No Wi-Fi singal? Check this out!

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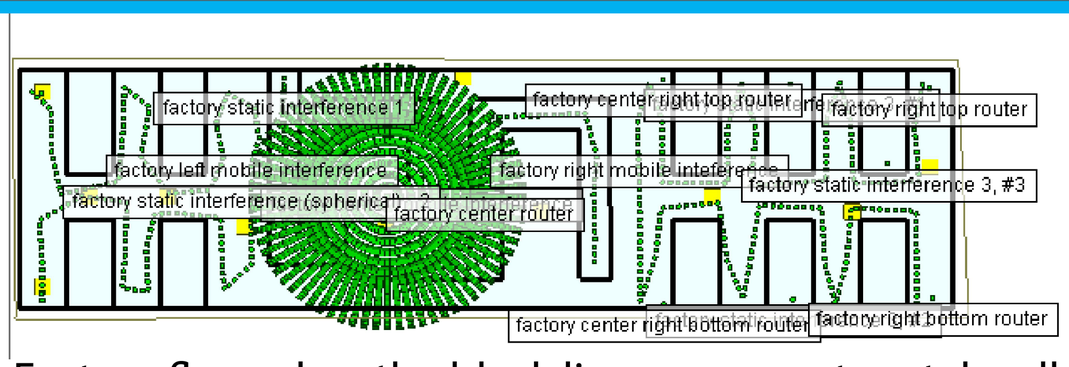
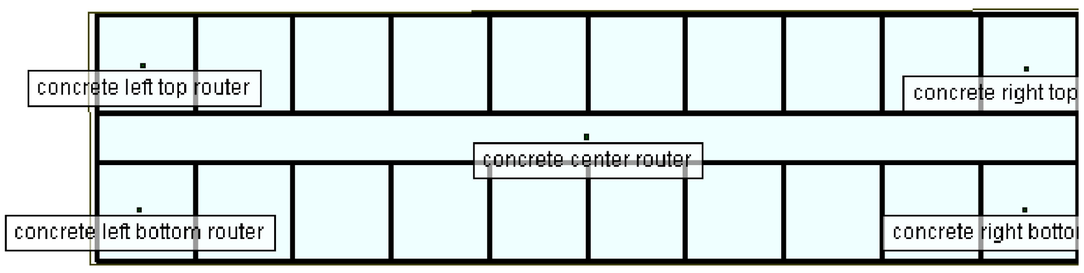
The Problem / Question

In order to optimise wireless signal coverage in various settings, how IEEE 802.11 signals interact with various kinds of materials is investigated through computer simulation.

Simulaion



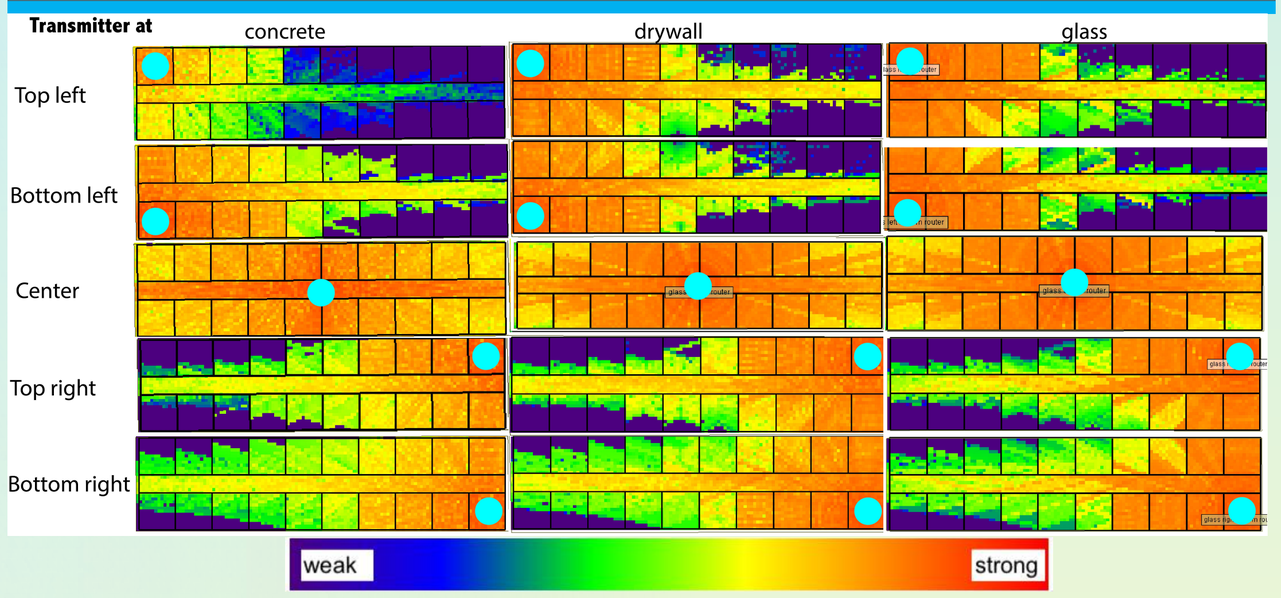
Factory floor plan: the black lines represent metal walls and the green paths are interference



Office place floor plan: the small boxes represent office places separated by walls and doors, the one shown above is of concrete while in the other two simulations it is of drywall and glass

- This is the floor plan used during the simulation. The rectangle on top is the factory floor plan which incorporates mostly metallic surroundings. This floor plan also considers static and mobile interference as indicated by the green lines and dots.
- The bottom rectangle is the office place floor plan, representing a single floor office place with 20 compartments separate by walls. Three simulations were run with the wall properties being calibrated to simulate concrete, glass and drywall.
- Software used for the simulations is Wireless Insite

Results



- Results of Wi-Fi receiver strength coverage in the coffice place setting with 3 transmissions allowed. (simulated signal rays are allowed to penetrate walls three times)

- In real life, electromagnetic signals can sometimes penetrate materials for more than 3 times. However, in this project, only 3 transmissions are considered due to limited simulation capacity. The number 3 was adopted because for most signals, signals degenerate quickly after 3 transmissions. The blue circles mark the positions of the transmitters(WiFi routers).

- As shown in the result, WiFi signals degenerate he fastest in concrete materials. Hence, remember not to put your WiFi routers at home behind concrete walls. Whereas it is also shown that glass affect signal coverage much less, hence putting WiFi routers in glass compartments is fine.

Conclusion

From the results, it can be seen that concrete obstruct wireless signal to a greater extent than glass and drywall. It is shown that it is viable to investigate the interaction of wireless signals of various properties with materials (existing or hypothetical) of diverse properties using computer simulation. ideally, computer simulations should be supported by real life experiments to prove its reliability so that the simulation method can be used for further exploration. However, in this project such physical experiments were not carried out due to limited resources and time, hence in the future this project can be further improved by carrying out relevant physical experiments.In the future, similar simulation technique can be used to investigate the application of 5G network in various settings.

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