Project WINDU Ethics Eval

Senior Design II

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Project WINDU (Wirelessly Operated Network Detection Utility) is a developmental solution for low-power communications security. While being a practical way for our team to challenge our knowledge, the project presents strides in research and development that can enhance current mitigation technology for the entire field. The broad scope of the project is to combat the effects of high amounts of noise in the low-power signals environment as well as mitigating targeted jamming attacks. Bluetooth signals, to this point, have not been able to efficiently detect and counter these factors, placing information loss as a high risk. It is important to note that this project does not seek to protect simple connections, such as a phone's connection to a wireless speaker, but seeks to protect networks operating in the low-power environment carrying critical information (science data, communications, etc.).

Down-time in a network can be caused by random noise and jamming attacks. This down-time can result in significant loss in data for networks such as a Wireless Sensor Network (WSN), where information may be collected and immediately transferred to a base station and wiped from the node itself. In a world where the wireless transfer of information is critical, detection and mitigation of threats must be realized as vital functions of a network. While this realization seems counter-intuitive, it has not resulted in proper detection schemes thus far for wireless networks. This is in part due to the rapid strides made in wireless technology, countered by their usage in practical application as an information hub. Much of the application in Bluetooth has been private or entertainment, and previously had no reason to require security. The signals environment contained less noise because of this. As low-power transmissions gain traction in business models and scientific research, an increase in noise and the need for security have now begun to arise.

The area our project seeks to impact is in the realm of information sustainability. Jamming is a big problem and when transmitting some data on a low power, low frequency signal jammers can easily disrupt communication causing data to be interrupted. Our jamming mitigation system attempts to tackle this is two ways. The first way is the alert system. The alert system provides the user with some alert on the base station when a connection between two nodes is interfered with for longer than an increment of time. This means the signal is not pinging the connection therefore the signal may be getting attacked. This allows the user to review the situations, thus ensuring the safety of the information. Is it just jamming or only interference? This is an important question and can only be determined by the length and severity of the loss of signal.

The other part that works toward safety of information is the what to do after jamming has been alerted. For our project we would like to try and have a mitigation technique trigger to raise the frequency. This does two things. The first being that it allows information to continue transmitting with less loss of time. If this signal is vital or important, time could be precious. In practical terms, significant amounts of data could be lost, giving competitors a. The range of options only show the importance. The mitigation technique also provides the opportunity to keep transmitting despite the attack. For many passive jammers there is no telling a signal is absolutely being jammed. Therefore, raising the frequency can have the signal go completely undetected which provides them more time before another attack, if this even comes at all.

As seen throughout the history of jamming attacks and countermeasures, dating back to World War II, the technology on both sides will continue to advance. Each side will try to outpace the other, either trying to interrupt the transmission of sensitive information or on the other hand,

trying to predict and protect from next generation attacks. Likewise, the signals environment will only see an increase in noise, causing network protection schemes to find newer and more innovative ways to mitigate their interference. While this project cannot predict advancements in the field of jamming technology, it seeks to generate a mitigation solution that has not yet been adapted for wireless networks in hopes to push research and development forward. Ultimately it will allow future researchers to build upon or improve this technology.

One primary implementation of this project could be in any future cubeSAT projects. CubeSAT projects include the use of small, basic satellites that perform very specific tasks within their limited functionality. One major problem that has been frequent among almost all cubeSATs is connection. These miniature satellites have a very limited amount of time with which they can broadcast their data back to the base station. During this time, these devices normally transmit the data using low-powered methods similar to Bluetooth and WIFI. The problem occurs when there is a large amount of noise that blocks/interrupts the signal and the data cannot be successfully transmitted. The team in charge of the cubeSAT can choose to either have that data abandoned or saved for another transmission attempt. While saving the data is normally the best choice, eventually, the device will run out of storage and not be capable of collecting any more without dumping some of the data.

Our project can be applied in the cubeSAT scenario to assist during the limited broadcasting time that the device has. If there is any amount of noise that would block or interrupt the signal or even something as extreme as an actual signal jammer, project WINDU would assist the device in broadcasting the data on a different frequency. With this implementation into the cubeSAT projects, the teams that are in control of them would not need to worry as much about lost data as there is a much larger chance for success when transmitting data from their device. This example is only of a very specific situation. Other than small cubeSAT teams, there are multiple different ways that our project can be adopted, implemented, and used to ensure better results when transmitting in a low powered environment.

Our project’s primary focus in the long run, can not only have an effect on us individually, the school, or even the state. Our project is able to have an effect on the world. As Bluetooth signals are becoming used for more things than just a simple way to connect your speakers, it's important to have security and alert measures in place to secure signals and secure data. Whether it used for wireless communication between military personal, used for digital television, or used at airports for communication, low power signals are a simple option for many. This goes for the entire world, private, corporations and even governments alike. By improving the reliability of wireless networks through use of detection and mitigation schemes, the flow of information can become much more efficient, thus allowing economic and scientific ventures to push new boundaries. Communication is the most important tool available to humanity, and countless breakthroughs can be directly related to the improvement of communication technologies. This project aims to continue this trend, no matter the size of our contribution.