi
B. Breadboard
C. 26- or 40-pin Breakout board with accompanying ribbon cable
D. LED Strips

E. Resistors
F. Jumper Cables
G. Channel solid relay

VI. WORKING

Use case diagrams model the functionality of a system using actors and use cases. In this context, a "system" is something being developed or operated, such as a web site. The "actors" are people or entities operating under defined roles within the system.
In above diagram the actors are user and system. The user performs basic functions like upload music file, change the track and pause it. The most important functions are automatically controlled by the system like initializing, loading the music track into the sequencer and the signals are seen as output on the GPIO pins.

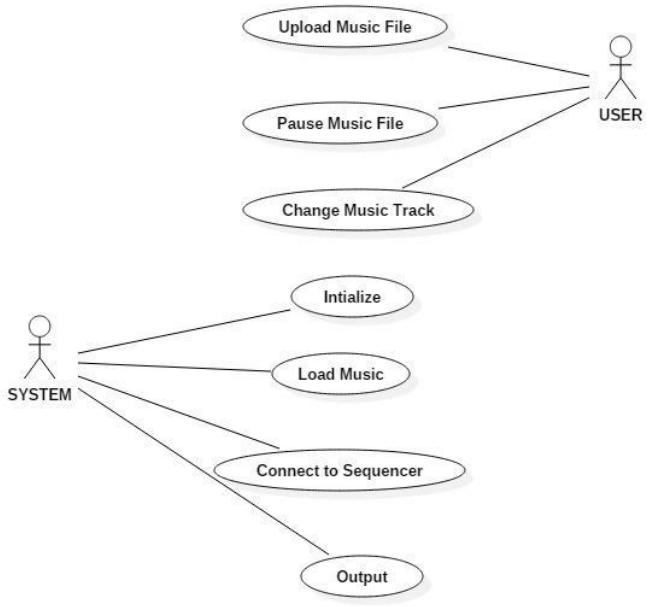

Fig. 2 UML Diagram (Use Case Diagram)

VII. LIMITATIONS

Currently, this project uses optimization techniques to find the best light setting and relies on the characteristics of sound like frequency however when the number of lights increases to hundreds, the optimization framework might not function sufficient for real-time light control. Also, this system can only suffice mediocre audio systems, for larger audio setup the IoT device would lack power and hence would need an external source to do so. This system uses frequency of the music at real time as a characteristic of simulating the light function with the music however lacks characteristic of identifying other characteristics such as amplitude, range, genre, lyrics for simulating the mood lighting.

VIII. CONCLUSIONS

This project represents an alternative for providing a visually appealing method for presenting visual displays or shows which can be controlled by audio or music, intended for use by musicians and other performing artists who heavily rely on visual creativity. A key feature of the algorithms being used in this project is the ability to sample the audio file quickly and provide an output which can control the connected lights at will. Experimental results with the LEDs demonstrate the feasibility of the system. In the future we plan link the music and light transitions together, and to make it a real-time system which most available systems today are not.

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