“Laser Focused”

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Our project idea builds upon light fidelity (LiFi) methodology as well as Free Space Optics (FSO), which is a form of wireless communication that involves the transmission of data via light as opposed to wireless fidelity (WiFi) technology which transmits data via radio waves. Current wireless capabilities heavily rely upon WiFi technology which has a maximum theoretical data transfer rate of 300 Megabits per second (Mbps). Although wired technologies can surpass this transfer rate, such as fiber optics' theoretical 10 Gigabits per second (Gbps), the intention behind the project is to improve upon wireless communication technology at distances reaching 500m whilst keeping consumer costs low.

For the hardware we will be designing two transceiver modules configured with a laser diode to provide focused beams of light, pulsing from one transceiver to the other, as well as a photodiode to receive the pulses of light and output a current based on the intensity of the incident light.

The transmitter would contain an op amp which serves to bias a current on the laser diode, maintaining an ON state while the transmission signal modulates the intensity of the laser light. A high intensity beam would indicate a HIGH, or 1, status while a low intensity beam would indicate a LOW, or 0, status. The use of light pulses that transmit at the speed of light greatly increases the efficiency and bandwidth of data communications. The photodiode on the receiving end would output a current that is dependent on the amount of light it receives; the more light received, the more current it outputs. This current would then pass through a transimpedance amplifier which will convert the current into voltage. The voltage would then be passed through a comparator with complementary outputs which would be amplified by additional op amps. For increased focusing of the beam we decided on using telescopic lenses to further collimate the beam of light.

The transceiver would be mounted atop a building to provide obstacle-free line-of-sight (LOS) connection to another transceiver. In the case that the line-of-sight is broken due to some obstacle getting in the way, the transceiver module will be moved by a motor to a different position and angle to allow a connection to be reestablished. After initial testing, if it is observed that there are data packets lost in transmission due to inclement weather or other environmental conditions, we will implement a secondary redundant laser transmitter-receiver pair to ensure a connection is maintained while providing better reliability and efficacy in our system.

Schools and living complexes would be suitable client targets as there would be a need for maintaining high speed connectivity across a range of buildings. Connections between multiple buildings would be easy to set up and protocols would be implemented to ensure energy efficiency and limit light pollution. Additionally, organizations that operate in third world countries require fast internet connections that might not be available in some locations due to its remoteness and distance from power lines, network nodes, etc. Our product would solve this issue by placing a transmitter/receiver at the required locations with repeaters/amplifiers in between if needed.