

Background

- Human identification is a fundamental problem in many common systems, like detecting the identity of students present in a classroom, or detecting if a certain patient has checked into the hospital or not.
- Two general categories of current human identification system:
 - Use of specific Biomarkers, like facial features, fingerprints, etc,
 - Physical act by the human subject, such as swiping cards, pressing passcode etc.
- Detection of unique bio-markers as well as storage of this data creates risky scenarios.
- Abundance of Wifi signals is now creating opportunities to utilize wifi signals to detect human presence as well as identify them.

Highlights of Research Idea

- The goal is to come up with a solution that utilizes Wifi to effectively detect human presence and identify them as individual by their unique ids.
- The solution should be able to detect and identify human as an individual by their own unique id just using wifi signals.
- This solution proposes a non-invasive approach with no involvement of risky biomarkers.
- One of the challenges of the research proposal would be to distinguish between human movement / presence from that of a non-human (i.e. pets, cars, robots etc).
- Machine learning can be incorporated to train the system and make it able to improve over iterations.

Approach

- Incorporation of Wifi Signal Features:
 - RSS (Received Signal Strength)
 - CSI (Channel State Information)
 - AoA (Angle of Arrival)
 - ToF (Time of Flight)
- Implication of different research models:
 - Probability-based Model
 - Fingerprint-based Model
- Matching algorithm with comparison and combination of transmitting and receiving signal, with the help of mobile devices and/or IoT modules

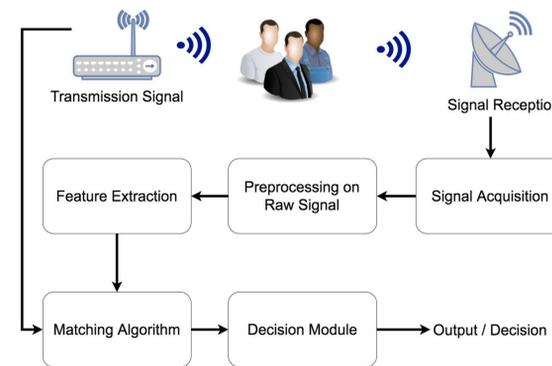


Figure: Process flow chart

Forward Thinking

- Wifi signals have shown promises for detecting motion and position of target objects,
- No published research has worked on identifying human.
- Our approach would propose a solution where the person won't even need to connect to the wireless local network or use any supporting applications.
- The presence and activity movements of a person should be good enough to detect his presence in a closed environment.

Significance

- Very recent research works on Wireless signals to detect different human activities and motion in the form of wifi.
- Commercial wifi devices used to recognise human activity with up to 96% accuracy (Wang, et.al., 2017).
- Wifi signals used to detect human emotions from RF signals reflected off human body (Zhao, et.al., 2016).
- Extension of these works might help us detecting and identifying human subjects in critical conditions like Adult healthcare, Security protocols etc.

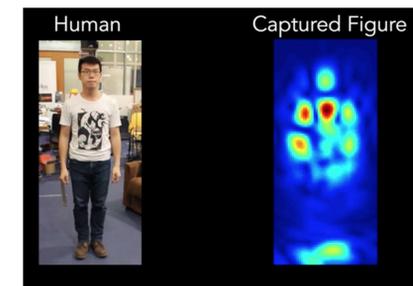


Figure: Human Body Shape Detection using Wifi Signals (Adib, et. al., 2015)

References

- Guo, L., Wang, L., Liu, J., & Zhou, W. (2016, December). A Survey on Motion Detection Using WiFi Signals. In *Mobile Ad-Hoc and Sensor Networks (MSN), 2016 12th International Conference on* (pp. 202-206). IEEE.
- Wang, W., Liu, A. X., Shahzad, M., Ling, K., & Lu, S. (2017). Device-Free Human Activity Recognition Using Commercial WiFi Devices. *IEEE Journal on Selected Areas in Communications*, 35(5), 1118-1131.
- Zhao, M., Adib, F., & Katabi, D. (2016, October). Emotion recognition using wireless signals. In *Proceedings of the 22nd Annual International Conference on Mobile Computing and Networking* (pp. 95-108). ACM.
- Pu, Q., Gupta, S., Gollakota, S., & Patel, S. (2013, September). Whole-home gesture recognition using wireless signals. In *Proceedings of the 19th annual international conference on Mobile computing & networking* (pp. 27-38). ACM.
- Adib, F., Hsu, C. Y., Mao, H., Katabi, D., & Durand, F. (2015). Capturing the human figure through a wall. *ACM Transactions on Graphics (TOG)*, 34(6), 219.