

Visual to Audio Substitution

Garabed Tashian
Jeffrey Crispo
Cameron Elliott

Abstract

The goal of this project was to create a device that would produce sounds so that people suffering visual impairment could have a way of 'seeing'. Our group has assigned different properties of sounds (frequency, amplitude, and speed of the sound) to help locate an object in the field of view. In our project we are using the frequency of the sound to determine where the object is on the x-axis. We are also using the amplitude of the sound to tell the person using our device how big the object is. Our last criteria is how often the sounds are produced to tell how fast the object is moving. In the end we hope to have a functional device that will benefit people with visual impairment.

Introduction

In this project we are creating a computer program that can take video feed and substitute it into specific sounds that can determine a few properties of the object (where it is, how large it is, and how fast it's moving). We will do this by giving the sounds specific characteristics. Any video taken will run through our program in Matlab to determine certain features of the object in the video. These features are, as stated above, where it is, how large it is and how fast it is moving. We have specific algorithms in Matlab that will allow us to find all of the above stated properties. The main objectives we hope our algorithm will do is subtract frames, find a centroid, and produce a sound. After this is finished and our IRB document is approved we will test our algorithm on test subjects to see how well it works. If we find any weaknesses in our project we will fix them (time permitting) and improve the final product.

Design

- Origin of problem

The reason we thought of doing this project was to help people who are blind. Our group is trying to produce a device that will allow people to see using sound, but not be too intrusive to the point where we impair their hearing. The purpose of this is to give someone who is blind more knowledge about what is around them so, for example, in a situation of crossing the street they can know the cars coming, using sound, and not get hurt. Our hope is to improve their quality of life.

- Realistic constraint (tech, econ, time, environment, ethical, social, health, safety, manufacturability, sustainability)

There are some major constraints on this project because of time availability. The three of us working on this project are full time students and only have a semester to finish this.

Realistically we are not going to get this project into a workable device for industry, however we are going to use our Matlab algorithms and see if it's possible. If we had all the time in the world we would create a functional model, test it on a lot of subjects, and then go back and fix whatever we could to make it better. In the semester that we do have, we have to run our IRB approval through the commity and get it approved before we even start testing people.

Another constraint could be both health and safety of the person using the device. Obviously the product we have now is nowhere near what is needed to pass certain medical standards. If we had more time then we could make sure it met every standard needed.

Standards

Electrical:

The standard IEC-60601-1 applies to our project because we will be using electrical equipment with our test subjects. Our working model in the end will run off of batteries, probably no more than 9 volt, which shouldn't cause any harm to the subjects.

Nevertheless we still need to follow the constraints to make sure everything is ok with how we have everything hooked up.

The following applies to our project:

4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9

5.1, 5.2, 5.3, 5.4, 5.6, 5.8, 5.9.1

6.4, 6.6

7.1.1, 7.1.2, 7.1.3, 7.2, 7.5, 7.6, 7.9

14.4, 14.5, 14.6, 14.7

Sound:

The standard set by ANSI for sound applies to our project because we will be using different characteristics of sound on our subjects. We will be using loudness and frequency in our experiments and final product so we need to know the limitations of the human ear. We will create algorithms in our code so that the noises produced will not be insufficient for the user to hear or too loud that it will damage their ear/ears.

- List of parts we are using

All of these materials are Rohs Compliant. There are no harmful elements in them. Matlab, Webcam, headphones, computer

- Design alternative

This project could have many design alternatives because it is basically the choice of the creator on what properties to use to determine things about the object moving. For instance, we could have used frequency to determine how close to object was or different sounds to see where the object was. Even though there are a lot of other ways we could've constructed this project we feel like the way we're doing it gives the best information to the subject/user.

- IRB(why we want it)

This project needs an IRB because we will be conducting human test studies. After our form is approved and we finish creating a functional algorithm we will test subjects to see how well our project works. The following are all components to our IRB form we sent in.

IRB Document

This application form is to seek initial IRB approval for a research study.

There are three levels of IRB review (Full Board, Expedited and Exempt), determined by the nature of the project, level of potential risk to human subjects, and the subject population. It is the principal investigator's responsibility to request the type of review he or she believes is appropriate for the study, but the IRB will make the final decision. Regardless of the type of review, all applications use the same submission form.

As required, read the linked URI IRB policies and procedures [HYPERLINK "http://www.uri.edu/research/tro/about/IRB/IRB Policies and Procedures.doc"](http://www.uri.edu/research/tro/about/IRB/IRB%20Policies%20and%20Procedures.doc) [manual](#), where you will find guidance as to which level of review to request.

Following are three separate checklists and instructions for submission for each of the three levels of IRB review: Exempt, Expedited and Full Board. One checklist must be completed and submitted with your IRB application form, located immediately following the checklists.

Be certain to answer all questions thoroughly and attach all necessary documentation to avoid delays in the review of your IRB application.

All documents must be submitted electronically as attachments to the project package on IRBNet. The IRB cannot review any project unless the documents are submitted as a single package. For instructions on using IRBNet, please see [HYPERLINK "http://www.uri.edu/research/tro/about/IRB/IRBNetinstructions.html"](http://www.uri.edu/research/tro/about/IRB/IRBNetinstructions.html) [Instructions for IRBNet Online Submissions](#).

Graduate students must submit an original hard copy of their Thesis/Dissertation Proposal Approval Sheet to the Office of Research Compliance after submitting IRBNet package electronically. A PDF version of the form should also be included with the IRBNet package.

If you have any questions, please contact the Office of Research Compliance at (401)874-4328 or [HYPERLINK "mailto:compliance@ds.uri.edu"](mailto:compliance@ds.uri.edu) compliance@ds.uri.edu.
University of Rhode Island - Institutional Review Board
Instructions and Checklists for IRB Application Submission

EXEMPT REVIEW – Submit one original or copy of each document

If you are unsure which level of review to request, review the URI IRB policies and procedures manual for guidance, using this link: [HYPERLINK "http://www.uri.edu/research/tro/offices/compliance"](http://www.uri.edu/research/tro/offices/compliance) www.uri.edu/research/tro/offices/compliance

If your research is restricted to the analysis of secondary data, fill out and submit a Secondary Data Analysis Form located on the Compliance website. Do not submit an IRB Application Form unless you are instructed to do so by the Office of Research Compliance.

In making the request for exempt review, complete and submit this Checklist with your application, attaching all required documents to your IRBNet package:

FOR	Submit a letter by the principal investigator indicating why the exemption should be granted, citing which of the
MCH	six published reasons for exemption applies. When the research will be conducted by a student, the letter

	authority granting permission to use the data.
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one copy of all recruitment materials you plan to use, such as flyers, emails, notices, instructions, etc.
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one copy of all written materials to be used with study participants, such as surveys, questionnaires, sample interview questions or interview guides. If applicable, include online consent document or scripts that are part of consent process.
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one copy of each informed consent document and/or assent document written using language no higher than the eighth-grade reading level.
FORMCHECKBOX Y FORMCHECKBOX N/A	If you are using secondary data that is not publicly available, include a prior IRB approval number or a letter granting permission to use the data.
FORMCHECKBOX Y FORMCHECKBOX N/A	Provide documentation of CITI Program Training in the Protection of Human Subjects for all key personnel. Comparable training certification from another credible source will be considered by Office of Research Compliance staff.

University of Rhode Island - Institutional Review Board Instructions and Checklists for IRB Application Submission

EXPEDITED REVIEW – Submit one original or copy of each document

If you are unsure which level of review to request, review the URI IRB policies and procedures manual for guidance, using this link: [HYPERLINK](#)

"<http://www.uri.edu/research/tro/offices/compliance>" www.uri.edu/research/tro/offices/compliance

In making the request for expedited review, complete and submit this Checklist with your application, attaching all required documents to your IRBNet package:

FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one completed research proposal (ex. thesis, dissertation, or sponsored research grant proposal) less any appended material not necessary to an understanding of the project. Student proposals must include the original Thesis/Dissertation Approval Sheet.
FORMCHECKBOX	Submit one completed IRB Application Form using the latest version from our website. <i>The</i>

Y FORMCHECKBOX N/A	<i>application form is revised regularly. Please check our website for the current version.</i>
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FORMCHECKBOX Y

FORMCHECKBOX N/A	Ensure that all parties named on the Assurance (final page of the Application) sign the package electronically via IRBNet. Directions for registering with IRBNet and signing a package can be obtained HYPERLINK "http://www.uri.edu/research/tro/about/IRB/IRBNetinstructs.html" here .
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one copy of any survey, questionnaire, sample interview questions, and flyers or advertisements.
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit one copy of all informed consent documents to be used written using language no higher than the eighth-grade reading level. If applicable, include online consent request or scripts that are to be used as part of consent process.
FORMCHECKBOX Y FORMCHECKBOX N/A	If the research involves a cooperating agency, institution, school district, etc., a letter of agreement to participate in the research (on letterhead, submitted as a PDF) is required. If the cooperating agency has an IRB, a copy of that agency's IRB approval is required. Research that is to be conducted in foreign countries requires a letter of agreement from an appropriate official or cooperating institution. Use of secondary data that is not publicly available needs a prior IRB approval number or a letter from a person in authority granting permission to use the data.
FORMCHECKBOX Y FORMCHECKBOX N/A	Documentation of CITI Program Training in the Protection of Human Subjects for all key personnel. Comparable training certification from another credible source will be considered by Office of Research Compliance staff.

**University of Rhode Island - Institutional Review Board
Instructions and Checklists for IRB Application Submission**

If you are unsure which level of review to request, review the URI IRB policies and procedures manual for guidance, using this link: [HYPERLINK "http://www.uri.edu/research/tro/offices/compliance"](http://www.uri.edu/research/tro/offices/compliance)www.uri.edu/research/tro/offices/compliance

FULL COMMITTEE REVIEW

If neither of the streamlined reviews is possible, the proposal must be reviewed by the convened Institutional Review Board, which meets monthly.

If it is determined that a student's research proposal will require Full Board review, that student's major professor or a member of the student's research committee must accompany the student to the IRB meeting. Material for full committee review must be submitted at least two weeks prior to the monthly meeting (see IRB meeting schedule at [HYPERLINK](#) "<http://www.uri.edu/research/compliance/newirb.htm>" "<http://www.uri.edu/research/compliance/newirb.htm>"). Please make your submission electronically via [HYPERLINK](#) "<http://www.irbnet.org/>" "[IRBNet](#)."

For full board review, complete and submit this Checklist with your application, attaching all required documents to your IRBNet package:

FORMCHECKBOX Y FORMCHECKBOX N/A	Submit a completed research proposals (ex. thesis, dissertation, or sponsored research grant proposal) less any appended material not necessary to an understanding of the project, (if student, include the original Thesis/Dissertation Approval Sheet).
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit a completed IRB Proposal Application Form using the latest version from our website. <i>The application form is revised regularly. Please check our website for the current version.</i>

FORMCHECKBOX Y
FORMCHECKBOX N/A

Ensure that all parties named on the Assurance (final page of the Application) sign the package electronically via IRBNet. Directions for registering with IRBNet and signing a package can be obtained HYPERLINK " http://www.uri.edu/research/tro/about/IRB/IRBNetinstructs.html " here .	
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit copies of any survey, questionnaire, sample interview questions, and flyers or advertisements.
FORMCHECKBOX Y FORMCHECKBOX N/A	Submit informed consent(s) used, written using language no higher than the eighth-grade reading level. If applicable, include online consent request or scripts that are to be used as part of consent process.
FORMCHECKBOX Y FORMCHECKBOX N/A	If the research involves a cooperating agency, institution, school district, etc., a letter of agreement to participate in the research (on letterhead, submitted as a PDF) is required. Research that is to be conducted in foreign countries requires a letter of agreement from an appropriate official or cooperating institution. If the cooperating agency has an IRB, a copy of that agency's IRB approval is required. Provide a copy of each document.
FORMCHECKBOX Y FORMCHECKBOX N/A	Provide documentation of CITI Program Training in the Protection of Human Subjects for all key personnel. Comparable training certification from another credible source will be considered by Office of Research Compliance staff.

IRB ID No. _____(Internal Use Only)

1.1 Review Requested – Choose One: (See URI IRB Policy and Procedures for guidance)

a. FORMCHECKBOX Full Board b. FORMCHECKBOX Expedited Review c. FORMCHECKBOX Exempt Review - Category #_____

1.2 Project Title (Project title must match grant title. If different, also provide grant title):

Movement to Audio system FILLIN "Text42"

Project Duration:

Start Date: FILLIN "Text42"9/19/12	End Date: 2/1/12 FILLIN "Text42"
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Principal Investigator (PI)

**EVERY SUBMISSION REQUIRES A PI. THE PI CANNOT BE A STUDENT.
PI NAME MUST BE THE SAME ON THIS FORM AND IRBNet SUBMISSION**

Name FILLIN "Text42"Dr. Ying Sun	
Mailing Address: FILLIN "Text42"	Phone Number:
Email: FILLIN "Text42"sun@ele.uri.edu	Fax: FILLIN "Text42"
University Department: FILLIN "Text42"Biomedical Engineering	College: FILLIN "Text42"University of Rhode Island
Occupational Position at URI:	

Other: Staff FILLIN "Text42" FILLIN "Text42" Yes Faculty FILLIN "Text42"	
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1.5 Co-Investigator (Students cannot be co-investigators):

Name: FILLIN "Text42" Dr. Eugene Chabot	
Mailing Address: FILLIN "Text42"	Phone Number: FILLIN "Text42"
Email: FILLIN "Text42"	Fax: FILLIN "Text42"
University Department: FILLIN "Text42"	College: FILLIN "Text42"
Occupational Position at URI: Other: Staff FILLIN "Text42" Faculty FILLIN "Text42" FILLIN "Text42" FILLIN "Text42"	

1.6 Student Investigator

Name FILLIN "Text42" Jeffrey Crispo	
Local Mailing Address FILLIN "Text42" 51 Glendale Road Narragansett RI 08822	Phone Number: FILLIN "Text42" 908-328-5793
Permanent Mailing Address (if different) FILLIN "Text42"	Fax: FILLIN "Text42" N/A
Email: FILLIN "Text42" jeffrey_crispo@my.uri.edu	
University Department: FILLIN "Text42" Biomedical Engineering	College: FILLIN "Text42" University of Rhode Island
Dissertation/Thesis Proposal: Yes FORMCHECKBOX No FORMCHECKBOX IF YES, please submit thesis or dissertation proposal with this IRB Application Form	

1.7 Key Personnel - Other people engaged in the study who have access to identifiable information about subjects (i.e. enroll participants, conduct consent process, collect or review identifiable information, or conduct intervention activities):

Name	Position	Role on study
		FILLIN "Text42"
FILLIN "Text42" Cameron Elliott	FILLIN "Text42" Software Engineer	FILLIN "Text42"
FILLIN "Text42" Garabed Tashian	FILLIN "Text42" Hardware Engineer	FILLIN "Text42"
FILLIN "Text42"	FILLIN "Text42"	FILLIN "Text42"
FILLIN "Text42"	FILLIN "Text42"	FILLIN "Text42"
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FILLIN "Text42"	FILLIN "Text42"	FILLIN "Text42"

1.8 Training in Responsible Conduct of Research With Human Subjects

Have all study investigators and other key personnel completed training in the responsible conduct of research with human subjects within the past three years?

YES FORMCHECKBOX

NO FORMCHECKBOX

If **NO**, it is the principal investigator's responsibility to ensure that all key personnel complete responsible conduct of research with human subjects training and to provide documentation to the Office of Research Compliance in order to receive IRB approval. Use the following link to access URI's training program, the CITI Program: HYPERLINK "https://www.citiprogram.org/default.asp" <https://www.citiprogram.org/default.asp>

CITI CERTIFICATES MUST BE SUBMITTED WITH YOUR IRBNET SUBMISSION

1.9 Funding

A. Will this be an externally funded project?

YES FORMCHECKBOX

NO FORMCHECKBOX

If yes, please answer the following:

Funding source: FILLIN "Text66"

Is the funding source PHS? FILLIN "Text66"

C. URI Log Number: FILLIN "Text66"

1.10 Collaborating Institutions and Investigators

A. Does the research involve a collaborating agency, institution, school district or other organization (entity)?

YES FORMCHECKBOX

NO FORMCHECKBOX

IF YES, please complete the following:

A1. List all collaborating entities.

FILLIN "Text36"

A2. Does each collaborating entity have a Federalwide Assurance?

YES FORMCHECKBOX

NO FORMCHECKBOX

A3. If yes, please provide the Federalwide Assurance Number(s) of each collaborating entity:

FILLIN "Text36"

A4. For each collaborating entity, a copy of a letter of agreement to participate in the research (on letterhead) is required. If the collaborating entity has an IRB, a copy of that entity's IRB approval is

required. Please include all necessary documentation with the submission of this IRB APPLICATION form.

Does the project involve one or more independent investigators who are not formally affiliated with the URI or another institution with a Federalwide Assurance (FWA)?

YES FORMCHECKBOX

NO FORMCHECKBOX

If YES, the independent investigator(s) must sign a formal written agreement of commitment to follow the human subject protection policies of URI.

Part 2. Summary of Activities

You may copy and paste information from your proposal or consent, if appropriate, in response to any of these questions.

Briefly describe the research study design, providing a short overview using layman's terms: FILLIN

"Text30" We are taking video and converting it into sound. We will use sounds to represent movement on the screen. We will only detect motion on the screen, not the entire picture of still objects. The volume of the sound will change with respect to the size of the image. The frequency will change depending on where the object is located on the x-axis of the screen.

Describe the tasks research subjects will be asked to perform. Attach surveys, instruments, interview questions, focus group questions, etc. Describe the frequency and duration of procedures, tests, and experiments.

FILLIN "Text30" We plan on moving objects to different parts of a computer screen while producing different sounds (from the algorithms we used in mat lab) for the subject to hear while they . The purpose is to see how accurate the subjects are at detecting what part of the screen the object was moving. We plan on doing this by showing the subject what it sounds like when there's movement on different parts of the screen, then having them close their eyes and listen to it. After they listen to it we will ask them where the movement was on the screen and see how accurately they can determine where the movement was using a four quadrant grid. These tests should only be about 10 to 15 minutes each. We have a page of test questions that we will ask the subject to complete 10 times.

Provide a full description of risks and measures to minimize risks. Include risk of psychosocial harm (emotional distress, embarrassment), economic harm (e.g., loss of employment or insurability, loss of professional standing or reputation, loss of standing within a community), and legal jeopardy. Describe what will be done to minimize those risks.

FILLIN "Text30" There will be no risk involved in our study.

Describe any potential for direct benefit to individual subjects, as well as the benefit to society based on scientific knowledge to be gained; these should be clearly distinguished. Monetary payment or other compensation is not considered a benefit.

FILLIN "Text30" The benefits are helping students research a tool that can hopefully be used in the future to help others.

2.5 Does the research involve (Check all that apply):

FORMCHECKBOX **Use of private records (e.g. medical, educational financial)**

FORMCHECKBOX **Possible invasion of privacy of subject or subject's family**

FORMCHECKBOX **Deception**

FORMCHECKBOX **Deprivation of physiological requirements such as sleep or food**

FORMCHECKBOX **Surveys requesting disclosure of sensitive information or illegal activities**

FORMCHECKBOX **Diet and exercise interventions**

FORMCHECKBOX **Presentations of materials that might cause stress to a particular population**

FORMCHECKBOX **Infectious or hazardous materials**

FORMCHECKBOX **Risks to job security or financial stability**

FORMCHECKBOX **Invasive medical procedures other than blood draws**

FORMCHECKBOX **Blood draws**
 FORMCHECKBOX **Investigational New Drug**
 FORMCHECKBOX **Investigational New Device**
 Other (please describe) FILLIN "Text60"

Part 3. Characteristics of the Subject Population and Location of Study

Expected total maximum number of subjects:

FILLIN "Text30"15 Must be an exact number – cannot be a range.

Note: You may not exceed the number of subjects approved by the IRB. If you wish to enroll more subjects, you must first submit a request to the Office of Research Compliance.

Expected age range of subjects:

FILLIN "Text30"18-60

Briefly describe the subject population. Specify number, sex, ethnicity, race and age. Justify exclusion of any group, especially by criteria based on gender, ethnicity, race or age.

FILLIN "Text30" We are looking to test a random set of subjects from different ethnicities and to get some young and old participants to see if there's differences in ability to interpret data the sound displayed to them.

3.4 Vulnerable populations to be recruited for this project (Check all that apply):

FORMCHECKBOX Children (17 or under)	FORMCHECKBOX URI Students	FORMCHECKBOX Decisionally impaired
FORMCHECKBOX Prisoners	FORMCHECKBOX URI employees	FORMCHECKBOX Frail elderly
FORMCHECKBOX Pregnant Women	FORMCHECKBOX Employees of Researcher	FORMCHECKBOX Other: _____

3.5 Describe the location(s) where subject recruitment will take place (e.g. university, agency, hospital, shopping mall)?

FILLIN "Text22" At the University of Rhode Island

(Private settings require an authorization letter.)

Part 4. Recruitment and Informed Consent Process

4.1 Describe the recruitment process, being sure to explain who will approach potential subjects and how the privacy of potential subjects will be protected. Describe any incentives or inducements that will be offered. List all recruitment materials to be used (e.g. advertisements, bulletin board notices, emails, letters, phone scripts, or URLs) and attach copies to this form:

FILLIN "Text63" An email will be distributed to undergraduate students, graduate students, and faculty on the Electrical, Computer, and Biomedical Engineering Department's mailing lists here at URI. The email will be distributed by Dr. Sun or Eugene Chabot, to avoid any pressure from direct contact of a faculty or staff member. It is expected that the pool of potential participants will include a diverse group of males and females with different racial and ethnic backgrounds. Of this pool, the first 15 responders will be taken for this study.

4.2 Principal investigators are responsible to see that reasonable steps are taken to ensure that subjects are fully informed and understand the study. Considering that consent involves a process of communication in addition to use of a consent form, describe how you plan to consent your subjects.

FILLIN "Text63" After they sign the consent form we will ask them if they are sure they want to go through the experiment right before we begin

If any potential participants could have limited decision-making capacity, language barriers or hearing difficulty, describe how capacity to consent will be assessed.

FILLIN "Text63" If we get someone who does not know english we will get a translator. We will do our best to accomadate someone with disabilites if they sign up for this experiment

4.4 If your study population includes a substantial number of people who speak a foreign language, a consent form should be provided in translation. Please provide the name/credentials of the person who will do the translations.

FILLIN "Text63"N/A

If translated by the PI, a second fluent translator should also review the translation.

4.5 Parent/Guardian Consent and Assent – If enrolling children, describe how parent(s) or guardian(s) will provide consent and how child will provide assent.

FILLIN "Text63"Our age range is from 18 to 60. We do not have any children who will be participating in this study.

4.6 Waiver or alteration of consent: The IRB may approve waiver or alteration of one or more of the elements of consent in some minimal risk studies. Do you plan to request one of the following:

FILLIN "Text32"NO**Waiver of signed consent form**

FILLIN "Text32"NO**Alteration of consent (i.e. deception)**

FILLIN "Text32"NO**Waiver of any other elements of informed consent** , or entire consent

If so, please explain why the study is considered to be of minimal risk and why the waiver would be necessary to conduct the research:

FILLIN "Text32"

****The consent form(s) to be used for this study must be included with the submission of this IRB APPLICATION form. Use the following link to access recommended consent form templates: www.uri.edu/research/tro/offices/compliance**

Part 5. Privacy and Confidentiality

5.1 Describe any links between data collected and subject identity. Examples of links include names, addresses, telephone numbers, etc.

FILLIN "Text64"We don't need to know anything from any of the test subjects except how accurately they can complete the tasks asked of us.

5.2 Describe the provisions made to maintain anonymity and/or confidentiality of data collected, including assignment of identification numbers, coding systems, etc.

FILLIN "Text61"Our group will assign numbers to each test subject so that each person will have more confidentiality.

Where, how long, and in what format (such as paper, digital or electronic media, video, audio, or photographic) will data be kept? Include details about where data will be stored (address), how it will be secured and who will have access to the data. For example, storage and security methods can include such methods as locked cabinets, password protection, encryption, firewalls, etc.

FILLIN "Text61"The data will be stored in a secure login at a URI computer. It will be kept in Open Office

5.4 Is Investigator requesting authorization for use and disclosure of Protected Health Information (PHI) from a covered entity? (Ex. Hospital, pharmacy, physician office)

YES FORMCHECKBOX

NO FORMCHECKBOX

5.5 Is Investigator requesting waiver of authorization for use and disclosure of PHI?

YES FORMCHECKBOX -- Fill out and submit [HYPERLINK](#)

"<http://www.uri.edu/research/compliance/humansubj.htm>"[Waiver of Authorization](#)

NO FORMCHECKBOX

Describe how the results of this research will be publicly disseminated (e.g. thesis, dissertation, publication, presentation that is not internal):

FILLIN "Text62"The results of the research we perform will be publicly disseminated by a presentation and a paper on our results.

Part 6. Conflict of Interest

A **conflict of interest** may exist whenever financial considerations or publication rights have the potential to compromise or have the appearance of compromising one's professional judgment and independence in the design, conduct or publication of research. The IRB considers the investigator's financial interests when evaluating the protection of human subjects. If a financial interest is reported, the IRB will assess the investigator's objectivity in:

Communicating risks	Selecting subjects
Promoting informed consent	Gathering, analyzing and reporting data

In the space below, identify whether you (including your spouse or dependent child) or any key person affiliated with the project has any financial interest, financial relationship, governance or administrative affiliation with any entity that is providing funds for or which has rights to intellectual property resulting from this study.

FILLIN "Text61"N/A

6.2 Does this study evaluate a drug, a device, a test for disease, or a product?

YES FORMCHECKBOX

NO FORMCHECKBOX

IF YES, please answer the following two questions:

A. Do you (or any member of your immediate family) own stock, shares, or have other investments in the product or company owning, manufacturing, or developing the drug, device, test, or product exceeding \$10,000 or 5% ownership during the conduct of the research or within one year of the termination of the research study?

YES FORMCHECKBOX - Complete the HYPERLINK

"<http://www.uri.edu/research/compliance/confint.htm>"[Conflict of Interest Disclosure Form](#)

NO FORMCHECKBOX

B. Do you receive any remuneration from the manufacturer, developer or owner of the device, drug, test, or product being evaluated?

YES FORMCHECKBOX - Complete the HYPERLINK

"<http://www.uri.edu/research/compliance/confint.htm>"[Conflict of Interest Disclosure Form](#)

NO FORMCHECKBOX

6.3 Are you serving as a paid consultant or speaker on behalf of the sponsor of your research?

YES FORMCHECKBOX - Complete the HYPERLINK

"<http://www.uri.edu/research/compliance/confint.htm>"[Conflict of Interest Disclosure Form](#)

NO FORMCHECKBOX

If any changes affect your answers to any of the questions in Part 6, it is your responsibility to report these changes to the Office of Research Compliance promptly.

Part 7. Assurance Statement

Required Electronic Signatures on IRBNet to complete your assurance:

Principal Investigator

Co-investigator(s) if applicable

Student investigator(s) if applicable (sign as team member)

Department Chair or Dean

Submission of the fully signed IRBNet package will serve as your assurance that the following statements are true:

I CERTIFY as follows concerning the above named research proposal:

I have read and am familiar with the University of Rhode Island's "Policies and Procedures Manual for Human Subject Protection."

The rights and welfare of the subjects will be adequately protected.

Risks or discomfort (if any) to subject(s) have been clearly indicated and it has been shown how they are outweighed by potential benefits to the subject or by the importance of the knowledge to be gained.

The informed consent of subjects will be obtained by appropriate methods that meet the requirements of the University's general assurance procedures.

Any proposed changes in research activity will be reported to the IRB. Those changes may not be initiated without IRB review and approval except where necessary to eliminate apparent immediate hazard to the subjects. Any changes relating to Part 6, Conflict of Interest, will be reported immediately to the Office of Research Compliance.

Any unanticipated problems involving risks to human subjects or others will be reported to the IRB immediately.

The Principal Investigator certifies that he/she has reviewed this IRB Application and ensured that all materials follow the instructions and checklists (see Pages 1-4) developed by the University of Rhode Island Institutional Review Board. The Principal Investigator acknowledges responsibility for the work of student investigators that he/she supervises.

Consent forms

Consent Forms for Subjects

The University of Rhode Island
Department of: Electrical, Computer and Biomedical Engineering
4 East Alumni Avenue
Kingston, RI 02881

Project: Visual to Audio Substitution

CONSENT FORM FOR RESEARCH

You have been invited to take part in a research project described below. The researchers will explain the project to you in detail. You should feel free to ask questions. If you have more questions later, Jeff Crispo, Garabed Tashian, or Cameron Elliot, the people responsible for this study, (908) 328-5793, will discuss them with you. You must be at least 18 years old to be in this research project.

Description of the project:

You have been asked to take part in the study that aims to investigate how well specific sounds can be recognized. These sounds are going to be produced based on what a video camera or webcam detects. They are being used to pick up movements which will be turned into sounds with certain timing, frequency, and loudness to make it possible to know where on the screen the movement was. This information will be used in constructing an assistive technology device to provide visual information to individuals with very limited or no vision.

What will be done:

If you decide to take part in this study here is what will happen: you will sit in a chair in front of a computer screen. The researchers will go over how the program works and show you so that you will be somewhat trained for what to look for. This way you will understand how the frequency, loudness, and length of the noise all come together. You will be asked to close your eyes, to imitate someone with blindness, and the program will be played for you. After the program you will be asked a few questions about the program.

Risks or discomfort:

No risks or discomfort are expected with this study.

Benefits of this study:

Although there will be no direct benefit to you for taking part in this study, the researcher may learn more about the limitations of relaying information through the sense of hearing. An assistive technology device will be constructed using the findings of the studies performed by the researcher and it is expected that this may benefit individuals with visual impairments.

Confidentiality:

Your part in this study is confidential. None of the information will identify you by name. All records will be stored on a designated secure computer of the biomedical department.

In case there is any injury to the subject: (If applicable)

If this study causes you any injury, you should write or call Dr. Ying Sun at the University of Rhode Island at (401) 874-2515. You may also call the office of the Vice President for Research, 70 Lower College Road, University of Rhode Island, Kingston, Rhode Island, telephone: (401) 874-4328.

Decision to quit at any time:

The decision to take part in this study is up to you. You do not have to participate. If you decide to take part in the study, you may quit at any time. Whatever you decide will in no way affect your grade or status as a student. If you wish to quit, simply inform Jeff Crispo at (908) 328-5793 of your decision.

Rights and Complaints:

If you are not satisfied with the way this study is performed, you may discuss your complaints with Dr. Ying Sun at (401) 874-2515 or with Eugene Chabot at (401) 868-8241, anonymously, if you choose. In addition, if you have questions about your rights as a research participant, you may contact the office of the Vice President for Research, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, Rhode Island, telephone: (401) 874-4328.

You have read the Consent Form. Your questions have been answered. Your signature on this form means that you understand the information and you agree to participate in this study.

_____ Signature of Participant	_____ Signature of Researcher
_____ Typed/printed Name	_____ Typed/printed name
_____ Date	_____ Date

Please sign both consent forms, keeping one for yourself.

Proposal

Audio based visual substitution system

Team Members:

- Garo Tashian- Hardware
 - Cameron Elliott- Software
 - Jeffery Crispo- Manager
- Group will share responsibilities of tasks.

Our research will be used to help the visually impaired. We hope to make a device that will substitute visual signals to audio signals. Similar devices have been tested on static objects. Our device will focus on moving objects, which pose the greatest threat to our target population. In order to test the feasibility and effectiveness of our device, we will conduct a human study.

We will first have to complete the IRB forms in order to conduct a human study. Next we will create a motion detection algorithm using frame subtraction. This algorithm will determine what objects are moving. Since the camera

will always be moving, this could be tricky because everything will appear to be moving. Next, we will write an algorithm that maps the moving objects to sound. We will represent the 2 dimensional visual signal with time on the x axis and frequency on the y-axis.

During the human study, we will first play a video of a moving object on a computer screen, while playing sounds that represent the moving object. For example, if an object is in the lower left corner, a sound with a low frequency and a short time delay will be played. If that object moves to the lower right corner, a low frequency with a long time delay will be played. Once each subject has learned what each tone represents, we will play only sounds, asking each subject where the object started and ended. This will tell us if they can decipher the direction of the moving object.

Based on the information from our human study, we will attempt to make our device more accurate and easier to use by modifying our algorithms. Once everything is fine tuned, we will complete our final paper.

Goal- Make motion detection algorithm to change motion to sound in order to detect danger.

Subtasks:

- **Fill out test subjects form**
- **Create motion Detection Algorithm**
- **Implement sound into coding**
- **Finish hardware**
- **Finish testing subjects**
- **Finish final prototype**
- **Finish paper**

Resources:

Dr. Chabot will be a good resource.

Scholarly articles:

Robust Real-Time Periodic Motion Detection, Analysis, and Application by Ross Cutler and Larry S. Davis, Fellow, IEEE

Parts needed: Camera, headphones/speakers, software, hardware (board, chips, etc.)

Test Questions

Test

5 sec for each question

Each question will be asked 15 times

We will ask the first question 15 times then the second 15 times and so on

1.) Where is the object on the screen?

Object 1

Left ___
Middle ___
Right ___

1. Where did the object start/ where did the object stop?

Start

Left ___
Middle ___
Right ___

Stop

Left ___
Middle ___
Right ___

3.)Which object was moving faster?

Object 1 _____
Object 2 _____

5.)Which object was larger?

Object 1 _____
Object 2 _____

Methods

Functionality

We begin by taking a video of a car in motion and converting into gray scale on Matlab. We then use image subtraction and thresholding to get the object of concern by itself and to filter out all the background noise. Once we have the object alone, we begin to implement the ways of motion detecting. We arrange an x and y axis to determine the location of the object. We count the number of pixels to see the size of the object and we use the change of position of the object to determine speed. We then take all these properties and convert them into different sounds that go along with the properties we have set forth for this project.

Software

Motion Detection

```
%a=VideoReader('/Users/yingsun/Desktop/carmovingcloser.mov');  
xyloObj = VideoReader('/Users/yingsun/Desktop/carmovingcloser.mov');  
  
nFrames = xyloObj.NumberOfFrames;  
vidHeight = xyloObj.Height;  
vidWidth = xyloObj.Width;  
  
% Preallocate movie structure.  
mov(1) = ...  
    struct('cdata', zeros(vidHeight, vidWidth, 3, 'uint8'),...
```

```

        'colormap', []);
% Size a figure based on the video's width and height.
hf = figure;
set(hf, 'position', [150 150 vidWidth vidHeight])

oldframe=read(xyloObj, 1);
grayoldframe=rgb2gray(oldframe);
imwrite(grayoldframe, 'captured.jpeg');

% Read one frame at a time.
for k = 2 : nFrames
    newframe = read(xyloObj, k);
    movgray=rgb2gray(newframe);
    mov2=movgray-grayoldframe;
    diff_im=imabsdiff(movgray, grayoldframe);
    diff_imbw=im2bw(diff_im,0.25);
    bwarea=bwareaopen(diff_imbw,500);
    %imshow(bwarea);
    mov3=bwmorph(bwarea, 'spur');
    mov4=bwmorph(mov3, 'thin');
    mov5=bwmorph(mov4, 'majority');
    imshow(mov5)

    % pause
end

```

Tone

```

a=pic
[rows,cols]=size(a)
toneFreq=5000
total=2000 %total samples
soundtime=2 %length of sound
pixels=rows/4
b=zeros(rows,cols)
[location,z]=find(a==1)
b([location])= [location]
for x=1:rows % for each column
    xstart=round((total./rows)*(x-1)+1) % start sample
    xend=round((total./rows)*x) %end sample
    eval(['x_' num2str(x) '=b(' num2str(x) ',1)']); % find value of pixel

```

```

    if eval(['x_' num2str(x) '==0'])
        tone=0
    end
    % for x=0:.25*rows
    %   tone=50
    % end
    tone=eval(['toneFreq*x_' num2str(x)])
    y(xstart:xend,1)=sin(linspace(0, tone*soundtime./rows*2*pi, round(total/rows)));
end

sound(y,5000)

```

Frequency

```

total=2000 %total samples
soundtime=2 %length of sound
a=pic
[rows,cols]=size(a)%get amount of rows and columns
for x=1:cols % for each column
    xstart=round((total./cols)*(x-1)+1) % start sample
    xend=round((total./cols)*x) %end sample
    eval(['x_' num2str(x) '=a(1,' num2str(x) ')']); % find value of pixel
    if eval(['x_' num2str(x) '==0']); % if white
        y(xstart:xend,1) = sin(0); % sound=0
    else y(xstart:xend,1) = sin(linspace(0, 50*soundtime./cols*2*pi, round(total/cols)));
    end
end
plot(y)
sound(y,5000)

```

GUI

```

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',    mfilename, ...
    'gui_Singleton', gui_Singleton, ...
    'gui_OpeningFcn', @motion_OpeningFcn, ...
    'gui_OutputFcn', @motion_OutputFcn, ...
    'gui_LayoutFcn', [] , ...
    'gui_Callback', []);
if nargin && ischar(varargin{1})

```

```

    gui_State.gui_Callback = str2func(varargin{1});
end

if nargin
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT

% --- Executes just before motion is made visible.
function motion_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to motion (see VARARGIN)

% Choose default command line output for motion
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes motion wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = motion_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;

% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)

```

```

% hObject handle to pushbutton1 (see GCBO)
% eventdata reserved - to be defined in a future version of MATLAB
% handles structure with handles and user data (see GUIDATA)
global vid
imaqreset;
error=50;
s=25;
vid=videoinput('winvideo',1,'YUY2_640x480');% take video input
triggerconfig(vid,'manual'); % after triggering only we get video
set(vid,'FramesPerTrigger',1); %only 1 frame per trigger
set(vid,'TriggerRepeat', Inf); %repeating trigger infinite time
set(vid,'ReturnedColorSpace','rgb');% colour space used is rgb

i=0;
start(vid);% video is started

prev=getsnapshot(vid);%take video snapshot as previous one
while(1)
% for mk=1:100
j=0;
trigger(vid);
temp=getdata(vid,1);% take video data
axes(handles.axes1); %point to the axes where u want to display the frame
imshow(temp); %show the frame on axes
g=getsnapshot(vid); %get current frame
a=prev-g; %take difference between 2 frames
a=rgb2gray(a);
prev=g; % store current frame as previous frame
stats = regionprops(a, 'centroid');
centroids = cat(1, stats.Centroid);
if((sum(sum(a))/100)>(s/10)*100*50)%check if difference between frames is greater than
threshold
disp('motion detected');%yes than motion detected
axes(handles.axes3);
imshow(a);%show difference as snapshot
hold on
plot(centroids(:,1), centroids(:,2), 'b*')
hold off
imwrite(g,'captured.jpeg');%store difference to folder
j=j+1;% continue the loop
else

```

```

        disp('no motion');
        pause(1)
    end
%   % Centroid
% im = imread('CTHemorrhage.tif');
% imshow(im)
% BW = im2bw(im);
% figure, imshow(BW)
% stats = regionprops(BW, 'centroid');
% centroids = cat(1, stats.Centroid);
% figure, imshow(BW)
% hold on
% plot(centroids(:,1), centroids(:,2), 'b*')
% hold off

end

%   disp('difference');
%   disp(sum(sum(sum(a))));
    i=i+1;%continue the loop

end

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global vid
stop(vid);

```