Remote Mic Stand for Pogo Studio

Project Proposal

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I. Introduction

1.) The project was chosen to solve a problem for a local recording studio, Pogo Studio. The motivation for the project is the quality of sound varies with the position and orientation of the microphone. The problem is forgetting the old sound after walking into the next room and repositioning the mic. The wireless mic stand will solve this by enabling the sound recorder to move the mic from the studio wirelessly. It is exciting to work on a project that will directly solve a customer's problem, and also learning that there is a large market for this product.

2.) **Objectives:** The overall scope of the project is to be able to move a microphone stand from inside the recording room wirelessly such that sound-checks can be performed efficiently. Adjusting the microphone stand wirelessly eliminates the hassle of walking back and forth between rooms to adjust the stand, as well as not forgetting the previous sound quality at the mic's previous position.

- Functionality
    - Adjust forward/backwards and left/right
    - Adjust height up/down
    - Adjust pan/tilt
- Goals
    - Perform adjustments wirelessly via smart phone app
    - Store positions as presets
    - Recall preset positions by location and orientation of mic

II. Design

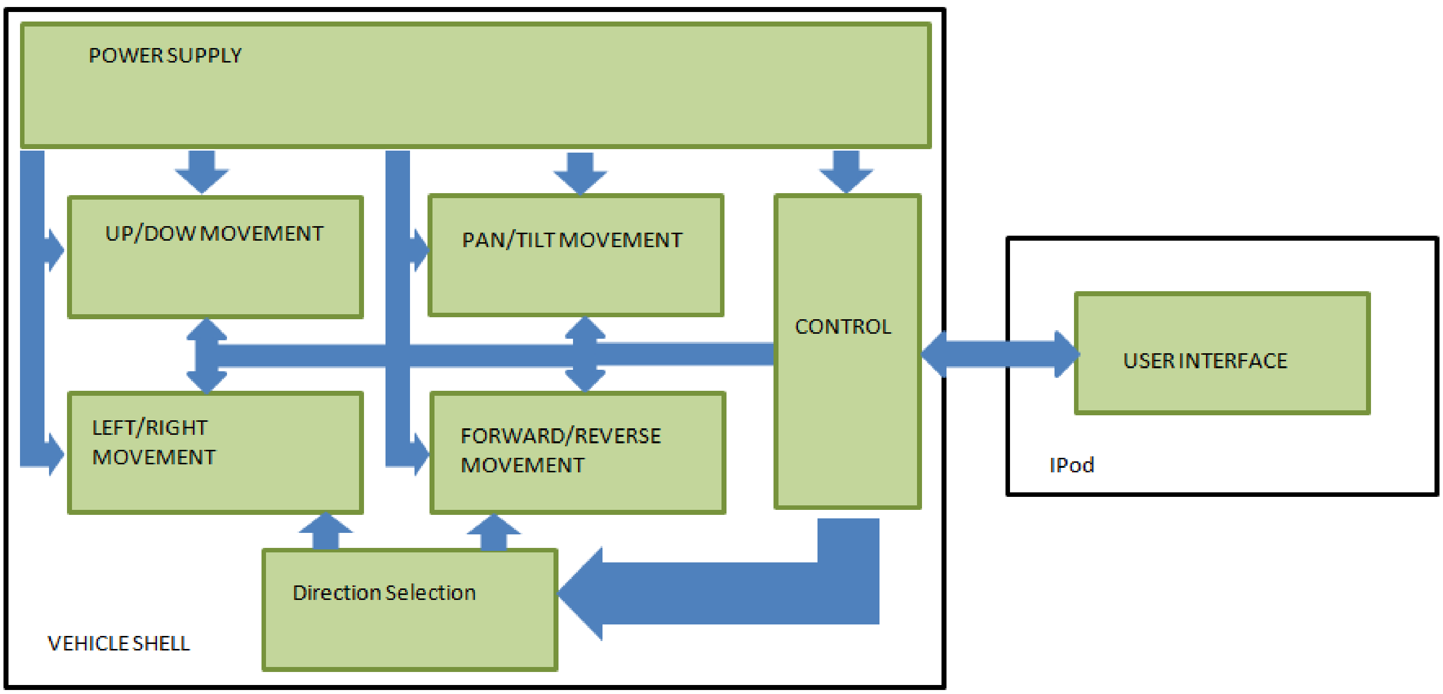

Figure 1 Block Diagram

The block diagram in Figure 1 is vital to the completion of our project. By separating the device into several different sub-levels, we will be able to mark the progress of our project, divide the work amongst the group, and run tests to help determine the functionality of the robot. Each part plays a vital role in the circuit and will need to be tested and verified in order to successfully output a finished product. Table 1 describes the functionality of each component.

Table 1 Block Description

Block Name	Block Description
Power Supply	• 12VDC Rechargeable battery (LT®1083 possibly) • Battery mounting hardware • Connect to circuit motors and control system to power hardware
Control	• Wifi router to interact with the user interface • Receives signals from user interface to dictate direction of robot movements • Transmits signals to user interface for stored locations information • PIC16F877A microcontroller translates signals from wifi router and transmits signals to motors on board • Microcontroller outputs will be connected to each motor drive to accurately move motor in correct direction
Direction Selection	• Motor Drive to dictate direction and speed of motor • Servo Motor to move correct wheel axles up or down. If user goes forward/backwards, one set of axles will be used. If user changes to left/right, that axle will pull up and the other axle will then be used • Motor and motor drive will be connected to the power source • Drive will be run via the control component, which sends to signals for the motor action • Mounting equipment will be needed for motor and drive
Forward/Reverse Movement	• Brushless DC motor connected to an axle to run the wheels • Motor Drive to dictate direction and speed of motor • Motor and motor drive will be connected to the power source • Drive will be run via the control component, which sends signals to the drive to dictate the motor action • Mounting equipment will be needed to support motor and motor drive • This motor will be connected to one axle to turn the wheels in the desired direction
Left/Right Movement	• Brushless DC motor connected to an axle to run the wheels • Motor Drive to dictate direction and speed of motor

	• Motor and motor drive will be connected to the power source • Mounting equipment will be needed to support the motor and motor drive • Drive will be run via the control component, which dictates which direction the wheels will turn • This motor will be connected to one axle to turn the wheels in the desired direction
Up/Down Movement	• Brushless DC motor will be used to move the mic holder up or down • Motor Drive to dictate direction and speed of motor • Motor and motor drive will be connected to the power source • Drive will be run via the control component • Gears to interlock with stand to propel mic upwards or downwards • The motor will be connected to gears to power the movement • Mounting equipment for gears, motor, drive
Pan/Tilt Movement	• 2 Servo motors connected to mic holder to pan and tilt the mic • Motor Drive to dictate direction and speed of motor • Motor and motor drive will be connected to the power source • Drive will be run via the control component • Mounting equipment for the drive and motor
Vehicle Shell	• 8 wheels capable of supporting about 10 lbs of weight • 4 axles • Frame (plastic, fiberglass, or wood) to support all hardware • All wires to direct power and signals • Moveable joint for pan/tilt movement • Equipment will all be mounted onto here
User Interface	• App capable of use from Iphone or Ipad • Will allow user to move microphone in any dimensional direction • Will store previous locations and display with label so that user can move to a previously stored location • Communicate with vehicle control via wifi network

III. Requirements and Verification

Our project must meet a list of requirements in order to be successful. Each component of our project will be developed and tested individually so that full functionality is present. Finally, we will assemble all of the pieces so that our device meets our expectations and the customer's. Table 2 contains the list which details the testing process we will take.

Table 2 Block Testing

Block Name	Block Requirements	Verification
Power Supply	• Transmit a 12 VDC voltage with a ripple of < 3% • Be able to support load of entire system • Will need to remain charged for a full day's worth of recordings • Will need to stay attached to base of device	• Test ouput voltage under various load conditions • Load numbers and voltage results will be displayed in a table • Using calculations of our supplies, we will determine if the power supply is acceptable • We will find load of entire day's work and test that value against the batteries capabilities • Several trials will be run to guarantee necessary results • Robot device will be moved to make sure battery stays attached
Control	• Accurately receive all signals from user interface: forward/reverse movement, left/right movement, up/down movement, pan/tilt movement • Accurately transmit above signals to appropriate motor drives • Distance of Wifi detection must be accurate up to 50 feet	• Create a table with all signals needed • Test both receiving and transmission of all signals and chart responses in table • Block is not complete until all signals are working 100% of the time • Use Ipad signals to transmit to device wifi • Increase the distance of the device and Ipad until maximum distance is recorded • Place barriers (wall, glass, etc.) between the two to test the amount of resistance

		allowable • Record results in table and find most consistent data • Make sure meets requirements
Direction Selection	• Accurately receives signal from controller • Turns motor correct direction when signal is received • Motor supports weight of load • Motor turns in timely fashion	• Input test signals to circuit to test if motor drive and motor both respond accurately • Load motor with increasing torque until max torque is realized. Make sure max torque is higher than device would require • Chart results in graph • Test that wheels still reach ground on each switch
Forward/Reverse Movement	• Accurately receives signal from controller • Turns motor correct direction when signal is received • Motor supports weight of load • Motor turns in timely fashion	• Input test signals to circuit to test if motor drive and motor both respond accurately • Load motor with increasing torque until max torque is realized. Make sure max torque is higher than device would require • Chart results in graph
Left/Right/Up/ Down Movement	• Accurately receives signal from controller • Turns motor correct direction when signal is received • Motor supports weight of load • Motor turns in timely fashion	• Input test signals to circuit to test if motor drive and motor both respond accurately • Load motor with increasing torque until max torque is realized. Make sure max torque is higher than device would require • Chart results in graph
Pan/Tilt Movement	• Accurately receives signal from controller • Turns motor correct direction when signal is received • Motor supports weight of load • Motor turns in timely fashion • Pan and tilt to move 90	• Input test signals to circuit to test if motor drive and motor both respond accurately • Load motor with increasing torque until max torque is realized. Make sure max torque is higher than device would require • Chart results in graph • Test full range of movement to make sure pan and tilt can

	degrees up, down, left, and right	reach 90 degrees in each direction
Vehicle Shell	• Withstand weight of entire device • Movement is smooth and accurate • Parts stay together • Vehicle is safe and efficient	• Place increasing amount of weight on car until the wheels will no longer turn. Record results. • Complete test runs using vehicle to note quickness and smoothness. If robot can move in all directions without a pause or stop, smoothness test will pass. • Testing that the vehicle is safe is mostly from an electrical standpoint. We will test all wires to make sure there is no danger of the user being electrocuted
User Interface	• Accurately remember locations • Correctly transmit all signals to controller	• Create test locations and determine if application accurately remembers specified locations • Use signals chart from control component to test if all signals are accurately transmitting

The most important component of this project is the controller. This is the interface between the Ipad app and the hardware device. Thus, it must be able to receive all signals accurately, quickly, and consistently. There will be several output signals from this controller, and each signal must be working properly. The microprocessor will need to be programmed and debugged, which will take time and attention to detail. The logic of our microprocessor will need to be checked and tested to assure quality performance. Without this key component functioning at 100%, our project will not work.

The testing method for the control component will be to connect each of the outputs of the microprocessor to an LED light. Then, using the Ipad user interface, we will send a signal of each type to the control system to test its response. If the proper LED lights up, that will count as one successful signal. After each signal has been correctly received 5 times in a row, the control component will be complete. Figure 2 shows the testing chart we will use to plot the 5 test trials for each component.

Forward	Reverse	Left	Right	Up	Down	Pan Left	Pan Right	Tilt Up	Tilt Down

Figure 2 Control Test

IV Cost and Schedule

A.) Labor:

Tyler Harrington: $35/hr x 2.5 x 195 hours = $17,062.50

Alex Lincoln: $35/hr x 2.5 x 195 hours = $17,062.50

Zach Newell: $35/hr x 2.5 x 195 hours = $17,062.50

B.) Cost of Equipment:

- 5 Motors
  - motors for bi-directional movement: 3 x $200.00 = $600.00
  - motors for panning, tilting, and raising the microphone: 3 x $7.00 = $21.00
- Vehicle shell to house all equipment
  - Frame consisting of wood/plastic/fiberglass: $40.00
  - Mounting Equipment: $30.00
  - Cables for motors/wires for communication and power: $40.00
  - Wheels: 8 x $1.00 = $8.00

- Axles: 4 x $1.00 = $4.00
- Equipment to raise/lower axle: $6.00

- Control system
  - Wireless transmitter/receiver: 1 x $20.00 = $20.00
  - P IC16F877A Microcontroller: 1 x $5.00 = $5.00
- Power supply
  - 12 V Battery 5AH: 1 x $20.00 = $40.00
- User Interface
  - App writing software: 1 x $50.00 = $50.00

C.) Total cost

(3 x $17,062.50) + ($864.00) = **$52,051.50**

D.) Schedule

	Duties			
Week of (Sun):	**Note(s)**	**Zach (Leader)**	**Alex**	**Tyler**
16-Sep	Proposal Due 9/19 Meet with Mark Rubel	1.) Intro and Schedule 2.) Order Parts	1.) Design and Requirements/Verifications 2.) Speak with Shop Workers on mech design	1.) Cost Analysis 2.) Research/ Choose Transceiver
23-Sep	DR Sign-up Opens	Program PIC to send/ receive data through tranceiver	Coordinate wheels (mechanical design)/consult with shop workers for mounting	1.) Program basic app functionality
30-Sep	Design Reviews	Design electrical schem	design mechanical Schematic	software layout and piece everything together
7-Oct		Have motor functioning via iPhone	Submit layout/plan for shopworkers	Have motor functioning via iPhone
14-Oct		Testing motor functionality and movement of structure		
21-Oct	Ind. Progress Reports Due 10/24	Progress Report and testing motor functionality		
28-Oct		Continue Testing and begin to introduce store/restore positions logic		
4-Nov	Mock-up Demos and Presentation Sign-ups	Test and validate position store/restore functionality		
11-Nov	Mock-up Presentations	Mock-up Presentation planning and incorporate store/restore functionality with pan/tilt		
18-Nov	Thanksgiving Break			
25-Nov	Demo and Presentation Sign-ups	Validate proper functionality on all counts and prepare for final demo		
2-Dec	Demos	Validate and demo		
9-Dec	Presentations, Final Papers Due 12/12	Split Final Paper assignments		