Bluetooth Enabled Panic Button for Potential Rape Victims

	Participated in & did the coursework [Y/N]?
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1 Conspectus

1.1 What are the objectives of the coursework?

1) To assess any Digital Communications Technology (DCT) to be used in marginalized sector.
2) To modify the DCT appropriate to the selected marginalized sector.
3) To appraise the economic, societal, and environmental implications of the modified DCT.

1.2 How does the coursework fit with the course and previously done coursework?

By:

1) Involving the modification of a communication platform between potential rape victims and emergency contacts
2) Using digital communications theory to enhance performance of data transmission for the protection of app users.

1.3 How were the objectives achieved?

By:

1) Targeting the marginalized sector of the DCT which are potential rape victims.
2) Modifying the multiple access method used by bluetooth from FH-CDMA to TDMA

1.4 What are the key results and generalizations?

The key results are:

1) Help the master (rape victim) in a Piconet maintain more than one connection simultaneously.
2) Make use of multiple point in reaching out contacts once the panic button is pressed.
3) The modification of multiple access scheme used by bluetooth standard.

By affixing my/our signature/s, I/we, the author/s, pledge that: I/we have completed this coursework on my/our own; I/we have not used any unauthorized material/assistance/help on this coursework; and I/we have not given directly or indirectly to any other student/unauthorized person/means any access to any part of the specified coursework. Coram Deo.

Coursework Starting Date: July 13, 2018
Submission Date: August 18, 2018

2 Concepts and Principles

2.1 What are the necessary and relevant concepts and principles for understanding the coursework and for supporting the correct results?

1) Mastery of how Bluetooth works and its specifications
2) Knowledge about different techniques used in Multiplexing methods
3) Clear understanding of Frequency Hopping Spread Spectrum (FHSS)
4) Basic concepts about bluetooth connections

2.2 How does any new component, not covered in previous coursework, function?

By:

1) Overlaying Time Division Multiplexing (TDM) on bluetooth connections.
2) Incorporating frequency hopping with TDM for simultaneous data transmission
3) Synchronizing a master device with the other two devices through the use of frequency hopping.

2.3 What figures, equations, and/or tables could support your answers in Sec. 2.1 and Sec.2.2?

1) The figure below shows an example of a wireless connection between a single or multiple devices using bluetooth

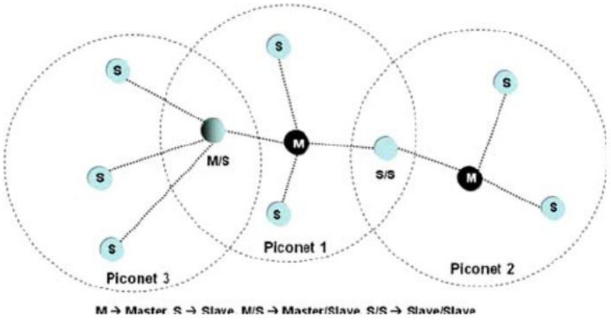

Figure 1. Piconet

2) The figure below shows a block diagram implementation for frequency hopping code.

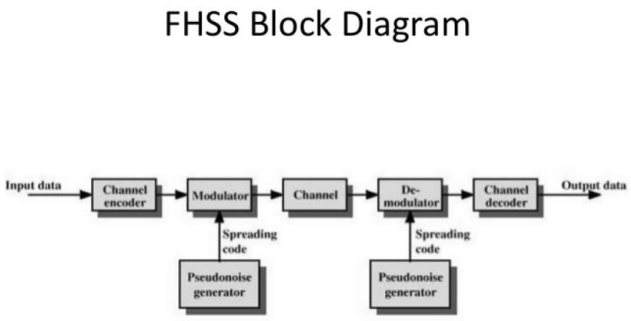

Figure 2. Block Diagram of FHSS

2.4 Did you cite more than two publications in your answers in Sec. 2.1. and 2.2

Yes

2.5 Did you cite any online source in your answers in Sec.2.1 and Sec.2.2?

Yes.

3 Methodology

3.1 How does your implementation in Sec. 3.5 achieve the objectives?

By:

1) Simulating the performance difference between CDMA and TDMA.
2) Showing application of TDM and full full duplex transmission to panic button device.

3.2 Why does your implementation in Sec. 3.5 achieve the objectives?

Because:

1) The application of TDMA simplifies the point to multiple-point connections
2) Multiple-point connections can help the rape victim reach out to a lot of contacts simultaneously

3.3 How does your evaluation in Sec. 3.6 achieve the objectives?

By:

1) Proving that the use of overlay TDM into FSHH would improve its duplexing technique.
2) Making the panic button device more efficient and faster for reaching help since multiple contacts are accessed simultaneously.

3.4 Why does your evaluation in Sec. 3.6 achieve the objectives?

Because:

1) It is proven that a possibility of simultaneous access point is possible with bluetooth through simulation
2) It could serve as new innovation to further studies about multiple access with bluetooth.

3.5 Implementation

3.5.1 What were the materials used?

1) Bluetooth Module
2) Arduino
3) Push Button

3.5.2 What is the summary of the processes used to make the coursework?

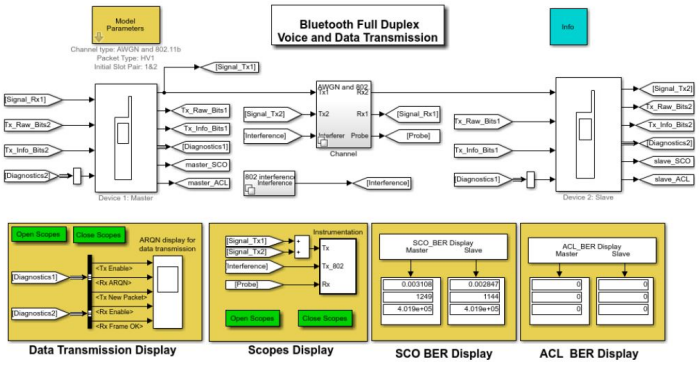

Figure 3. An example of bluetooth module in SIMULINK to be used for DCT

1) Overlaying of bluetooth protocol to hardware device.
2) Master device shares different hopping code for each slave devices.
3) Each slave devices are independent of each other.

3.6 Evaluation

3.6.1 What were your procedures for evaluating the correct outcome of your coursework?

1) Researched for different multiplexing techniques.
2) Studied the difference between FHSS and TDMA and how TDMA was incorporated to bluetooth.
3) Created a full duplex piconet between a master and slave device for comparison.

3.6.2 What quantities were gathered and how have you obtained them for testing the veracity of your results?

1) Hopping Spectrogram
2) Timing Diagram
3) BER Calculation Rate

4 Results and Discussions

4.1 How do the results achieve the objectives?

By:

1) Showing that TDMA was more efficient compared to CDMA. With this, the modified DCT would highly benefit the marginalized sector.
2) Proving that TDM and FDM overlays protocol are beneficial to helping the device to be able to connect to more than one data connection to other devices simultaneously
3) Knowing that using bluetooth modules with modified DCT is better than using other modules such as GSM/GPRS because the marginalized sectors are able to get more benefits with less expenses.

4.2 Why do the results achieve the objectives?

Because:

1) The marginalized sector will consume less on the device due to the cheaper module that will be used
2) Bluetooth is less harmful to the environment since it does not release any ionizing radiation compared to other modules like GSM or GPRS
3) The project device overall is societal for its objective is to prevent harm that may be inflicted by rape victims.

4.3 Are all you results correct in accordance to what you described in Sec. 3.6 evaluation process? Why?

Yes, because:

1) The researchers were able to overlay TDM with FHSS and showed a simulation of it.
2) A full duplex system between a master and slave device was made using SIMULINK

4.4 What are the results?

1) Figure 4 and 5 shows the results of the hopping spectrogram and the timing diagram of the bluetooth module when full duplex was implemented.

Figure 4. Timing Diagram and Slots

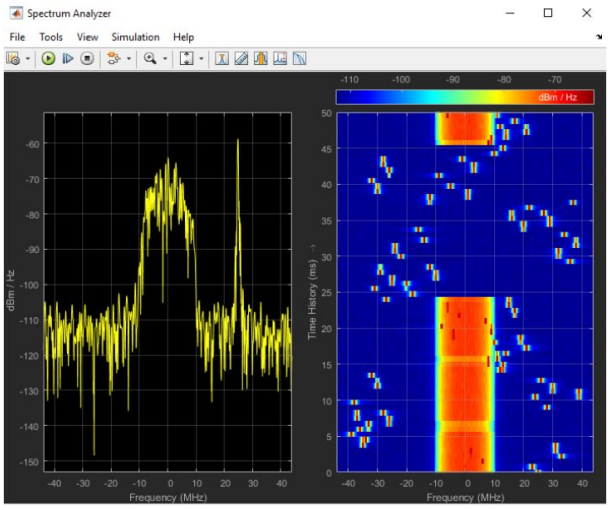

Figure 5. Hopping Spectrogram graph from Spectral analyzer

2) It can be seen in Figure 6 and Figure 7 that both connection has the same hopping sequence.
3) Data transmission is at different time slots thus creating a possibility of having simultaneous connections

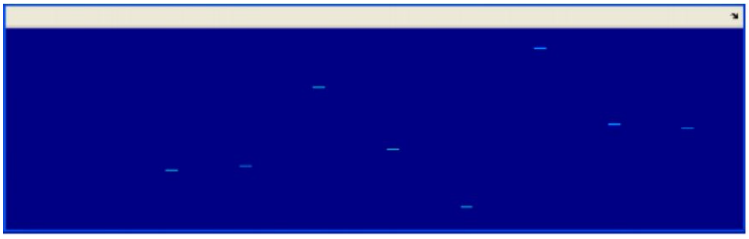

Figure 6. Hopping Spectrogram output for connection 1

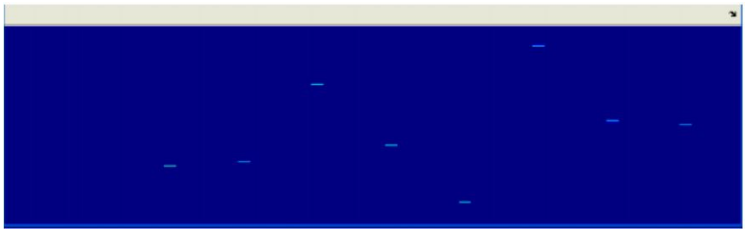

Figure 7. Hopping Spectrogram output for connection 2

4.5 Did you cite more than two publications in your answers above (yes/no)?

Yes.

5 Conclusions

5.1 What are the main points that should be known, remembered, and learned about the coursework?

1) The multiple access of Bluetooth, from CDMA to TDMA, could be modified to have a better performance.
2) Bluetooth could be modified in such a way that it could connect to multiple data connection simultaneously by implementing TDM and FDM overlays

5.2 What are the gists of the inferences drawn from your results?

1) Replacing the original GSM module to Bluetooth module is an acknowledgeable procedure due to its economical, societal, and environmental benefits.
2) With the use of CDMA and TDMA performance measurements exhibit that the degradation can be to the inverse of third or fourth order, making the proper selection of a desired receiver threshold even more important than with a conventional FM two-way radio modeling.

5.3 Briefly, what are your comments on (1) your results, and (2) future coursework if any?

1) The results show that TDMA is remarkably better than that off CDMA because a single frequency can support multiple, simultaneous data channels.
2) To create a working hardware model of the implemented codes above

REFERENCES

Abuzneid, A., Patel, S., Mohammed, V. U., & Godula, V. K. (2008). Multiplexing overlays on bluetooth. In *Novel algorithms and techniques in telecommunications, automation and industrial electronics* (pp. 375–383). Springer.

McDermott-Wells, P. (2004). Bluetooth scatternet models. *IEEE potentials*, *23*(5), 36–39.

Miller, B. A., & Bisdikian, C. (2001). *Bluetooth revealed: the insider's guide to an open specification for global wireless communication*. Prentice Hall PTR.

GRADING RUBRIC FOR THE PROJECT

CRITERIA	EXEMPLARY 4 (Exceeds Expectations) (all checked boxes → exemplary)	SATISFAC-TORY 3 (Meets Expectations)	DEVELO-PING 2 (Below Expectations)	BEGIN-NING 1 (Not Acceptable)	RATING
Concrete understanding	□ 1. Are key points that should be known, remembered, and learned about the coursework correct? □ 2. Is the gist of the inferences drawn from the results accurate? □ 3. Are the necessary and relevant concepts and principles for understanding the coursework and for supporting the correct results accurate and structured with logical reasoning? □ 4. Does the coursework show that it is (or are the answers) on target with sound rationale, backed by strong comprehension, and defended well?	More than half of the exemplary checklist has been met	Half of the exemplary checklist has been met	Less than half of exemplary checklist has been met	_____
Articulateness in communications	□ 1. Does the coursework show that it has not committed plagiarism? □ 2. Is the presentation of information logically structured, mutually exclusive, and/or collectively exhaustive (should it be necessary)? □ 3. Are data, figures, tables, equations, abbreviations, and notations properly labelled and neatly presented? □ 4. Is the report (written and/or oral) made according to suitable and/or technical standards and set format? □ 5. Are literature or source references properly cited? □ 6. Is there absence of verbosity?	More than half of the exemplary checklist has been met	Half of the exemplary checklist has been met	Less than half of exemplary checklist has been met	_____
Competence in applying principles	□ 1. Are methods for achieving the coursework objectives properly selected? □ 2. Is the implementation of the methods successful? □ 3. Is the evaluation for testing the correctness of the results appropriate? □ 4. Are the required output and deliverables met according to the set requirements? □ 1. Do the results show evidences of all the project objectives being attained? □ 2. Does the documentation discuss how the topic developed historically from the past until now? □ 3. Does the documentation discuss how the topic developed technically from the past until now? □ 4. Did the proponent(s) define their project entirety into a manageable structure? □ 5. Did the proponent(s) sequence their project activities correctly? □ 6. Did the proponent(s) estimated the project duration properly? □ 7. Did the proponent(s) develop their schedule well? □ 8. Did the proponent(s) perform schedule control? □ 5. Are encountered problems, like source of errors, clearly identified and addressed by sharp and logical investigative and observational skills? □ 6. Does the submitted coursework match academic honesty standards?	More than half of the exemplary checklist has been met	Half of the exemplary checklist has been met	Less than half of exemplary checklist has been met	_____
Remarks:				**Grade:**	= _____ / 12 = _____ %