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Robotic Microphone Stand for Pogo Studio

Project Proposal

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1. Introduction

1.1 Title

Robotic Microphone Stand for Pogo Studio

The reason why we have selected this project is it involves challenging design and implementation work in different areas of electrical engineering such as logic circuit design, control systems, signal processing and so on. We are excited about working on this project because it can really help solve problems in the real world.

1.2 Objective

In most music studios, in order to achieve the best sound effect, studio workers have to either go back and forth between the control area and the recording area adjusting the microphone's position or have someone work in the potentially high-volume recording area and move the microphone around. The purpose of this project is to design a robotic microphone stand which can be remotely controlled to move the mic to different positions. Also previous mic positions can be stored and retrieved for the convenience of sonic comparison.

Features

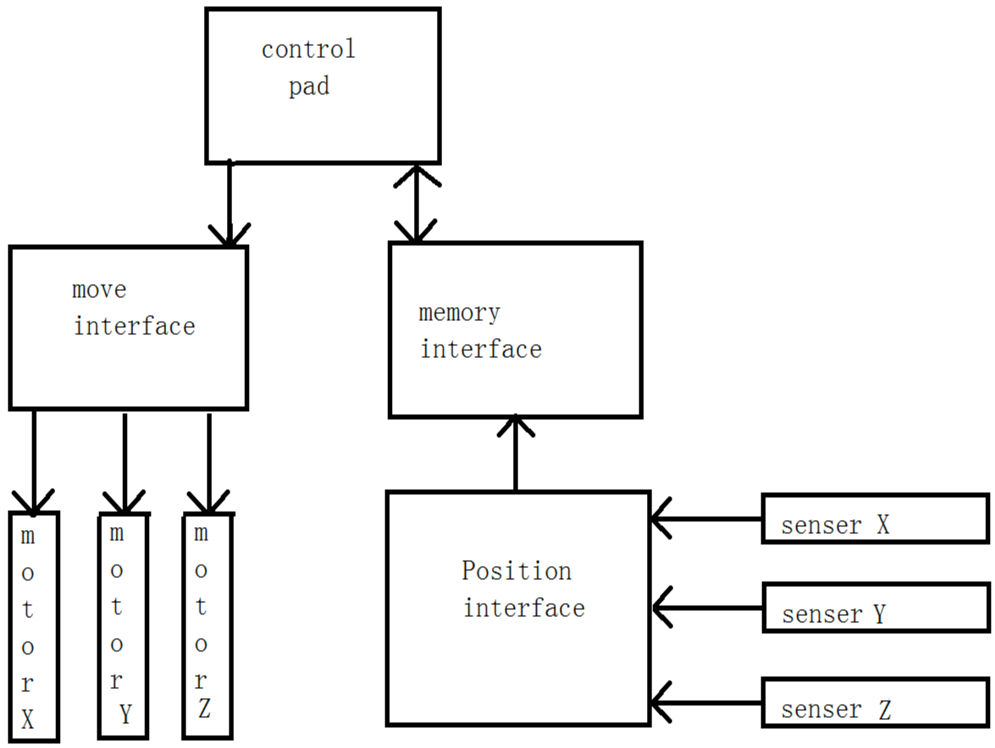
- Installing three-axis (X, Y, Z) tracks to realize three-dimensional movements (left, right, up, down, forward, backward) of the mic.
- Remote control functionality will be implemented with wires. We will try to add wireless control through Bluetooth if possible.
- A user interface will be built with a joystick controlling the horizontal movements, two buttons controlling the vertical movements, three push-buttons for three different memory locations and store, retrieve, clear options for each memorized location.

Benefits

- Significantly reduce the time gap between moving the microphone from one place to another. Consequently, studio workers can keep better audio memories for better comparing sound effects.
- Position memorizing makes mic adjusting and sound effects comparing more convenient.
- The functionality of remote controlling makes the presence of an assistant in the recording area not necessary, providing a less hazardous working environment.

2. Design

2.1 Block Diagram



2.2 Block Description by Parts

Motor X,Y,Z- core dynamic outputs from control system.

Sensor X,Y,Z-input and feedback from current location.

Position interface- deals with raw inputs from sensors and output formalized vector into memory.

Memory interface-contains memory locations that stores vector from positioning interface. It also has a built-in instruction cycle that disables user input and retrieve stored location.

Control pad- user's interface with the hold system, contains all movement buttons and memory options.

3. Requirements and Verification

3.1 Requirements

The three basic movements that are to be implemented are defined in X,Y and Z directions, representing left-right, forward-backward and up-down. A joystick on the control pad would send instructions to X-motor and Y-motor and thus controls the movements in these two directions at the same time. Similarly, two buttons namely "up" and "down" would take care of the vertical movement. Basically three instructions-clockwise rotation, counter clockwise rotation, hold-are to be sent out by the control pad to the motor.

We use positioning sensors instead of memorizing previous movements and plus that with initial position in vector space. This would enable us of implementing a feedback system and thus avoiding accumulating errors and the inconvenience of repositioning the mic from time to time. So three laser sensors would take care of the three measurements in three directions. Since we are using sliding axes, a reflecting end at each axe would give us the feedback of current position. And then all feedback times are put through the positioning interface are thus be translated to a dimension three vector and this vector is constantly being updated upon the new position the mic acquired.

Sometimes an output of the current position from the positioning interface to the memory interface is required. This happens each time when a memory instruction is performed through the control pad by the user. So there would be six buttons representing three memory locations (number of memory locations could vary during project). Each memory location corresponds to two buttons S and R. S means the memory interface load the current location from positioning interface and store it into the corresponding memory position. R means a read from the corresponding memory location and the motors would then follow the instructions from memory interface to move back to the stored location. the memory interface upon receiving an Receive instruction would take the current location and the desired location into account and calculate the motion of motors. Control pad takes no further input of user during a Receive until memory interface sends back an End signal stating the Receive has been done, where current location is (or about)the same to the desired location.

3.2 Verification

Testing would be divided into pieces based on the accomplished list in schedule. First phase we will have the motors functioning and thus we should test the motors with their battery consumption, rotating speed, and torque generated. Second phase of testing would be more software bound and we should have our PCB board functioning, it should calculate the position upon data input from sensors and take in memory value and losslessly store it into the correct memory location. Loading from memory is also tested in this phase in preparation for the next phase. The last phase involves most testing because we are using a feedback loop to implement control of the motors. We should also take care of the end signal to avoid continuously ajusting mic position and loss of control from the user.

3.3 Tolerance Analysis

The most error as for this project should occur in the retrieving process. Exactly reaching the previous location would be mission impossible. And actually a closed-loop feedback system returns gain less than unity. And thus we should specify in our logic that a small amount of deposition should be tolerated and an approximation comparison returns whether a retrieving has been fulfilled. We will further discuss about the percentage error after visiting the studio and measured our building dimensions.

4. Cost and Schedule

4.1 Labor

	Desired $	Hr/week	Hr in total	Final deal
Kai	$30	10hr	120hr	9000
Weihong	$30	10hr	120hr	9000

4.2 Parts

Part	#	Cost
Electric motor	3	15
medal axis	10	5
boards	3	1
battery	20	15
wire	a lot	10
PCB	2	0
miscellaneous	a lot	20
user’s control box	1	10

Total cost: $ 18076

4.3 Detailed Schedule

Week	Task	Member Assigned
9/16	Write proposal	Kai
	Finalize and turn in proposal	Weihong
9/23	Visit Pogo Studio and research different mic stand	Kai
	Visit Pogo Studio and start designing mic stand	Weihong
9/30	Order parts and start building tracks for the stand	Kai
	Build tracks and Research Power supply structure	Weihong
10/7	Hardware build-up, research remote control	Kai
	Hardware build-up, research position sensors	Weihong
10/14	Testing, check for three dimensional movements.	Kai
	Complete the hardware build-up, add remote control	Weihong
10/21	Add sensors for postion senoring	Kai
	Test sensors and remote control functionality	Weihong
10/28	Adjust sensor postion and improve performance	Kai
	Build positioning interface and test	Weihong
11/4	Memory build-up	Kai
	Implement position retieving functionality	Weihong
11/11	Testing the position retieving functionality	Kai
	Assemble all parts together	Weihong
11/18	Thanks giving break	Both
11/25	Final assembly and testing	Kai
	Final assembly and testing	Weihong
12/2	Demo	Both
12/9	Final paper and presentations. Disassemble project.	Kai
	Final paper and presentations. Check in supplies.	Weihong