MP3 Doorbell

Final Paper Design Document

May 5, 2004

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1. Statement of Work

Our group analyzed the standard home doorbell and modified it in accordance with the current pop culture's need for customization and entertainment. We captured the desired features from our survey analysis. We will produce the MP3 Doorbell; a wireless doorbell that plays the customer's favorite song clips (or sound effects) through the user's personal computer when the doorbell button is pressed.

Clips (user defined time length) will be played each time the button is pressed. The user may also select to have random clip playback with each button press by changing their Nullsoft Winamp's media player settings. The user will be able to edit any type of sound file, convert it into MP3 format, load it into the MP3 Doorbell by using Nullsoft's Playlist software, and repeat this as many times as desired.

Author: C. Dharmavaram
2. Assessing Customers’ Needs and Wants

2.1 Prospective Customer

Today’s consumer has many products to choose from and companies differentiate their products by the features and customization (consumer self-expression). The MP3 Doorbell will be marketed to college-aged students and professionals. We based this on current media advertising campaigns marketing cell phones and music to 18-35 year olds. Pick up any magazine or newspaper and you are bound to see cell phone ads and mp3 news about companies getting into the music downloading frenzy (Napster, iTunes, and even Walmart).

We conducted two surveys. We first surveyed college students and support staff at the University of Illinois at Chicago to understand peoples’ perceptions about existing doorbells, and mp3 players. We also used that information to gauge how much people are willing to pay for these types of products. We also surveyed engineering professors to get a better understanding about the technical needs our project may require. The survey results (professor/technical audience and student/general public audience) are followed by a correlation matrix of how the extracted needs and wants relate.

Author: F. Manriquez

2.2 Surveys

2.2.1 Technical Survey

Greetings. We are part of a senior design engineering class at UIC researching experiences and uses of sound device playback. We appreciate your honesty and time. Thank you.

Please answer the following general questions:

1.) Based on experience, how easy is it to interface USB devices?

<table>
<thead>
<tr>
<th>Not Easy</th>
<th>Somewhat</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Absolutely Needed

Wanted, Not Required

2.) How useful are LCD screens for users of personal music players?

<table>
<thead>
<tr>
<th>Not Useful</th>
<th>Somewhat</th>
<th>Very Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Absolutely Needed

Wanted, Not Required
3.) How relevant are color LCD screens for personal music players?
Not relevant    Somewhat    Very Relevant
1    2    3    4    5

Absolutely Needed   Wanted, Not Required

4.) How important is it that users be able to order music play lists or have random playback?
Not important    Somewhat    Very Important
1    2    3    4    5

Absolutely Needed   Wanted, Not Required

5.) Should an average consumer be able to self install a doorbell?
Yes    No

YES    NO

6.) Should there be technical support for the user?
Yes    No

YES    NO

7.) Should the user manual have schematics?
Yes    No

YES    NO

8.) Should the manual be available on a CD?
Yes    No

YES    NO
2.2.2 Non-Technical Survey

Greetings. We are part of a senior design engineering class at UIC researching experiences and uses of sound device playback. We appreciate your honesty and time. Thank you. 

Please answer the following questions relating to MP3 players:

1.) When listening to MP3s, music quality is important to you.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Some what</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

- Absolutely Needed [ ] - Wanted, Not Required

2.) When purchasing a personal music player, user-friendliness is an important feature.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Some what</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

- Absolutely Needed [ ] - Wanted, Not Required

3.) How much do you think an MP3 player costs?

$138.63

4.) How much would you be willing to pay for an MP3 player?

$106.00

5.) If you purchase a MP3 player, how long would you wait until upgrading to another model?

2 Years

6.) How useful are LCD screens when using personal music players?

<table>
<thead>
<tr>
<th>Not Important</th>
<th>Somewhat</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

- Absolutely Needed [ ] - Wanted, Not Required

7.) How relevant are color LCD screens to you when purchasing a personal music player?

<table>
<thead>
<tr>
<th>Not Important</th>
<th>Somewhat</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

- Absolutely Needed [ ] - Wanted, Not Required
Please answer the following questions about cell phones:

8.) Is the customizability of cell phones important to you?

Yes  No

YES  NO

If you answer yes, please rank the following list. If not, proceed to question 9.

1 – Least Important through 9 Most Important

_____ Personalized Ring Tones
_____ Physical Appearance
_____ Weight
_____ Battery Life
_____ Keypad (interface)
_____ Display (Color LCD Screen)
_____ Display (Black / White LCD Screen)
_____ Digital Camera
_____ Display Quality

Please answer the following questions relating to doorbells:

9.) How important is the appearance when you purchase a doorbell?

Not important  Somewhat  Very Important

1  2  3  4  5

Absolutely Needed  Wanted, Not Required
10.) What type of exterior appearance does your current doorbell have?
   a.) Wood Finish
   b.) Metallic Finish
   c.) Wood and Metal Finish  Wood and Metal Finish Most Frequent
   d.) Plastic (Specific Color: ________________)
   e.) Other _____________

11.) Do you pay attention to a doorbell chime?
    Yes  No

12.) How important is it that you be able to customize the sound of your doorbell?
    Not Important  Somewhat  Very Important
    1  2  3  4  5

Absolutely Needed  Wanted, Not Required

13.) How much do you think a doorbell costs?
    a.) $0.00 - $9.99
    b.) $10.00 - $19.99 $10.00 to $19.99 Most Frequent
    c.) $20.00 - $29.99

14.) How much would you be willing to pay for a doorbell?
    $15.33

Please answer the following general questions:

15.) Do you own or have access to a computer with USB (universal serial bus) ports?
    Yes  No

16.) Does electrical utility cost influence your product purchasing decisions?
    Yes  No

Author: F. Manriquez
2.3 Correlation Matrix of Overlapping Design Needs

<table>
<thead>
<tr>
<th></th>
<th>Appearance</th>
<th>LCD Interface</th>
<th>Cost</th>
<th>Functional Features (addons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>LCD Interface</td>
<td></td>
<td>-</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

++  Highly correlated positive  
+    Moderately correlated positive  
–     Moderately correlated negative  
––    Highly correlated negative

Our design was influenced by what we are capable of as undergraduate engineering students and what we extracted from the surveys. The surveys indicated that consumers want a lot of features for the lowest cost. We captured the desired features from the assignment #1 surveys. We will produce the **Mp3 Doorbell**; a wireless doorbell that plays the customer’s favorite song clips (or sound effects) when the doorbell button is pressed. There will be no need for an LCD interface because a PC will be used to handle the clip selection and playback options. The user may also select to have random clip playback with each button press. The user will be able to edit any type of sound file, convert it into mp3 format, and load it into the **Mp3 Doorbell**. A personal computer and commercially available free software (internet access required) will be needed thus allowing the user to repeat this process as many times as new clips are desired. These are the needs and wants based on our survey results (professor/technical audience and student/general public audience) that our **Mp3 Doorbell** will accommodate.

Author: F. Manriquez
3. Technical Specifications

3.1 396/397 Deliverables

➢ Our design team will provide system design and detailed design documentation necessary to manufacture the device. A prototype will be provided to demonstrate the design. We will conduct formal tests to verify the correctness of the device’s operation. To ensure a quality product, the three main deliverables are specifically depicted in the following list:

❖ System Specifications
  ✓ Design concept
    ▪ The device (modified commercially available wireless doorbell) will, mounting hardware, and a Serial RS-232 microchip device to receive notice of a doorbell button press to a Window 98 or higher serial-port ready personal computer
  ✓ Design alternatives
  ✓ Block diagrams
  ✓ Functional descriptions

❖ Final Paper Design Document
  ✓ Parts list
  ✓ Completed analysis
  ✓ Schematic
  ✓ Computer Software Flowchart
  ✓ User Manual
    ▪ The user manual will indicate the proper and safe procedure for successful installation of the doorbell, complete with visuals of each step
  ✓ Cost analysis
    ▪ MP3 Doorbell’s target price is $21.57

❖ Prototype
  ✓ Physical representation of MP3 Doorbell
  ✓ Must be capable of self-installation
  ✓ Packaging
  ✓ Working demonstration

➢ Length of the design process must be accomplished within 6 months, where the fully functional prototype will be ready by December 2004

➢ The doorbell button will be on the exterior of the home with the mounted doorbell inside towards the center of the house in the standard doorbell location

➢ The MP3 Doorbell button will be powered by an appropriate battery and the inside mounted unit will plug into a standard two prong wall outlet

Author: A. Ahmed
3.2 Acceptance Test Procedures and Numerical Technical Specifications

- The following test procedures depicted in the table will ensure quality product.
- These tests are followed up by the United States FCC guidelines and Underwriter Laboratories standards, thereby further ensuring our product will be successful in the market.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Button</td>
<td>1. Button Press&lt;br&gt;Wirelessly interface doorbell to play on first press with only 1/100 pressings resulting in a failure following the United States FCC guidelines for similar devices&lt;br&gt;2. Maintenance&lt;br&gt;The button’s batteries must last at least 500 successful presses (this approximates one calendar year)&lt;br&gt;3. Material&lt;br&gt;White Polycarbonate Housing: Must keep stable over 0 to 120°F temperature range&lt;br&gt;Button can be standard plastic but must be able to keep stable and operate over 0 to 120°F temperature range</td>
</tr>
<tr>
<td>Mounted Doorbell</td>
<td>1. Material&lt;br&gt;Clear Polycarbonate Housing: Must be comparable to Lexan, Hyzod, and Tuffak, this material must be able to withstand forceful impacts and be stable between a minimum 40 to 90°F temperature range&lt;br&gt;2. Interior Components&lt;br&gt;The housing will have molds for the power supply</td>
</tr>
<tr>
<td>PC Speaker</td>
<td>1. Speaker (+- 3% range values will be acceptable)&lt;br&gt;4 ½ “ full-range speaker must have a frequency range of 70 to 15,000Hz, must have less than or equal to an 8ohm impedance and dc resistance of less than 8 ohms to handle power levels of 20 to 40 Watts, a resonant frequency between 65 to 85 Hz.&lt;br&gt;2. Weight&lt;br&gt;Magnet weight must be less than 10 ounces, moving mass should be less than 5 grams, and the voice coil diameter cannot exceed 2&quot;.&lt;br&gt;3. Loudness: The PC speaker loudness must be able to be heard from 10 to 80 db</td>
</tr>
<tr>
<td>Total Weight</td>
<td>The combined components must not exceed 1.5 kilograms so that it can be safely mounted to the typical household walls</td>
</tr>
<tr>
<td>Power Supply</td>
<td>The DC power supply must meet Underwriters Laboratories standards for standard 115 volt home wall outlets and supply the needed power to the speaker, and wireless receiver hardware</td>
</tr>
</tbody>
</table>

Author(s): F. Manriquez
3.3 Draft Users Manual

1. Identify all the components
2. Doorbell button
3. PC speaker (not included; assumed user already has it)
4. 3 Phillip head screws
5. 3 dry wall brackets
6. 2 AA batteries
7. Washers
8. Doorbell installation
9. Insert in the back of the doorbell button 2 “AA” batteries
10. Drill a hole in the desired spot outside of your house
11. Insert (1) dry wall bracket and install a screw (allow space for mounting)
12. Proceed to mount doorbell onto wall
13. NULLSOFT WINAMP Download
14. Please follow through the instructions for downloading Winamp.

- Go to http://winamp.com and click on Winamp 5.03 released 3/30/04
- **Click on Get Free**

  ![Winamp 5.03 Player Download](image)

- **Click on Download Now!**

  ![Winamp 5.03 Player Download](image)
- Click on Open (this downloads to the temporary directory that is removed after installation)

- Follow the boxed (in red) directions from top to bottom

[FILE DOWNLOAD]
This is how WINAMP looks on your PC:

**NULLSOFT WINAMP PLAYER**

![WINAMP Player Interface]

**NULLSOFT WINAMP SHORTCUT**

- Before powering up the computer, locate and plug in the RS-232 cable (female end goes to the computer)

15. Power up the computer
- Launch WINAMP. NOTE: Double click on the shortcut.
- After you have created your assortment of MP3 files you may now transfer them to WINAMP PLAYLIST.

16. For best results we recommend user to operate system in a central location.
17. Test and enjoy!

Author: A. Ahmed
4. Design Alternatives

4.1 Alternatives

4.1.1 MP3 Decoder Card

This scheme involves the creation of a wireless transmitter (doorbell button) and receiver (doorbell chime, wireless speaker). The receiver will be its own module that will be able to receive files (mp3 clips) via flash memory connected to the micro controller. The micro controller will send the memory information (song clip) to the mp3 decoder card. Once this occurs, the decoder card will send its digital information to the Digital to Analog Converter that will be sent to the amplifier to be outputted to the module’s speaker for playback. If a person continues to press the doorbell, the process will repeat.

Author: A. Ahmed
4.1.2 PC-Doorbell

The intent is to take an existing wireless doorbell system and catch the signal from the receiver and send it to the users’ computer. That will function by retrieving the signal before it triggers the default chime pre-functioned within the module. This signal in turn will be sent to the PC via a RS-232 cable. The PC will detect the signal and trigger a Hardware interrupt. Once this occurs the PC runs code to launch a playlist of type .PLU (Winamp Supported). This playlist, located in a certain sector of memory, will contain songs of the users delight. If a person continues to press the doorbell it will launch the playlist again. For best results we insist that the user have the PC (and doorbell) located in a central area of the house. Also, the user should specify on their Winamp preferences that the player stop after every song and that the list be randomized.

Block Diagram Representation

Author: C. Dharmavaram
4.1.3 Wireless MP3 Doorbell Player

Clips are edited by the user on their personal computers via the software of their choice (free editing software is available on many internet sites). The modified mp3 player is removed from the doorbell unit and connected to the PC via its included USB cord. The songs are downloaded to the device through its included software. Once the player is placed back into the doorbell base unit it is ready to go. Every press of the existing wireless doorbell turns on the MP3 player that plays through a pre-amplified speaker. The volume level will be controlled by the volume knob on the player.

Author: F. Manriquez

4.2 Analysis

Which of these is the lowest-risk approach and why?
The lowest risk approach is the PC doorbell because it involves the least amount of hardware and software. This makes the chance for part delays less likely. Our team can program at any location and this will be accomplished sooner leaving more time for hardware debugging.

Which of these is the highest risk approach and why?
The mp3 decoder card has the highest risk approach due to the number of hardware and software components. There will be a lot of down time while waiting for parts and then there will be at least five separate programs to write in order to interface all the parts.
Which of these may potentially yield the least expensive product?

**Chart 4.1**

<table>
<thead>
<tr>
<th>Design Alternative</th>
<th>Estimated Production Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless MP3 Doorbell Player</td>
<td>$40.00</td>
</tr>
<tr>
<td>PC Doorbell</td>
<td>$30.00</td>
</tr>
<tr>
<td>MP3 Decoder Card</td>
<td>$40.00</td>
</tr>
</tbody>
</table>

The PC doorbell will yield the least expensive product due to the few number of components needed to complete the project. Our team will do the programming and the only associated cost with that will be time. All three designs require a PC so its cost is not taken into account.

Which of these will be “fall-back” design alternative if one of the components that you plan to purchase becomes unavailable or does not arrive on time?

The wireless mp3 doorbell player will be the “fall-back” design alternative since its parts are readily available (Home Depot / Radio Shack type stores) and has the fewer disadvantages than the mp3 decoder card.

Which of these is best suited for public demonstration at the Engineering Expo?

The wireless mp3 doorbell player is best suited for demonstration at the Expo since its hardware enclosures are all pre-manufactured making it look very sharp and clean.

Author: F. Manriquez
5. Evaluation Criteria and Selection of Best Design Approach

5.1 Criteria

To best analyze the approach for determining the best design alternative we considered several factors. Collectively we found ways in which our individual designs can be differentiated. In a raw manner, we identified the general advantages and disadvantages to each design. To be more critical, we defined key categories such as cost, number of software programs, and number of hardware pieces. From this we conducted our analysis and found a mutual alternative to progress as our design.

Author: C. Dharmavaram

5.2 Evaluation

We deliberated for some time on what the best alternative should be based on our criteria. Table 5.1, on the subsequent page, includes a breakdown of the criteria. From the broad standpoint, we noticed Alternative #1 having the most pros and cons. While on the other hand, the Alternative #3 had the fewest of each. Also, it was assessed that the Alternative #2 had an even mixture of advantages and disadvantages.

From the perspective of cost, we noticed Alternative #2 having a substantially lower cost than the other two designs. Cost is essential for the sole purpose of not overspending what the consumer will pay for the product. In addition to cost, we weighed out how many different software programs we needed to create. In this category we saw Alternatives #2 and #3 have a desirable amount of only 1 program. Alternative #1 with its many interfacing requires 5 programs to manipulate its components. With the cost and number of software parts, there was also the number of hardware pieces required. We visualize that a higher quantity of parts equates to longer periods of design, and in turn is inversely proportional to our success. In this case, Alternatives #2 and #3 have an equal amount of hardware. After we contemplated these unique variations involved in each design, we became comfortable settling on one design.
### 5.3 Final Decision

With the culmination of all our deliberating, we arrived to point where we decided that Alternative #2 (PC Doorbell) is the best direction for our design. From the evaluation conspired, it seems that this design is the most flexible. Essential reasons that singled out this design were the software complexity of Alternative #1, the hardware complexity of Alternative #3, and the economical advantage of Alternative #2. It is seen that both Alternatives #2 and #3 have four hardware pieces, but #2 has the PC as its final piece and #3 has an MP3 player module as its final piece. The hardware configuration of Alternative #3 seemed time-consuming, thus Alternative #2 was found more viable.

Author: C. Dharmavaram
6. Detailed System Design

6.1 Theory

6.1.1. How Doorbell Works

Magnetic Motor
- The core of a conventional doorbell is an electromagnet (an electromagnet is a coil of wire, wrapped around a piece of magnetic metal)
- Running electrical current through wire creates a very small magnetic field around the wire. Coiling the wire amplifies this magnetic field, so it has a substantial effect on any magnetic objects around it.
- When you hold down a doorbell button, it closes an electrical circuit so that household current flows through the electromagnet by way of a transformer
- The magnetic field of the electromagnet is put to work to drive some sort of a noisemaking apparatus, which in our case, will be the MP3 Player
- Ding-Dong
  - Solenoid
    - an electromagnet where the coiled wire surrounds a metal piston. The piston contains magnetically conductive metal, so it can be moved backward or forward by the electromagnetic field.

6.1.2. How Serial Ports Work

- Serial Port
  - Most basic external connection
  - All computer OS support serial ports
- Functionality
  - Transmits a byte of data one at a time
- UART
  - Transforms parallel o/p of PC’s system bus and transforms into serial form
  - Built-in buffer
### 9-Pin/25-Pin Connectors

<table>
<thead>
<tr>
<th>9-pin connector</th>
<th>25-pin connector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Carrier Detect</strong> - Determines if the modem is connected to a working phone line.</td>
<td>1. Not Used</td>
</tr>
<tr>
<td><strong>2. Receive Data</strong> - Computer receives information sent from the modem.</td>
<td>2. <strong>Transmit Data</strong> - Computer sends information to the modem.</td>
</tr>
<tr>
<td><strong>3. Transmit Data</strong> - Computer sends information to the modem.</td>
<td>3. <strong>Receive Data</strong> - Computer receives information sent from the modem.</td>
</tr>
<tr>
<td><strong>4. Data Terminal Ready</strong> - Computer tells the modem that it is ready to talk.</td>
<td>4. <strong>Request To Send</strong> - Computer asks the modem if it can send information.</td>
</tr>
<tr>
<td><strong>5. Signal Ground</strong> - Pin is grounded.</td>
<td>5. <strong>Clear To Send</strong> - Modem tells the computer that it can send information.</td>
</tr>
<tr>
<td><strong>6. Data Set Ready</strong> - Modem tells the computer that it is ready to talk.</td>
<td>6. <strong>Data Set Ready</strong> - Modem tells the computer that it is ready to talk.</td>
</tr>
<tr>
<td><strong>7. Request To Send</strong> - Computer asks the modem if it can send information.</td>
<td>7. <strong>Signal Ground</strong> - Pin is grounded.</td>
</tr>
<tr>
<td><strong>8. Clear To Send</strong> - Modem tells the computer that it can send information.</td>
<td>8. <strong>Received Line Signal Detector</strong> - Determines if the modem is connected to a working phone line.</td>
</tr>
<tr>
<td><strong>9. Ring Indicator</strong> - Once a call has been placed, computer acknowledges signal (sent from modem) that a ring is detected.</td>
<td>9. – 19: Not Used:</td>
</tr>
<tr>
<td></td>
<td>20. <strong>Data Terminal Ready</strong> - Computer tells the modem that it is ready to talk.</td>
</tr>
<tr>
<td></td>
<td>21. Not Used</td>
</tr>
<tr>
<td></td>
<td>22. <strong>Ring Indicator</strong> - Once a call has been placed, computer acknowledges signal (sent from modem) that a ring is detected.</td>
</tr>
<tr>
<td></td>
<td>23. – 25: Not Used</td>
</tr>
</tbody>
</table>
6.1.3. How RS-232 Communications Standard Works

- RS-232 serial port
  - most widely used means for transferring data
  - Robust and easy to use
- RS-232 Devices
  - 1488 and 1489
    - powered by bipolar power supplies
    - requirement for each transmitter to provide a $+5V$ (minimum) signal for a low and $-5V$ (minimum) signal for a high.
      - These higher voltages ensure greater noise immunity after they travel through lossy cables to RS-232 receivers

Author: A. Ahmed
6.2 System Schematic Diagram

Author: A. Ahmed
6.3 Computer Software Flowchart

START
User presses the doorbell button (transmitter)

NO

Transmitted signal reach the receiver?

YES

The chime of the receiver goes off, triggering the logic gates (or some pertinent circuitry to go “HIGH”)

Once the “HIGH” logic gates trigger, it sends a pulse through RS-232 interface to the PC *(will need an RS-232 chip or a µC to interface this communication standard)

NO

Pulse received by PC?

YES

PC generates a hardware interrupt in order to launch an already user pre-generated mp3 playlist from an mp3 player
Software commands to configure the particular mp3 player to “play” the mp3 clip from playlist

The mp3 clip is transferred to a transceiver

PC user must make sure the mp3 player such as Winamp’s settings are set at the following instructions:
Play → Jump to → Start of list
[Or just press Ctrl+Z]
The purpose of this is for the clip to stop automatically and not keep on continuing, which defeats the purpose of a doorbell. Once the door is answered, there is no need for the mp3 to continue

Has the doorbell button been pressed more than once?

YES

NO

END

Author: A. Ahmed
7. Project Management

7.1 Network Diagram

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parts Purchase</td>
</tr>
<tr>
<td>2</td>
<td>System Familiarity</td>
</tr>
<tr>
<td>3</td>
<td>Code Testing</td>
</tr>
<tr>
<td>4</td>
<td>Doorbell Testing</td>
</tr>
<tr>
<td>5</td>
<td>Packaging</td>
</tr>
<tr>
<td>6</td>
<td>Integration and Testing</td>
</tr>
<tr>
<td>7</td>
<td>Finalize</td>
</tr>
<tr>
<td>8</td>
<td>Prototype</td>
</tr>
<tr>
<td>9</td>
<td>Project Management</td>
</tr>
</tbody>
</table>
7.1.1 Critical Paths

After we achieve familiarity with the system components we are ready to split up the tasks by working in parallel fashion. The limiting factor at this stage is Task 4.0. Due to its complexity it will take 3 weeks for Task 4.0 to complete. So, regardless of how early Task 3.0 finishes we must wait for Task 4.0. Since Task 5.0 is independent of Task 6.0, we need not complete it before Task 6.0. From analysis of the network diagram and visualizing the order of operations, it is evident that Tasks (4.0, 6.0) are on the critical paths. On their parallel routes they are the longest to complete.

7.1.2 Responsibilities

Network Diagram Tasks (NDT): Indication of which category each persons duties fall into

Chaithanya Dharmavaram (Project Manager): Ensures schedule is in tact, stimulates progress, delegates responsibilities, and revolves around all facets of the project
NDT: 9.0

Felipe Manriquez (Research Engineer): Formulates new possibilities for advancement, establishes vision for project
NDT: 1.0, 3.0, 6.0, 7.0, 8.0

Adil Ahmed (System Design Engineer): Knowledge of system manipulation and integration
NDT: 3.0, 4.0, 6.0, 7.0, 8.0

Author: C. Dharmavaram
7.2 Cost Analysis

The length of time from purchase is dependent on the Shipment method. Assuming Ground shipping it should take 4-5 business days. With the exception of the Mounting Hardware, all of the other components will be purchased online. An estimation of cost for the components is $21.57. With manufacturing we expect a cost of $35.00, if we produce mass quantities.

Parts List:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>COST</th>
<th>WEB SITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232 Chip</td>
<td>$4.43 (for 100)</td>
<td><a href="https://shop.maxim-ic.com/cgi-bin/Maximstorefront/1405379479/Product/View/MAX211ECAI">https://shop.maxim-ic.com/cgi-bin/Maximstorefront/1405379479/Product/View/MAX211ECAI</a></td>
</tr>
<tr>
<td>Wireless doorbell system:</td>
<td>$10.95</td>
<td><a href="http://store.yahoo.com/urdefense/doorwir.html">http://store.yahoo.com/urdefense/doorwir.html</a></td>
</tr>
<tr>
<td>Mounting Hardware (2 screws + 2 drywall brackets)</td>
<td>$.50</td>
<td>Home Depot, Menards, ACE Hardware</td>
</tr>
<tr>
<td>1'x1' Plastic Enclosure</td>
<td>$4.70</td>
<td><a href="http://www.surplussales.com/Enclosures/encl_3.html">http://www.surplussales.com/Enclosures/encl_3.html</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$21.57</td>
</tr>
</tbody>
</table>

Author: C. Dharmavaram
8. Appendix – Data Sheets, Parts Information


http://store.yahoo.com/urdefense/doorwir.html

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**General Description**

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where ±12V is not available.

These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5µW. The MAX225, MAX223, MAX235, and MAX245/MAX246/MAX247 use no external components and are recommended for applications where printed circuit board space is critical.

**Applications**

- Portable Computers
- Low-Power Modems
- Interface Translation

**Next-Generation Device Features**

- For Low-Voltage, Integrated ESD Applications: MAX3222E/MAX3232E/MAX3237E/MAX3241E/
  MAX3246E: +3.0V to +5.5V, Low-Power, Up to 1Mbps, True RS-232 Transceivers Using Four
  0.1µF External Capacitors (MAX3246E Available in a UCSP™ Package)
- For Low-Cost Applications: MAX221E: ±15kV ESD-Protected, +5V, 1µA, Single
  RS-232 Transceiver with AutoShutdown™

**Ordering Information**

<table>
<thead>
<tr>
<th>PART</th>
<th>TEMP RANGE</th>
<th>PIN-PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX220CE</td>
<td>0°C to +70°C</td>
<td>16 Plastic DIP</td>
</tr>
<tr>
<td>MAX220CSE</td>
<td>0°C to +70°C</td>
<td>16 Narrow SO</td>
</tr>
</tbody>
</table>

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**Defense Devices.com**

SELF DEFENSE THAT MAKES SENSE

Home > House Alarm Systems > Wireless Doorbell Chime

**Wireless Doorbell Chime**

Wireless DoorBell Chime has many uses

Have you ever been in a back room of your home and missed a visit from friends because you could not hear them knocking? That won't happen again with the use of our Wireless Doorbell. Installs quickly without the hassle of running any wires. Just mount the transmitter near your door and place the receiver anywhere in your home within eighty feet. When the transmitter button is pressed a pleasant chime will sound. The wireless doorbell can also be used in the home by the elderly or bed ridden to call for assistance. Requires two "AA" and one 9 volt batteries. (not included)

**Availability:** Usually ships the same business day.

DRW: Usually $15.95  Sale Price: $10.95, 2/$19.95  Order

**Surplus Sales of Nebraska**

Where the hard to find parts are found... and on hand!!

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**Plastic / Fiberglass Builder's Enclosures**

**Instrument Case**

(ENC) CASE-KS

High quality black thermosetting plastic case has glass like finish and 6-32 brass inserts for cover mounting screws. A perfect box for instruments or a multitude of projects.

Case Only: (ENC) CASE-KS

$2.95 each - $2.50 (4-12), $2.20 (12+)

Aluminium Cover: (ENC) CASE-KSAC

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**Instrument Case**

(ENC) CASE-KS11

Same as left but no brass inserts. Black. 3-1/2" tall by 2-1/2" wide by 1-1/4" deep.

$1 each

(ENC) CASE-KS12

Same as left. Has 6-32 brass inserts for cover mounting screws. Black. 6-13/16" tall by 2-1/4" wide by 2-1/4" deep.

$4.75 each

(ENC) CASE-KS13A

These cases have three pre-drilled holes, and a battery holder mounted to the case. Same size as the (ENC) CASE-KS13 left.

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Screws, may be obtained at a local hardware store such as HOME DEPOT

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Author: A. Ahmed