Report Title (use style: *paper title*)

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*Abstract*—Write a single, brief paragraph summarizing your report’s content. Refer to [1] for some useful guidance. THIS TEMPLATE’S FORMATTING IS ONLY PROVIDED AS AN OPTIONAL RESOURCE. YOU CAN USE ANY STYLE AND DOCUMENT EDITOR YOU PREFER. ONLY REQUIREMENT IS THAT YOU ADDRESS THE REQUIRED SECTIONS ENUMERATE IN BLACK TEXT. ALL TEXT COLORED RED IS TEMPLATE EXPLANATION AND GENERAL GUIDANCE. YOU SHOULD NOT LEAVE THIS TEXT PRESENT IN YOUR FINAL REPORT. This document is a “live” template and already defines the components of your paper [title, text, heads, etc.] in its style sheet. The first example of each style’s use will have the style listed in green text and parentheses. They should not be left in your report. (*Abstract*)

Keywords—Any keywords you think better identify your project, e.g., obstructions, orientation, detector, etc. (key words)

# Introduction (*Heading 1*)

In this section, you should provide the following information. (Body Text)

## Project Description (Heading 2)

My project focuses on using Bluetooth signals from raspberry pis to predict the distance between the two devices when different obstructions interfered. Ultimately, with the ability to predict distance and duration of time, this project relates to piPACT’s goal of contact tracing under a private setting.

## Background Information

The devices I used are raspberry pis. For the purpose of this project, they are simply devices that advertise and scan Bluetooth signals [1]. Bluetooth signals are … [2]. Specifically, the received signal strength indicator (RSSI), a value to convey the strength of the received Bluetooth signal. Both physical and atmospherical changes in the setting affect the RSSI value [3]. The predicted distance extracted from the RSSI value is used for contact tracing, a method to identify and contact the people who have been too close to someone with a disease for too long [4].

# Hypothesis/Hypotheses

Hypothesis 1 is physical obstructions will decrease the RSSI value, thus affecting the prediction of distance. Hypothesis 2 is atmospherical obstructions will decrease the RSSI values, thus allowing for a better prediction of distance. Hypothesis 3 is that it is possible to create a detection algorithm with signals from two raspberry pis. Hypothesis 4 is putting the same obstruction on a pi will result in significantly different RSSI values as opposed to putting it on the other pi.

* All hypotheses result in being able to predict distance and duration of time which can later be used for contact tracing.
* Because the measured variable is a Bluetooth signal value, the hypotheses are directly related to Bluetooth based contact tracing.
* For hypothesis 1, the specific obstructions observed are a pair of athletic shorts, a pair of jeans, a cabinet, and a human.
* Hypothesis 2 tests the effect of temperature and humidity.
* Hypothesis 3 focuses on creating a model and algorithm that linked RSSI to distance for distance prediction.
* Hypothesis 4 tests if an obstruction affects the advertiser pi approximately equally compared to its effects on the scanner pi.

# Experiments and Data Collections

In this section, you should begin by providing a high-level overview of the experiments and data collections you executed. Subsequently, you should go into more detail on the following items. One approach might be to present this overview as a table where each row describes a distinct experiment/data collection in terms of which hypothesis it addresses, primary reason/aspect for executing it, and the number of times repeated.

1. Example Experiment Overview (table head)

| Exp. # | Hyp. # | Reason | Brief Description (Temperature & Humidity were measured for all) | Rep. # |
| --- | --- | --- | --- | --- |
| 1 | 1, 2, 3 | Control | No obstructions | 44 |
| 2 | 1, 2, 3, 4 | Empircal quantification of effect | A pairt of shorts on advertiser raspberry pi | 44 |
| 3 | 1, 2, 3, 4 | Empircal quantification of effect | A pairt of shorts on scanner raspberry pi | 44 |
| 4 | 1, 2, 3 | Empircal quantification of effect | A pairt of shorts on both advertiser and scannerraspberry pi | 44 |
| 5 | 1, 2, 3, 4 | Empircal quantification of effect | A pairt of jeanrs on advertiser raspberry pi | 44 |
| 6 | 1, 2, 3, 4 | Empircal quantification of effect | A pairt of jeans on scanner raspberry pi | 44 |
| 7 | 1, 2, 3 | Empircal quantification of effect | A pairt of jeans on both advertiser and scannerraspberry pi | 44 |
| 8 | 1, 2, 3 | Empircal quantification of effect | A shelf in the middle of both raspberry pis | 39 |
| 9 | 1, 2, 3 | Empircal quantification of effect | A human body right in front of the \_\_\_\_ raspberry pi | ???? |

## Plan and Execution

For all experiments, the raspberry pis were orientated the same way. They were place in the same room, so the amount signal bouncing off surfaces should be approximately equal. They were on the floor except when they were in pockets of clothing. They advertiser pi’s TX power was consistent throughout. The varied distances were pre-measured, so the data from each variation should be at pretty equal distances.

Although changes in weather were present, they were a measured variable. …………

## Data Relevance

The goal of this project was to simulate real life situations when predicting distance from Bluetooth signals. Therefore, the physical obstructions in each experiment were chosen as they could be applied in the outside world: clothes as phones are in pockets, a cabinet like a grocery shelf or bookshelf, and human as phones could be in the back pocket.. Experiments 2, 3, 5, and 6 were conducted to see whether the pi that experienced the obstruction mattered.

## Examples

\*Graphs

# Analysis and Algorithms

## Description

Concisely describe the analysis and/or algorithms developed because of the data you collected. Descriptions of analysis should focus on the manner in which data was distilled into logical and evidence-based conclusions. Descriptions of algorithms should include algorithm goals, design (e.g., pseudo-code), and any special implementation considerations (e.g., choice of language, use of other software, etc.).

## Results and Examples

Provide both summary analysis/algorithm results in addition to specific representative and illustrative examples. Summary results should support the conclusions you make in later sections while specific examples used to explain and/or highlight interesting cases that may require more investigation.

# Conclusions

In this section, you should address the following.

## Hypothesis Evaluation

Provide your evaluation of each hypothesis you chose to address.

* Did you find the hypothesis true, false, or indeterminate?
* Upon what basis did you make your assessment? Refer to your previously presented results as evidence.

## Noteworthy Conclusions

PNot significat nafter 2 sample t test present any specific and noteworthy conclusions you have come to on the basis of your hypothesis evaluation. These conclusions should primarily be specific to the nature of the hypothesis or hypotheses you evaluated. For example, that “the presence of an obstruction between devices creates sufficient ambiguity in RSSI that it cannot reliably be used to determine proximity.”

## General Lessons Learned

Discuss any general lessons learned throughout this project as they relate to the feasibility, efficacy, and reliability of Bluetooth-based contact tracing that piPACT and PACT are pursuing. If there are no such lessons then this subsection should be skipped.

# Next Steps

In this section, present the next steps you would take given more time and resources. These can be tasks you would address in order to reinforce, refine, or re-evaluate your hypotheses and conclusions. They can also address aspects of Bluetooth-based contact tracing that your current effort did not address but will need to in order to realize practical application. For example, how to integrate a sensor onto a smartphone that is more easily available on a Raspberry Pi.

##### References

Insert full references here. Use whatever citation style you prefer but use it consistently. Be sure to use the appropriate template style in order for the reference list to be created properly. If using this template and MS Word, when citing references in your final report, try to use the cross-reference option in order to ensure citations are automatically updated.

1. <https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/technical_reports_and_report_abstracts/index.html> *(references)*
2. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
3. I. S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
4. K. Elissa, “Title of paper if known,” unpublished.
5. R. Nicole, “Title of paper with only first word capitalized,” J. Name Stand. Abbrev., in press.
6. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
7. M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first ...”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

# Template Guidance

This template, modified in MS Word 2007 and saved as a “Word 97-2003 Document” for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

## Maintaining the Integrity of the Specifications

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

## Prepare Your Paper Before Styling

Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections A-D below for more information on proofreading, spelling and grammar.

Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any additional pagination anywhere in the paper. Do not number text heads-the template will do that for you.

## Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

## Units

* Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
* Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
* Do not mix complete spellings and abbreviations of units: “Wb/m2” or “webers per square meter”, not “webers/m2”. Spell out units when they appear in text: “. . . a few henries”, not “. . . a few H”.
* Use a zero before decimal points: “0.25”, not “.25”. Use “cm3”, not “cc”.

## Equations

The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

Number equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop. To make your equations more compact, you may use the solidus ( / ), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

*a**b* (equation)

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

## Some Common Mistakes

* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
* A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
* Do not use the word “essentially” to mean “approximately” or “effectively”.
* In your paper title, if the words “that uses” can accurately replace the word “using”, capitalize the “u”; if not, keep using lower-cased.
* Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
* Do not confuse “imply” and “infer”.
* The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.
* There is no period after the “et” in the Latin abbreviation “et al.”.
* The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

## Using the Template

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

## Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is “Heading 5”. Use “figure caption” for your Figure captions, and “table head” for your table title. Run-in heads, such as “Abstract”, will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named “Heading 1”, “Heading 2”, “Heading 3”, and “Heading 4” are prescribed.

## Figures and Tables

#### Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

1. Table Type Styles

| Table Head | Table Column Head | | |
| --- | --- | --- | --- |
| Table column subhead | Subhead | Subhead |
| copy | More table copya |  |  |

1. Sample of a Table footnote. (*Table footnote*)
2. Example of a figure caption. (*figure caption*)

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.